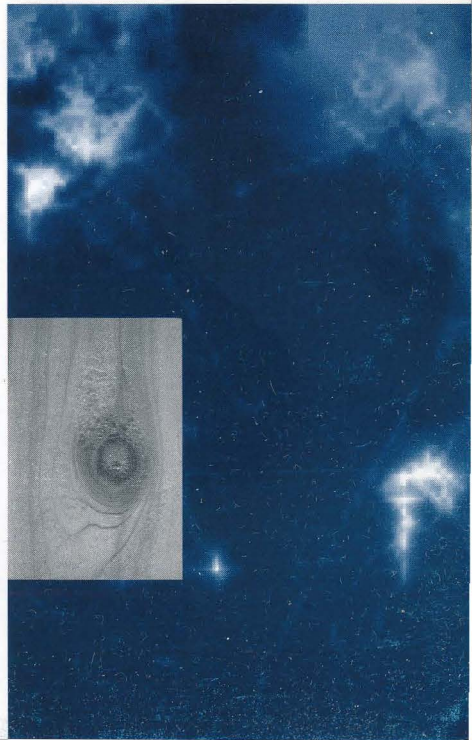
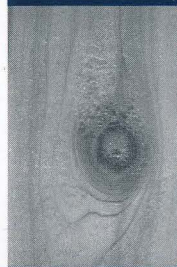




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# *Faith and Thought*

B U L L E T I N



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## Editorial

We are very sorry to report that our President, Dr. D.J.E. Ingram died in January this year after a long illness. We remember David with affection and thanks, and pray for his widow, Geraldine, and the children and grandchildren. An appreciation of David, spoken at his funeral, is reproduced here by kind permission of Geraldine.

This issue also contains the lecture, given by Professor Colin Russell, at the AGM in May 2000. I think that readers will find Colin's address very stimulating, and certainly informative. Most of us do not take the time to put our science and our faith into historical perspective, and this lecture gives us the opportunity to reflect on this.

The paper by Catherine Crouch has been reproduced **with permission** from *Perspectives on Science and Christian Faith*, Vol. 52, number 3, pages 156-158. The Editor found the article challenging and moving, coming from a young scientist early in her career. I hope readers agree.

There is a further index in this issue, though as yet incomplete. When Dr. R.E.D. Clark assumed editorship of the journal, he revised the system of indexing articles, making them include subject and author in considerable detail. Hence the index for the 30 volumes from 1939 to 1973 will take several issues to publish fully. We hope the final result will be useful.

## David Ingram (1927 - 2001)

### An Appreciation

From the outset of his life David was always a potential highflyer with the keenest motivation, a brainy boy from a clever family. Born in Raynes Park, he was brought up in Wimbledon by his parents John Evans and Marie Florence with his sister Jeanne and brothers Keith and Dennis. He was head boy of King's College School, Wimbledon, whence he won a coveted open scholarship to Oxford. Academically outstanding though he certainly was, he was also an athletic all-rounder, and in those early days of our friendship I well remember seeing a photo of him on the sports page of *The Oxford Mail* as he ran for his college in 1948.

David was just 18 when the Second World War in Europe ended, so fortunately his career was not interrupted by active service but developed in one unilinear sweep forward - a copybook, classic academic career which lasted 42 of his 73 years. Remarkably, as though engineered by a kindly Providence, this brilliant career was articulated in six septennia, or units of seven years, seven being the heavenly number of perfection: just imagine, seven years in Southampton, twice seven years in Keele, seven years at Chelsea, and twice seven years in Kent. And more poignantly still, nearly seven years in active retirement but decreasing health here in Somerset. Seven septennia, or 49 years.

And it all began in 1952, the year of his marriage to Geraldine, when he was appointed lecturer - and later reader - in the Department of Electronics at Southampton University. Here he did pioneering work under Professor Zepler in this highly specialised field, and I recall that one of his exciting projects at this time was the construction of an atomic clock. It was in recognition of such work that he was awarded an honorary DSc by the University of Clermont-Ferrand in 1960, and made a speech of acceptance in French. It was during his seven years in Southampton that he published his first two books, *Spectroscopy at Radio and Microwave Frequencies* in 1955 and in 1958 *Free Radicals as Studied by Electron Spin Resonance*. If my memory serves me, it was in the first of these books that each chapter began with a quotation from his favourite whimsical poem, *The Hunting of the Snark*, which bamboozled the Russians when they produced a pirated edition of it.

In 1959 David - still only 32 - succeeded F.A. Vick in the chair of Physics in the comparatively new foundation called University of North Staffordshire, which later became Keele University. Very early in his tenure the new Professor made his mark with his inaugural lecture on *Radiophysics - a new probe of the Universe*, and 'quickly achieved an impressive reputation for his inspiring introductory lectures at the beginning of the Foundation Year' [Kolbert, 157]. These were known

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to staff and colleagues as 'Ingram Spectaculars', and to the students as 'The Dave Ingram Show' because he performed dazzling party tricks such as calling out a pretty girl and causing her long blonde hair to stand on end. There is a photograph of him giving a Foundation Year lecture in John Kolbert's recent volume, *Keele, the First Fifty Years*, published by Melandrium Books last Autumn [pp 114-15].

Kolbert records that 'Ingram was an enthusiastic proponent of the Keele Idea and was in the forefront of the conferences held in the 1960s to explain to heads of schools why it was important that all students should study some arts and some science ... "No student can be considered as properly educated today," he wrote in *The Times* in April 1972, "unless he has some knowledge, both of the approach of the humanities and their methods of assessment, and also the meaning and reasoning of the scientific method in action." He saw the Foundation Year as the epitome of what Keele stood for, and he regarded teaching in the Foundation Year as a major challenge for 'an academic to produce the best teaching to meet the widest academic audience' [page 128].

These were arguably David's finest years, when he was at the zenith of his enthusiasm, fertility and productivity; and it was here in 1969 that he produced his third book, *Biological and Biochemical Applications of Electron Spin Resonance*. (He was to publish two further books on Physics in the 1970s). Apart from administering a sizeable department, he became Deputy Vice-Chancellor of the University from 1964 to '65, and again from 1968 to '71. So it was appropriate that when Keele celebrated its fortieth anniversary in 1990, he was invited back to preach at the Service of Thanksgiving.

David left Keele in 1973 to become Principal of Chelsea College of Science and Technology in the University of London, and he and Geraldine set up house first in Roedean Crescent, Roehampton, and later (from February 1978) in Limerston Street, Chelsea. With his unflagging and orderly mind he was in his element as an academic administrator, and his most memorable feat as Principal was the saving of a condemned college, St. Mark and St. John (known as Marjohn). A symbolic gesture, maybe: anyway, his grateful staff and colleagues presented him with a suitably inscribed plate on this occasion.

