

its victim the lineaments of God. The parasitic animal, following its ways in the body of either of these creatures, must also reveal these lineaments as does also the man who observes, with anger and despair, its destruction of the beauty he adores.

'The dilemma, then, is this. We try, in our human pride and self-centredness, to find a God who shall have made a universe suited to our ideas. . . . The way out is the way of the great objective artist . . . of conquering the self and entering into the souls of the objects which we perceive. . . . The attempt to do this, to enter into the non-human, whether it be living or not, and to recreate it, when it is understood, for the contemplation of our fellow-men, is the task of the saint, the artist and the philosopher rather than that of the biologist. He is, however, a poor biologist who does not try to be something of a seeker after God as well.'¹³

¹³ G. Lapage. *Parasitic Animals*. Cambridge, 1951, pp. 333-4.



THE SCIENTIST'S INTEGRITY*

LAURENCE BRIGHT, O.P.

I RECENTLY attended the meeting of the British Association at Oxford, at which a number of distinguished scientists emerged from the mysterious shadows of their laboratories and tried to give the general public an idea of what they had been doing—with varying degrees of success, since science has travelled far from the time when it was readily comprehensible to all educated people. One of the things that struck me was the number of times that the speakers went out of their way to emphasize that there was no longer any conflict—indeed, any possibility of conflict—between science and religion. It was natural enough, at an Oxford meeting, to recall the celebrated dispute which took place there in 1860 between Huxley and Bishop Wilberforce over the question of evolution. Tempers on that occasion ran very high. Nowadays, as was pointed out, such a scene is unthinkable. The

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Church and the scientists have come to realize more clearly the extent of their authority, and no longer seek to provide answers to those questions of pure knowledge which are known to lie within the other's province alone. There is at last some possibility of restoring the old harmony between natural and revealed knowledge which was broken four hundred years ago with the rise of modern science.

But it is hardly enough that science and religion are no longer active enemies. There is still a widespread feeling that science has dispensed with the need for religion: that though it may not be able to get rid of it, it can now afford to ignore the older authority, which can no longer do any harm. I do not think that this is the view of scientists themselves, however. Generalizations are easy to make, and usually impossible to verify or refute, but in my own limited experience (limited to Oxford, which is a highly peculiar place) scientists are nearly always interested in questions of religion—more so than any other occupational group of similar standing. I want to suggest that this comes from the nature of science itself. I shall try to indicate certain characteristics of scientific enquiry which make those who pursue it more open than others are to accept the full Christian revelation. This is how I would interpret C. A. Coulson's description of science as a 'religious activity', both in his recent Riddell lectures¹ and in his British Association discourse *Science and Religion*. A similar interpretation might also be given to the earlier series of Riddell lectures given by Michael Polanyi, *Science, Faith and Society*.² Since their views are not widely known except to scientists, I shall try to say something about them here.

It will first be necessary to say something about the nature of scientific theories. This is in fact rather a controversial matter, and not all scientists would accept what I have to say, but I do not see how to avoid some examination of the question. My remarks are based on the physical sciences, but with proper allowance for very real differences of method will, I think, apply to other forms of knowledge. Modern physics, then, is not an affair of collecting large numbers of observations and trying to draw a general pattern from them, rather like the old botanists collected their specimens and arranged them in elaborate classifications of

¹ *Christianity in an Age of Science* (O.U.P., 1953).

² O.U.P., 1946.

genera and species according to the features they had in common. A physicist starts from an already highly developed knowledge, and his problem is how to push it one stage further forward. He gets some sort of 'hunch'; how, it is not easy to say, any more than it is easy to say how the idea for a picture or a poem first comes. It is this place of intuition—the inspired guess, if you like—in modern science which gives it a claim to stand amongst the imaginative arts. Such a guess made by a non-scientist would have very little chance of proving correct. The power to guess right comes from a long formation within the scientific community: a long conditioning of the mind within a tradition, just as the painter or the musician must submit to long technical training until, by some strange paradox, his mind is able to create freely some new art-form. You cannot lay down rules for scientific discovery any more than you can lay down rules for making a poem, though there are rough rules for judging it after it is made. Everything depends on the scientist's own spontaneity—his freedom within the tradition.