In 1980, David was appointed Vice-Chancellor of the University of Kent at Canterbury, the apex of his academic and administrative success. Throughout his career he had a strong natural ambition to succeed and do well in every department of life, and one of the key words in his vocabulary was 'application'. David *applied* himself from start to finish, from dawn to dusk, and he succeeded and did well. Not for nothing did he list DIY among his three recreations, and he certainly **did it himself**, whether in the spheres of physics, mathematics and astronomy, or in mastering the magic of Information Technology, or in the last

few years in coping with the distressing process of renal dialysis.

I think it was during his fourteen years in Canterbury that - among many other good works, both religious and secular, such as helping the Carnegie UK Trust - David first became heavily involved in hospital administration, and continued this engagement in retirement. In Kent he was Chairman of the Chaucer Hospital Community Advisory Board, and in Somerset he was similarly involved. Little wonder that public honours came his way, and he was made CBE in 1991.

Now what of the spiritual dimension to his life: what of David as Christian? Coming from an Evangelical family, he was himself a pious boy who was not ashamed of the Gospel of Christ; indeed, in his twenties and thirties he did a good deal of energetic preaching, both indoors and in the open air. In Oxford, beside our prime site at the Martyrs' Memorial, we also preached at Gloucester Green opposite a cinema, and when once they were showing a film called 'Doomed Caravan' David's quick and fertile mind latched onto this title and made it the text of his proclamation that day.

His logical intellect was probably best employed in the field of apologetics, and perhaps the clearest defence of his beliefs may be found in the book he co-authored with Frank Rhodes, Robert Boyd and Donald MacKay called *Christianity in a Mechanistic Universe* [Inter-Varsity Press, 1964]. He was, I think, more than once President of the Inter-Varsity Fellowship of Evangelical Unions, and in latter years contributed to the Scripture Union Bible notes called 'Encounter with God'. In one of these, on a wistful note that struck a chord in many a reader, he evoked 'those blissful years when children think their parents and grandparents know everything and can do no wrong (soon to be disillusioned)' [*Encounter with God*, 11 February 2000].

Three of the manifold qualities that so endeared David to his countless friends were his unselfish generosity of spirit, his unflinching kindness of intention, and his humility of heart despite his notable achievements. This trinity of moral excellences made him an attractive colleague to work *with*, and an exceptional boss to work *for*, as no doubt several here can testify.

To sum up, I would say that David Ingram was blessed with three outstanding endowments: intelligence, efficiency and humanity - all of which he held in balance, for balance was the very linchpin of his philosophy. Did he not once write these wise words? - 'This principle of balance permeates the whole Christian message ... In our zeal for the defence of the truth we must beware of being too circumscribed or dogmatic, but take account of all works that might be helpful or relevant ...' [*Encounter with God*, 12 April 1997]. There surely we glimpse the pure essence of David's grasp of the universality of God's gracious plan of salvation.

Of course, there are many facets of David's life that I have not touched on, life-

enhancing things such as his love of the sea and 'messaging about in boats', his fondness for Mendelssohn's Italian Symphony, his positive cult of Christmas (did you receive his last Christmas card?). More heart-warming still, he was an adored and adoring father of three, and grandfather of three.

In all these activities and dimensions he was loved and supported by his devoted wife, Geraldine, who cared for him in sickness and in health, and who has endured such an atrocious ordeal during these last four weeks. Surely our hearts go out to her now in her sorrow and bereavement, and our tender affections enfold her in compassionate sympathetic embrace.

So David, our brother, friend and colleague, has fought the good fight, has finished his course, has kept the faith, and henceforth there is laid up for him a crown of righteousness through Jesus Christ our Lord. Amen.

*Philip McNair*

Wiveliscombe Parish Church  
Monday 22 January 2001.

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## **Victoria Institute Millennium Essay Competition**

***A Prize of £500***

**is offered for the best essay dealing with  
CHRISTIAN IMPLICATIONS OF THE HUMAN GENOME PROJECT**

**Closing date 31 October 2001**

### **Competition Conditions:**

1. The Council of the Victoria Institute will own the copyright of the essay, though the author will normally be permitted to embody it in a later, more comprehensive work.
2. It should not exceed 7000 words, excluding documentation, typewritten, with double spacing and 2cm margins.
3. It should be submitted to the Institute's office in Welling, accompanied by a brief synopsis of 200 words setting out which parts are claimed to be original, along with a sealed envelope with a motto outside, and the author's name inside.
4. Entries will be professionally refereed and if the referees consider the prize should be divided between two authors, the Council's decision will be final.

5. If no submissions are deemed worthy the Institute reserves the right to withhold the prize and to publicise another competition thereafter.
6. Submission of an entry will indicate candidates' assent to all these conditions.
  - *The successful author's name will be publicised as soon as possible after the closing date.*

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## **New Members**

Matthew J. Tindale, Msc.	Belton	S. Yorks
Rev. Andrew M. Fraser	Skerray	Scotland
James Downie, BA(Hons)	Valley Forge	USA

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## **Where Science and History Meet: some fresh challenges to the Christian faith?\***

**Colin A. Russell**

### ***Introduction***

Once upon a time, in 17th century England, a certain cleric wrote of his adventures in crossing the high mountains of Europe. He was not impressed by their beauty or their grandeur, as we might have expected, but rather by their wildness - "confusion" as he called it. He wrote:

There is nothing doth more awaken our thoughts or excite our minds to enquire into the causes of such things, than the actual view of them; as I have had experience myself when it was my fortune to cross the Alps and Apennine mountains, for the sight of those wild, vast and indigested heaps of stones and earth did so deeply strike my fancy, that I was not easy till I could give myself some tolerable account how that confusion came in Nature.<sup>1</sup>

The author, Thomas Burnet, was reading into nature what he saw in the revolutionary society around him. He, like us, was living through stirring times. He too was looking for a millennium, though his had nothing to do with the calendar. For, as Norman Cohn has written, "The pursuit of the millennium" has often occurred in history.<sup>2</sup> Burnet was writing in 1684, 35 years after the execution of King Charles I. Within five years the "Glorious Revolution" would



have come. For Burnet, at that apocalyptic time, nature and history were as one. So questions about “how that confusion came in nature” were equally applicable to the stormy history through which he was living.

For us, the “pursuit of the millennium” may take many forms: a millennium Dome whose failure speaks as eloquently as that of Israel’s golden calf; self-congratulatory TV reviews of a channel’s programmes before 2000; apocalyptic predictions of imminent doom through cosmic events, global warming or nuclear weapons in the “wrong” hands; and so on. Yet it cannot be coincidental that science and history are again converging. They weren’t always like that: school children before World War II were told “history is about kings and science is about things”. Thirty years ago it would have been unthinkable that journals like *Nature*, *New Scientist* or *Science* should have had articles on the applications of scientific research to matters of history. Even less probable would have been the dedication of prime TV time to a “history zone”, let alone to programmes where scientific methods were applied to solving historical conundrums. These range from innumerable searches for the lost Ark to DNA analyses of tissues from the Pharaohs in order to test for extensive inbreeding. Today the evidence is all around us that science and history cannot legitimately be separated. And, as for Burnet, their meeting raises critical questions of theological belief.

There seem to be two obvious ways in which interaction is occurring all the time: first, when science is applied to historical data, and, second, when historical methods are applied to scientific progress. We shall look briefly at these in turn. In each case, however, the field is so cast that the merest summaries can be given and it is recommended that the original papers be consulted wherever possible.

## **1. When science is applied to historical data**

### *Geology*

That geology is one of the chief historical sciences is obvious. Much has been written on this aspect of it and little need be added here, partly because it is so well-known, and partly because earth-sciences relate more to pre-history than to history.

On the question of the age of the earth events really began to move towards the end of the 18th century, culminating in Hutton’s famous declaration that there is “no vestige of a beginning, no prospect of an end”. Taking further this concept of an extremely long earth history Charles Lyell, in the next century, advanced in a uniquely extreme form the theory of uniformitarianism where all changes to the surface of the globe took place at the very slow rate we currently observe. Catastrophes like earthquakes were not denied but assigned a relatively minor place in shaping the scenery of today. This, of course, gave to Darwin all the time he needed for his species to evolve, and caused much pain to those earnest

souls who believed in a “young earth”, ostensibly on the basis of Scripture.

Efforts were made to escape the dilemma caused by a literal interpretation of the Genesis creation accounts, none more ingenious than the gap theory advanced by the famous Scottish evangelical leader, Thomas Chalmers. This supposed a vast time gap between the first two verses of Genesis. For all its ingenuity it has long been shown to be untenable on linguistic and exegetical grounds, as well as on the absence of geological evidence. Had it not been sanctified by Scofield, and incorporated into “his” Bible, it would probably have long since been forgotten.

Closely related to the age of the earth was its form, as we see it today. Put crudely, was it due to volcanoes or floods, to fire or water? Proponents of the latter view in the early 19th century were appropriately called “diluvialists”, though it was only later that the Flood of Noah was invoked as the major example of diluvialist shaping of the earth. This was quickly repudiated by Buckland, Sedgwick and other founders of geological science, but it rumbled on for a century and more, and was revived in spectacular form in the context of the late-20th century American fundamentalism. A great deal has been written about it and more heat than light has been generated. However serious geological science seems to be in little doubt that the form of the earth derives from far more than an inundation in the Near East almost within historic time.

The study of the origins of man is the work of that branch of geological science known as palaeontology (as well as evolutionary biology). Here science has almost the only contribution to make to this part of our history (or pre-history). The current consensus view seems to be that a tool-making *homo erectus* may be located in Africa at least 1.5 m years ago, and in China 800,000 years ago. But there are still huge gaps in the fossil record (e.g. of the ancestor of the chimp-human-gorilla) and science has much to learn as well as to teach.<sup>3</sup> Scientific questions about the “real Adam” remain to be solved, but they would appear to pose little threat to a mature theological belief.<sup>4</sup>

### **Volcanology**

Scientific interest in volcanoes continues to increase, and several studies of past volcanic activity have brought new light on wider aspects of ancient history. Only one illustration can be given, the dates when Joseph flourished in Egypt. The phenomenon of a seven-year famine is not likely to be attributable to a failure of the Nile to irrigate the flood-plain for that length of time, and instead the famine in Egypt could be attributed to climate disturbances in the 17th century BC. Occurrence of large acidity spikes in ice-cores from Greenland may be taken in conjunction with evidence from dendrochronology (tree-ring measurements), where exceptionally narrow tree ring growth can be located to

within almost a year: 1628 BC. These seem to correspond to a massive eruption of the volcano Santorini (Thera) in the Aegean at almost this time. It was an immense eruption with 30 km<sup>3</sup> of rock ejected, and ash found in an area over 2m.km<sup>2</sup>. The outfall of dust, the lowering of air temperatures, and the huge volume of acid rain could well account for a 7-year famine in Egypt and the surrounding area. If so, it occurred in the reign of one of the Hyksos dynasty, and the Biblical account of Joseph gains credibility as a true narrative.<sup>5</sup>

### **Archaeology**

In so far as it has developed its own methodology this subject must surely rank as a science. Sophisticated methods of dating pottery fragments have been supplemented by radiocarbon dating, a technique first used in 1949 which has been much refined, and its limitations have been more accurately understood. It measures the ratio <sup>14</sup>C/<sup>12</sup>C in organic material obtained from historical sources. One of its most spectacular - if trivial- results has been the debunking of the 1st century origin of the Turin Shroud; in a similar way it has been applied to fragments of the "True Cross". One illustration of its use in archaeology must suffice. At Tel Rehov, South of the Sea of Galilee, some extensive remains have been conventionally dated to an Egyptian raid just after Solomon's death (c.931 BC). Recently some have argued that the great fortresses and palaces were actually 100 or more years later, in which case these alleged relics of Solomon's military might may be spurious. Indeed the very existence of that monarch has been disputed. However an Israeli archaeologist, Amihai Mazar, has applied radiocarbon dating to burnt seeds and to a wooden beam, and concluded that the older view is correct.<sup>6</sup>

In view of the extensive coverage by expert writers elsewhere in this journal I confine myself to a recent observation that like other sciences, archaeology has had its fads and whims, and has emerged through four important phases:

*In the 1930s and 1940s* archaeological findings seemed generally favourable to Biblical accounts. The names of Sir Frederic Kenyon and Sir Charles Marston spring to mind, and excavations seemed not to deny but even to affirm the historicity of the flood, Abraham and other figures. The "biblical archaeology" developed by William Albright before and after the War was usually conducted by Christian scholars, and often had an apologetic function until about the mid-20th century.

*In the 1950s and 1960s* archaeology often acquired a nationalistic function. The state of Israel had been established in 1948, and Jewish archaeologists were keen to show Israel's origins in Palestine. Whether or not their conclusions were valid their enterprise was wholly proper, for no science can be conducted without presuppositions (even prejudice, some would say) and scientific research has

often had an extra “non-scientific” function as in religious or political apologetics. *In the 1970s and 1980s* there was much less overt concern for religious or political ends. This was a time for “rational thought”, uncluttered by metaphysical assumptions and dedicated to using the best and most modern techniques. Its advocates were sometimes called “Biblical minimalists”, the movement coming to a head in 1992 with Philip Davies’ book *In Search of “Ancient Israel”*.<sup>7</sup> It queries the existence of David and Solomon, and asserts the Bible has introduced an unacceptable bias into archaeological theory.

*By the mid-1990s* an onlooker could be forgiven for being totally confused and concluding that here is a classical example of a science subject to a multitude of external pressures that actually affect its conclusions. At the heart of the matter is a question as to whether Biblical texts have *any* value in the witness box. The fact is that, for many areas of research, they are almost all we’ve got. But not all would take them seriously. Until these storms have abated it might seem unlikely that the Christian church has much to hope for - or much to fear - from archaeological work in the Near East. But things are beginning to change. In a provocative but far-reaching review one recent commentator asserts that “many archaeologists say the minimalists have already gone too far”, adding that “now, despite years of trying to keep the Bible at arm’s length, archaeologists find themselves on the other side of the argument, accused by a new school of biblical scholars of having become biased by the holy book”.<sup>8</sup>

### **Astronomy**

There is space to mention only briefly some remarkable work on Biblical events by Colin Humphreys, Chairman of Christians in Science. On the date of the crucifixion he has provided a recalculation of the Jewish calendar using modern techniques in order to determine the date when the new crescent moon was first visible. If the “moon turning to blood” represents a lunar eclipse it then becomes possible to date the first Good Friday to 3 April, 33 AD. A further piece of research relates to the date of Jesus’ birth. An early suggestion (Origen) that the “star of Bethlehem” was a comet of 5 BC had been rejected because comets were usually supposed to herald bad news. This was shown to be not always the case. Chinese records report comets in 4, 5 and 12 BC. The first and last (Halley’s) were ruled out by contemporary events (the dates of Herod’s death and Tiberius’ reign respectively). Hence the Bethlehem “star” could be the comet of 5 BC. The Magi’s expedition could then have been triggered by the triple conjunction of Saturn and Jupiter known to have occurred in 7 BC, followed by their close massing with Mars in 6 BC. These and much other data have led to the proposal that Jesus was born in the spring of 5 BC. The author adds: “It seems best to consider as a working hypothesis that the (Biblical) report is correct,

and to investigate whether any astronomical phenomenon exists which fits the report".<sup>10</sup>

This is a far cry from the "Biblical minimalism" of some archaeologists!

### **Seismology**

Earthquakes along the Jericho fault on the Jordan plain have been recorded since 117 BC. They have probably been responsible for many incidents in the Old Testament before that. Examples include blocking of the mountain cleft in Jerusalem in c. 760 BC (Zech. 14: 4-5), the collapse of Jericho c. 1000 BC (Josh. 6), the crossing of Jordan (Josh. 3: 15-16), and the doom of Sodom and Gomorrah c. 2000 BC (Gen. 19 and 20), possibly now engulfed under the Dead Sea. Once again we have another reversal of "Biblical minimalism", so that now the OT is used to locate seismic events.<sup>11</sup> It is beginning to look as though not only may science serve history, but that history (in the form of Biblical records) may come to be of service to science. A similar sentiment was expressed in the unlikely context of a paper on marine engineering.

### **Engineering**

In 1955 a paper was given by Sir William Currie to the Institute of Naval Architects, dealing with past and future trends in liner design. Of crucial importance to a ship are its "form coefficients", i.e. the ratios length/breadth and breadth/depth. Considering two ocean-going liners the *Marmora* (1903) and the *Arcadia* (1954), the author showed that the later liner has ratios approaching those of Noah's Ark. He concluded, "It is interesting to note that as we learn more about ships and the sea, we find an inevitable return to the knowledge imparted to us by that master shipbuilder, Noah, who received his specifications from the heavens".<sup>12</sup> This opinion, which has not been widely reported, is yet a further example of (Biblical) history being at the very least of some relevance to the practice and application of science.

Such a conclusion leads naturally to an inspection of what happens when historical methods are applied not so much to specific sciences as to scientific progress in general.

## **2. When historical methods are applied to scientific progress**

To practising scientists the idea that science "progresses" is almost self-evident. Yet a historian must be free to question the inexorability of that or any other trend and, even when it is shown to have happened, will want to know the possible reasons. Much research has been done on the subject which is, indeed, a central interest of the history of science. Not only may such questions lead us to some useful lessons for the present, but they will also help to disclose the true historical nature of the phenomenon of "science progress". Several compelling

theses have been proposed and three of them will be briefly considered now.<sup>13</sup>

### ***The Puritanism thesis***

A theory advanced in 1938 by the American sociologist Robert Merton connected the emergence of science in the 17th century with the rise of Protestantism in general. In particular that specific form of Protestant religion known as Puritanism was identified as being specially favourable to the science then emerging. Thus a high proportion of Puritans (not merely Protestants) in the membership of the Royal Society in England has enabled Merton to argue that Puritan attitudes "did much to encourage" its growth.<sup>14</sup>

Criticism has mainly come on two grounds. First the almost exclusive claims for Protestantism have had to be modified in the light of significant scientific work by Roman Catholics, as Copernicus, Galileo, and many later figures, especially in France. They cannot be ignored. Nevertheless, despite the preponderance of Catholics in France, the ratio of Catholics to Protestants in the Académie des Sciences between 1666 and 1885 was 18:80. There does seem to be a correlation between prominence in science and religious allegiance.

The other main objection to Merton's thesis resides in the difficulty of defining a "Puritan". On one hand a person with that title is sometimes regarded as a kind of ascetic fundamentalist, while on the other he may be considered rather as a dangerous political radical. Many difficulties disappear if Puritanism is considered theologically rather than politically. From this point of view a Puritan will hold strongly to the teaching of the Bible as opposed to that of church or tradition, but may not necessarily support the Parliamentary cause in the English revolution. He might even be a "moderate Anglican".

If modern day sceptics are right, and there is no unequivocal proof that science was actively encouraged by Puritan theology, it may still be true that both may have been the outcome of a common cause or causes, including new movements of social and economic change and of a libertarian philosophy. However this may be, a general correlation seems inescapable in the 1660s between the promotion of science and a strong Biblical theology.

Some, however, would go much further than this, positing an explicit causal relationship between science and Puritanism, and arguing that the latter "caused" the former. One of the strongest advocates of this "hard" form of the Merton thesis has been the Dutch historian of science Reijer Hooykaas, notably in his momentous work *Religion and the rise of modern science*.<sup>15</sup> Whereas it was once customary to see science as a product of our Greek inheritance, liberated from its bondage to religion at the Renaissance, Hooykaas now proposes a view that is its polar opposite. Science may be understood far better as an offspring of that Biblical theology which was discovered at the Reformation. On this view

Greek philosophy may be seen as an inhibiting force for 1500 years, and its displacement by a Biblical theology of both nature and work at last permitted the rise of experimental science.

Despite much recent criticism, serious evidence exists in support of this thesis. Many well-known scientific figures as Francis Bacon, Robert Boyle and Isaac Newton declared that their science was theologically inspired and lived their lives accordingly. More indirect, though still impressive, evidence exists in several points of remarkable congruity between Biblical theology and the emerging credo of science.

At the root of the so-called “scientific revolution” lay what Hooykaas called the “demythologisation of nature”, and others have called its “mechanisation”. The traditional idea, endemic in cultures as far removed as mediaeval Europe and the ancient world of the Near East, was that nature, or “the world” was alive in some sense, an animate or even divine being. This “vulgarly received notion of nature” was exposed with devastating candour and logic by Boyle whose science was soaked in theology derived from the Bible. He saw, as did many of his contemporaries, that if “nature” is evacuated of all divinity, that it is not to be identified with God but seen as a creation by him, then it can become quite properly an object of study, manipulation and experiment. Such views were entirely consonant with the teaching of both Old and New Testaments.

Another idea that is consistent with the broad stream of Reformation thinking is that nature works in a law-like manner and is not erratic or (in principle) unpredictable. So students of nature like Descartes, Boyle and Newton began to speak of laws impressed by God on nature. As A.N. Whitehead later quipped, men looked for laws when they recognised the existence of a law-giver. None of our modern concerns with indeterminacy, randomness and chaos theory is relevant to the historical point that a law-like universe *at the time that it emerged* had a strong theological underpinning.

Science, of course, can only discover its own laws as people do experiments. However it had been the view of many Greeks in the ancient world that to descend to manual activity, and so to get dirty hands, was socially unacceptable (unless you happened to be a slave). It could even be said to be impious if your universe was part of God. So when Francis Bacon urged “men to sell their books, and to build furnaces” he was becoming the spokesman for a radically new experimental method. Not inhibited by Greek shibboleths he and others could cite widespread approval of manual techniques for mining, refining and testing in parts of the Old Testament.

Two other aspects of the religious impetus to science may be briefly mentioned. One was the biblical exhortation to see the heavens and earth as manifesting the

glory of their Creator. If Kepler felt that in his astronomy he was thinking God's thoughts after him, he proclaimed that "in the works of Thy hands I have exulted", a theme taken up strongly in Calvinistic theology at about this time. Finally, there was perceived to be a Biblical mandate to exert "dominion" over nature. This broadened the motivation of scientific work still further, "for the glory of God and the relief of man's estate", in the famous declaration of Francis Bacon. As Hooykaas wrote, "The Biblical conception of nature liberated man from the naturalistic bonds of Greek religiosity and philosophy and gave a religious sanction to the development of technology."

Declarations in the 17th and 18th centuries connecting science and Biblical beliefs are far too numerous for them to be dismissed as mere rhetoric. It has been said that Hooykaas, like Merton, underestimates the numbers of Roman Catholic contributions to the new science. Copernicus is perhaps the most widely quoted example of a Catholic man of science, yet we must not forget the astronomer's other cultural roots, not least the influence of his Lutheran assistant Rheticus, and the liberal legacies of Erasmus within his own church. At that time Roman Catholic attitudes towards nature varied considerably. Exceptions to the Hooykaas thesis unquestionably exist, but they should not conceal the large number of cases where it appears to be substantially correct. The debt of science to Protestantism generally is immense.<sup>16</sup>

### ***The dominion thesis***

There is little doubt that Christian theology has been a major formative influence on modern science. In recent years some have expressed the opinion that this has not always been in the best interests of the world, amongst them the American historian Lynn White in 1966/7. He has provided us with a further thesis, that much of the damage to our environment springs from a misuse of science and technology for which "Christianity bears a huge burden of guilt".<sup>15</sup> The problem lies, he says, in the "realisation of the Christian dogma of man's transcendence of, and rightful mastery over, nature". He sees the remedy as a return, not to the primitive Christianity of the New Testament, but to an animistic world like that of St. Francis of Assisi, who saw sun, moon, earth and its inhabitants as brothers. We must love nature rather than exploit it (which is how he saw the Biblical call to "dominion").

However we may view its theology or ontology of nature we cannot escape the fact that the White thesis is a quite specific historical hypothesis and therefore assessable only by use of the best historical techniques to examine the evidence. The result of such enquiries is not encouraging. It seems that few, if any, of the pioneers of modern science actually held this particular view of exploiting nature, nor did their colleagues in Reformation theology. John Calvin explicitly repudiated



it, as did William Derham, a widely-read writer of natural theology in the 18th century. They, and many others, argued that the Biblical “dominion” should be interpreted as “responsible stewardship”, not irresponsible plunder.

A further blow to the White thesis comes from the simple fact that, historically, immense environmental damage has occurred in places where Christianity could not possibly be held responsible. Examples range from the wholesale deforestation in Mediterranean lands BC, through the extinction of species in Asian forests, to the fetid pollution of the Ganges and the polluted air in modern inner-city Tokyo. Recent work on the dire effects of urbanisation, agropastoralism and animal extinction has shown the conspicuous absence of a theological agenda to drive them.<sup>18</sup> In fact recent calls for a human conquest of nature have come from Marxist rather than the Christian voices.<sup>19</sup>

As a historical generalisation, the Lynn White thesis stands largely discredited.

### ***The conflict thesis***

This thesis is much older than the other two.<sup>20</sup> It is also much better known.

Essentially it states that science and religion have been for centuries in a state of perpetual conflict and that, eventually, science will vanquish religion. Although one of its most vocal advocates was the Victorian naturalist T.H. Huxley, he had many allies in the late 19th century and no one individual should claim the credit (or the blame). Its promotion was greatly assisted by two books, by Draper<sup>21</sup> and White<sup>22</sup>. Though they date from the late 19th century they achieved enormous circulation and are still in print.

In essence it is argued that where scientific conclusions have been challenged by the church the challenge is usually unsuccessful and the ecclesiastical authorities have been forced into an eventual retreat. This is what allegedly happened to Galileo in the 17th century and to Darwin nearly 250 years later. Many more examples were unearthed by Victorian writers, with greatly varying degrees of credibility.

Despite a brave showing by its defenders the thesis has faced considerable difficulties. For example, it is hard to reconcile with the massive evidence for a powerful alliance between science and Christianity since at least the 17th century. How could they at the same time be in mortal conflict? Moreover a detailed examination of the relatively minor cases urged in the conflict literature reveals that many were badly documented with respect to original sources. In the event some have been shown to be greatly exaggerated, while others are quite simply apocryphal.

The cases of Galileo and Darwin have received much better investigation. These “martyrs to science” (as the conflict-mongers would sometimes call them) were

indeed assailed by organised religion and, in different ways, they suffered from that experience. However they seem to have been relatively isolated cases of genuine “conflict” and are a standing warning to historians not to generalise on the basis of a few, if notable, examples. In the case of Galileo his persecution owed much to power struggles within the church that had nothing whatever to do with astronomy. Darwin’s dilemma must be seen in the light of a range of other social forces, from the rise of religious scepticism in German theology to a different set of power struggles, those in the deeply divided society of industrial Britain.

Today the Draper and White manifestos of “conflict” are universally discredited as serious works of historical scholarship. They are rather to be seen as highly partisan tracts reflecting the tensions existing in the experience of the authors. Draper had become deeply disenchanted with the Roman Catholic church, partly on account of some family experiences and partly for its recent declaration of papal infallibility. White was president of one of the first non-sectarian colleges in the USA (Cornell) and had been strongly opposed by certain members of the religious establishment. Each had reason to oppose the organised church, and their attempts to discredit it by allegations of conflict with upright and incorruptible “science” must be seen as that, not history but myth.

Despite strenuous efforts by historians of science in the last thirty years the now discredited conflict thesis has shown remarkable resilience. It is the staple fare of much popular writing and broadcasting and is probably the standard view of the average man-in-the-street. If one asks how such a tendentious myth could have become so entrenched in western culture we need to recall the plight of English science in the last 40 years of Victoria’s reign. By comparison with Germany it was under-funded by government and inadequately supported by secondary education. With the general public it was fairly unpopular for a variety of reasons and was crying out for recognition and support. It had no chance of occupying a leading place in English culture so Thomas Henry Huxley and some close allies determined on a course of action. They would undermine the privileged position of the Anglican church as leader of English culture and put science in its place. A detailed strategy was worked out, of which one element was propagation of what we would call a “conflict thesis”. If the church was always portrayed as the loser in its eternal battle with science, its cultural leadership or hegemony would be seriously undermined. Using the books of Draper and White, the undoubted discomfort of many Christians over evolution, and a network of like-minded men of science, the proponents of “conflict” would do all in their power to ensure that the conflict thesis was accepted as a self-evident truth. They succeeded in creating a legend that has remained largely unquestioned, at least by the general public and the less responsible parts of the media until our own day.<sup>23</sup> Good

historical scholarship has never been more important.

### **Conclusion**

From the few examples given I hope it is clear that where science and history do come into contact the implications for Christian belief can sometimes be momentous. Where science purports to speak about history - even remote history - it is important to listen, even though at first sight the findings may not seem agreeable to the Christian faith. This is why there may be a challenge to the faith, compelling it to face up to findings of science, but with a critical eye. Science is never final, even when it speaks of the age of the earth, the origins of mankind and so on. But it is a God-given tool for humanity to use wisely, and never more so than when issues of faith may be involved. Equally, however, one may gain encouragement from many findings, though again with circumspection. It is always incumbent upon Christians to use Scripture wisely, and scientific light thrown upon history may well help us to do that.

When history looks at science, moreover, there may be similar benefit. To appreciate the strengths and weaknesses of the three historical theses mentioned above can considerably clarify our theological thinking. To know something of individual scientists may deliver one from falling into many of the traps awaiting the unwary. It is not wise, for example, to portray Galileo as physically ill-treated by the Roman Catholic Church,<sup>24</sup> or Isaac Newton as a paragon of Christian orthodoxy,<sup>25</sup> or Darwin as a late convert to the faith,<sup>26</sup> or his views as being unacceptable to all evangelicals,<sup>27</sup> or even to portray the "scriptural geologists" as a bunch of early 19th century cranks and half-wits.<sup>28</sup> Because none of these assertions is true they can have no place in an apologetic presented with honesty and integrity.

One contemporary challenge to the Christian faith is thus to use the findings of history of science in a clear-sighted and responsible way, though that often entails a good deal of time and trouble. Another challenge is to do everything possible to expose the dangers inherent in a "Biblical minimalism", and to encourage scientific investigation into historical data supplied by Scripture, contemporary records or archaeology. When our "creationist" friends declare that this is exactly what they are doing we need gently to remind them how the wider issues of literary genre and cultural context need also to be taken into account. This is never more true than when considering the Old Testament stories of creation, but of course it applies to all scientific studies of records of past events.<sup>29</sup>

The latest convergence of science and history on TV or in the newspapers may also have another effect. It may well remind us that, as Burnet felt, nature and history are not truly separable. If all truth is one that is hardly surprising. As we glimpse something of their interactions we may see something greater than either can provide on its own: a vision of the sovereign Creator by whose will they, and we, continue to exist.

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## **Scientific Ethics: A Realm for Partnership?**

**Catherine H. Crouch**

As policy debates over public funding of embryonic stem cell research have unfolded over the past year or so, I have found myself increasingly uncomfortable. Uncomfortable partly because the editorial pages of *Science* imply that the mainstream scientific community unanimously supports government funding of embryonic stem cell research and assumes ethical issues can be resolved along the way. Uncomfortable partly because I am convinced that from the moment of fertilization, a developing fetus should not be treated as simply a resource for enhancing the health of people who are further along in their development. Uncomfortable partly because I am a physicist, not a biologist, and am not sure I fully understand the scientific issues. And, finally, uncomfortable because I am not certain what to do with my discomfort beyond e-mailing comments to the National Institute of Health regarding their proposed ethical guidelines. What is a postdoc in applied physics to do about attitudes in the scientific community or federal policymaking in areas outside of her field?

Embryonic stem cell research is among the most visible of a number of ethical issues related to doing science. Some other current issues that come to mind quickly are closer to my field of expertise: global climate change, nuclear waste disposal, nuclear weapons testing and storage, and federal spending on missile defense systems of questionable effectiveness. With these issues, I feel reasonably sure I understand the scientific issues involved. But I still find myself wondering how to respond. Am I called to engage in the political process surrounding these issues, and, if so, at what level? Should I write to my Representative or senator? Join a lobbying organization? Look for a job on the staff of a legislator or in the national scientific organizations that deal with these issues? Run for national political office?

As scientists in today's increasingly technical society, our knowledge gives us

increasing potential for power and influence, which few of us use effectively, if at all. While my anecdotal experience is that many - perhaps even most - scientists are socially concerned, it also seems that most are not particularly engaged in policymaking. Furthermore, most of us are not prepared, either by our profession or by society, to think about the ethical and political questions that arise at the boundaries of our work. (Does anyone know of any Ph.D. programs that include training in ethics?<sup>1</sup>)

I suspect there are two reasons for this. First, mastering and then staying abreast of scientific work is sufficiently time-consuming that it is not clear if there is time (at least until relatively late in one's career) to become both educated and involved in ethical and political decision making. (One of my coworkers has decided that he must choose between his concern for ethics and policy and his interest in research science, so he has taken a job with a policy think-tank instead of pursuing a "scientific" career.) I do not have enough time to keep up with all the journals related to my field: I have accomplished all I can hope for if I regularly scan over the potentially related abstracts. To become well educated in another scientific area, much less to become a sophisticated thinker on ethical political issues, seems almost out of the question.

Second, most of us became scientists because of a love for the natural world and an aptitude for scientific reasoning. Ethical and political thinking and involvement require different skills than analytical scientific research. It is also less likely that there exists a single, obviously correct solution to any problem. We scientists, however, are trained to pursue the one right answer, and may find it difficult to deal with other kinds of problems. In my own work on improving undergraduate science education, I often find myself wishing that all students were exactly the same so that all students would respond the same way to a given pedagogy, just as all hydrogen atoms respond in the same way to a particular excitation. I imagine a similar level of frustration arises for scientists who deal with ethical questions without simple answers, or for scientists dealing with political processes that often seem (at least from the outside) to function counter to all rational expectations. Retreating into the laboratory seems appealing in face of such ambiguities.

This is where we need each other. Jesus called his followers into the Church, where individuals with different gifts or inclinations serve together. The challenges of living out the love of God in a fallen world are too big to tackle alone! To respond to science-related ethical issues, we need fellow scientists who are followers of Jesus to encourage us not to bury our heads in the sand, but to think with us about the scientific issues and to plan strategies together that impact the broader scientific community. We also need the rest of the Church. We need its rich history of theological understanding and experience on which Christian

ethical thinking must be based. We need our brothers and sisters who have devoted their lives to acquire understanding in ethics and politics. If only scientists think about these issues, our ideas will be the poorer for it.

What better mission exists for a professional association of Christians in science than to provide resources and partnership for responding to ethical issues? Organizations, like the ASA and Christian Medical and Dental Society, provide information on ethical issues for their members.<sup>2</sup> This information could include materials designed to educate scientists about issues outside their own fields (for example, a guide to the biology of embryonic stem cell research written for scientists not in biology). Going a step further, such organizations could connect concerned members to opportunities for in-depth training in ethical and political issues, and can provide more broadly aimed workshops and seminars. Most important, such organizations can help members with common concerns to connect to other Christians with expertise in ethics or politics.

I want to find other scientists - particularly, but not only, biologists - as well as other Christians, who are trying to think about embryonic stem cell research out of a Christian framework. I want to pray with people, who are broken hearted before God, over the brokenness of our world.

An obvious challenge to the connected community of Christian scientists that take on such a mission is the disagreement among Christians about how to think and respond to ethical issues. However, the ASA seems to have found a strategy for responding to the problems raised by teaching evolution, even though I doubt there is anything resembling complete agreement on that within the ASA membership. If the most valuable role that a professional organization can play is bringing together concerned individuals, then disagreement, if communicated in love and humility, can be used by the Holy Spirit to produce clearer thinking.

As I write these words, I am anticipating the birth of my second child in just a few weeks. I am acutely aware that not long from now, I will have even less time and energy than at present to devote to thinking about embryonic stem cell research, much less doing anything about it. But this is where prayer and partnership come in. I need partners, more actively working than I, who will encourage me to pray, and for whom I can pray. May God send such partners my way.

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## Notes

<sup>1</sup> A number of Ph.D. programs provide training in research ethics, e.g., what constitutes falsification of data, appropriate use of information about others' research, and so on; I am more interested in training in general ethical thinking, which for a Christian would be grounded in theology.

- <sup>2</sup> Some resources which are available for people interested in these issues:
- The ASA web site (<http://www.asa3.org>) includes links to ethics resources on the web and ethics-related materials that have been published recently in *PSCF*.
  - The Christian Medical and Dental Society has an ethics commission which has addressed a number of bioethical issues through political papers: see <http://www.cmds.org/ethics/>
  - The Coalition of Americans for Research Ethics has an extensive web site on embryonic stem cell research at <http://www.stemcellresearch.org/>
  - The University of Pennsylvania has a large center for bioethics, with information at <http://www.med.upenn.edu/bioethics/>

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## Book Reviews

**Paul Solly**

***Save Our Souls. A Christian philosophy of the mind.***

Pentland Press, Edinburgh, 2000. 262 pages hardback, £15.

ISBN 1 85821 742 3.

*Reviewed by D.A. Booth.*

Paul Solly's S.O.S. is for the idea that the human soul is immortal. He sees the situation as desperate because what used to be termed a person's 'soul' is now called our 'mind' and this thinking, feeling and deciding self is believed by many scientists and philosophers to depend on the physical brain and so not to continue to exist when a person dies.

Mr. Solly concludes his book with the Christian gospel. However, there seems to be only one passage where he claims a biblical basis for the view that the soul/mind survives death. On page 247, he writes: "The Bible teaches that[,] when a person dies, an invisible non-physical resurrection body comes into being out of the natural body, and this [resurrection] body sleeps until the resurrection. The mind is united to this resurrection body."

This suggestion is not easy to fit to New Testament statements about death and resurrection. Jesus Christ was truly dead from Good Friday evening until early Easter Sunday morning, when God raised Him - indeed, with a visible and in some sense physical body. Furthermore, Paul writes in the future tense in 1 Corinthians 15, "the dead will be raised imperishable" (verse 52). In Paul's analogy for death and resurrection, the plant "does not come to life unless it dies" and is buried as a seed (verse 36). The dead believers who await the Resurrection "have fallen asleep in Christ" (verse 18) because the death of a Christian is temporary, until "death has been swallowed up in victory" (verse



54), but it is real death, of the body, the mind and also the sociality of the departed person.

Nevertheless, this book provides a useful entry to the plethora of writing on these issues. Most chapters provide a series of thumbnail sketches of different positions on a wide variety of matters. These summaries are usually reliable and Paul Solly makes many good points in comment. An early *tour de force* is a dozen pages encapsulating the views of 78 philosophers and other thinkers on the mind, from Plato to Susan Greenfield. Solly summarises his own view of the mind as number 79 and dubs himself “a folk-psychologist”. In philosophical circles, this term refers to those who argue that science will never be able to dispense with ordinary mental concepts such as belief and desire. Solly’s definition is rather different: “a simple person whose pronouncements are nothing but what is obviously true”! Perhaps this was written with a smile but it does rather give the game away. For Solly’s comments on others’ positions tend to re-state his own view, rather than engage with the arguments that others have put forward for doubting such views.

A key illustration is the treatment of Wittgenstein’s later views. Solly complains that the *Philosophical Investigations* “threw many arguments into the air” and “it is not clear where they were supposed to land” (page 7). In fact, Wittgenstein directed each argument against an idea that he and his readers still often hold; furthermore, holding that idea makes one insist on some substitute before relinquishing the idea; yet the argument just is that there can be no substitute for that idea. So the arguments may seem to hang in the air but that is an illusion of not accepting how flawed the refuted presupposition is. This almost irresistible idea is that words have meaning by being pictures somehow of the world or, more generally, that it is possible to have a general theory of how language is meaningful. Solly is at least partly aware that this is what Wittgenstein was arguing against: he acknowledges that Wittgenstein considered the enterprise of seeking a theory of meaning to be misconceived (page 7). Yet Solly merely asserts, “but [Wittgenstein] did have a theory of meaning” and proceeds to impose on the discussion a theory of meaning of the sort that Wittgenstein’s arguments refute, that “minds attach meanings to words”.

Solly misses the force of Wittgenstein’s attacks on the theory that meanings are things that minds attach to words because he thinks that this was an attack on the existence of mind. Rather, Wittgenstein was attacking misuses of the concept of mind to give a bogus theory of how language has meaning. Wittgenstein debunked the presupposition that introspection can give an account of how successful communication occurs within a linguistic culture. This misunderstanding is unfortunate because the arguments against private language etc. are a much more successful attack on attempts to reduce mind to brain (that rightly so concern

Solly) than merely pronouncing it an obvious truth that the mind is not the brain.

The value of this book as a resource is increased by an index of topics addressed and authors cited in the text, plus lists of books on the philosophy of mind (with some theology and some science), on consciousness and on meaning. Readers interested in a topic should follow up the original author or at least a recognised textbook of that field.

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### **Desmond Tutu**

#### ***No future without forgiveness.***

London: Rider, 1999. 244 pp. hb, £14.99.

ISBN 0-7126-7013-0

*Reviewed by Sally Nelson.*

Imagine being 76 years old before you were considered competent enough to cast your first vote. Such was Nelson Mandela's experience in South Africa; while Desmond Tutu, Archbishop of Capetown until 1996 and author of this book, was 62. Under the indecency of apartheid, education and fluency counted for little if you happened to be black.

*No future without forgiveness* is, however, not just a gloomy account of how a nation of ordinary people was abused by a political system. Desmond Tutu was appointed as Chairperson of the renowned Truth and Reconciliation Commission, set up by the Mandela administration to deal with human rights abuses over a specified period, from the Sharpeville massacre in March 1960 to the democratic inauguration of Mandela as President in May 1994. The courageous and deeply spiritual way in which the Commission dealt with real people on both sides of the racial divide is a message of hope in a broken world.

In many countries which have moved from an oppressive to a democratic regime, past violations of human rights have either been ignored, or there have been public trials and swift retribution. The new leaders in South Africa believed that either of those ways would tear the nation apart and leave an inheritance of hatred and fear. Instead they opted for the positive 'third way' of offering free amnesty to perpetrators of violence if they made a full and frank confession to the Commission. The Commission heard heart-rending and vicious tales from both abusers and victims, and the psychological burden for the Commissioners must have been considerable.

Several theological themes stand out for me from the book. The first is the real sense of 'ubuntu' or community that existed in South Africa - a generous commitment to the healing of relationships that enabled this work to proceed. One wonders whether, in the UK, we would have sufficient respect for our shared

humanity for this process of restorative rather than retributive justice to succeed. Interestingly, some have accused the Commission of acting immorally towards the victims because the perpetrators could 'walk free' if they were honest. Tutu explains how the burden of exposure and the relief of confession brought their own punishment and healing.

Tutu explores the depths of evil and love that can exist in every person, but leaves us with a sense of the power of forgiveness and reconciliation. South Africa is not free from problems yet, but the bloodbath of Rwanda or Zaire has not happened, and there is hope that it will not if economic, as well as political, injustice can also be addressed.

Perhaps one of the most challenging chapters is the one entitled '*We did not know*'. When a system affords privilege and comfort to a group of people, and they do not know another way to live, gross injustice can seem normal. Even the church was not exempt from passive collaboration with apartheid. The Dutch Reformed Church, of course, justified it theologically (this position has now been revoked and there has been some public repentance) but even the Anglican Church, although officially denouncing apartheid, worked within its structures. Many ordinary people collaborated with the system because they believed the tale that they were resisting Communism - the line of the apartheid government. Readers may be interested to know that the South African Government's Chemical and Biological Warfare programme was being used not just for defensive purposes but also to prop up apartheid. What injustices might we, in our small corners, be condoning?

Tutu makes many probing observations about the nature of power and I particularly liked the way he insists that life need not be a case of 'top dog' and 'under dog', but that a more wholesome, united way forward can be found. He has preached this message to the world in Israel, Northern Ireland, Rwanda, and elsewhere, and has earned the right to be heard because the Truth and Reconciliation Commission was such a bold experiment in human trust and - largely - has worked.

This book is a message of hope triumphing over horror and of dreams come true. Read it!

*Rev. Sally Nelson is minister of Beechen Grove Baptist Church, Watford.*

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## Cumulative Index Part 3

The first part of this index was published in Bulletin 27 (April 2000) and covers volumes 1 to 43 (1866 to 19121); Part 2 (Bulletin 28) volumes 44 to 70 (1912 to 1938); Part 3 which follows (now much fuller than the previous indices) covers volumes 71 to 100 (1939 to 1973).

### Abbreviations

**Asterisk (\*)** - the first page of an article; **c** - correspondence; **d** - contribution to a discussion; **f** - and pages following (used sparingly; **frw** indicates that a further review by the same writer in the pages ahead); **n** - note; **ob** - obituary; **r** - review; **rw** - writer of a review.

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