But there is a second factor in the making of a scientific theory besides this free, creative, artistic element. A theory is not merely a work of the mind; it must also give a picture of an objective world outside us. It is based on experience, and confirmed in experience. The intuition must be confirmed or refuted by devising a suitable experiment; it must be tested in solid fact. The scientist must have an absolute adherence to truth; his theories must reflect the structure of a real world. There is a tendency nowadays to minimize this element in a scientific theory; to think of it as entirely a product of the mind, a convenient way of ordering the facts, without an objective basis, something merely conventional. Such a position is difficult to refute by logical argument, in much the same way as is philosophical solipsism; against such academic views one can only appeal to common experience. To a working scientist actually engaged in research, there is an overwhelming sense of given-ness about the simple forms that he uncovers from their hiding-place in the detail of nature. One knows that in a sense a scientific theory comes from one's own mind, yet equally clearly it comes from outside you, from an objective world that has revealed itself only on coming into contact with your own mind. Coulson quotes³ the words of Bragg: 'When one has

³ *op. cit.*, p. 31.

sought long for the clue to a secret of nature and is rewarded by grasping some part of the answer, it comes as a blinding flash of revelation: it comes as something new, more simple and at the same time more aesthetically satisfying than anything one could have created in one's own mind. This conviction is of something revealed, and not something imagined.'

Scientific theory, then, has both a subjective aspect, due to the activity of our minds, and an objective one, in so far as it is received passively from outside us. I shall consider this second aspect first of all. Coulson has actually suggested it as a basis for the affirmation of God's existence, and I believe that this has more to be said for it than might at first appear. It is not an argument from within science, as was Paley's argument from design (really from the geometrical order revealed by Newtonian mechanics), or as are certain more recent arguments from cosmological hypothesis. It depends on our seeing all scientific theory as something objectively given to us; it is in fact identical with St Augustine's standard argument from the nature of truth. Augustine persuades us to understand truth as arising from the illumination of our minds by the action of God. Such an argument is sometimes suspect because it is based on interior rather than on external experience, but I do not think this suspicion justified unless the experience in question is subjective, which it is not in the case under consideration.

But it is time to take a stand on more solid ground. I want to examine the effect on the scientist himself of the work in which he engages; still, first of all, from the objective aspect. I suppose the majority of people today tend to look on their jobs as something pretty separate from the rest of their lives. They have no sense of their work being a vocation. I am not talking of Catholics, or even of certain other kinds of Christian; but of the vast number of people up and down the country who have no one to explain to them that all things can be done for the glory of God. The scientific community, though not necessarily consciously, forms something of an exception to this rule. This is because, as we have seen, the scientist is devoted in a very particular way to the discovery of truth. So of course is the philosopher in his study, but by the nature of things there are far more scientists in the world than there are philosophers, even though they are not all doing very important work—and it could of course be argued that the

deepest insight into nature that can be given by science, is superficial in comparison with philosophical truth. Yet every scientist can feel himself to be a part of a community whose motto, also, is 'truth'. There are research laboratories in which all the workers, down to the humblest, whose task is pure routine, are imbued with this feeling of sharing in a huge endeavour—mankind's most spectacular attempt to discover truth. Now it seems to me that any work which brings one into such direct contact with reality (and I have insisted on the objective nature of scientific truth) can easily come to be regarded, consciously or not, as the worship of God.

But before I develop this argument, I should like to say something of the scientist's attitude towards this reality, with which he is brought into contact. In order to do this I must now draw attention to the second element which I distinguished in scientific theory—that which comes from the activity of the scientist's own mind. Classical scientists tended to view nature dispassionately, as a dead landscape to be gazed on from far away. Hence the standard description of nature in terms of neutral particles, reduced, in Whitehead's famous phrase, to 'a dull affair, soundless, scentless, colourless; merely the hurrying of material, endlessly, meaninglessly'. But now, as we have seen, the process of scientific discovery is not thought of as a passive sorting-out of fact: it requires the scientist to be actively 'engaged-with' the reality he seeks to know. He must pursue his attack 'with zeal and hope and a sense of personal identification with the experiment'. Nature has become living to him rather than dead; to be wooed rather than bullied into giving up her secrets. Scientists have come to realize (largely, I think, because of Whitehead's pioneer work) that they will never understand nature unless they realize that they are part of her, as well as being her knower and her judge. No doubt the influence of biological theories of evolution (especially since elements of purpose have taken their place beside the mechanism of blind chance) has been important in producing this change of view. Some physicists have tried to reinforce it by an argument from within science itself; they point to the conclusion of quantum theory in which all observation of nature necessarily alters slightly that which is observed, so that an exact answer to certain questions can never be obtained. Personally I doubt whether such a discovery of the limits of observational technique has any relevance to the

general view of scientific theory which I have been putting forward; the role of the subject's activity in all observation was emphasized as long ago as Kant. The important point to grasp is this new sense, in science, of the bond between man and nature, and hence of her dignity.

I have insisted on the scientist's contact with the reality of nature, because it is this which saves his search after knowledge from being no more than an elaborate game. And now there emerges this sense of personal relationship with nature. We all accept readily enough the idea of sanctification through work; less readily perhaps, since the fourteenth-century 'failure of nerve', the idea of sanctification through intellectual work. Yet if a man's talent lies here, he has no right to neglect it; knowledge is one of the many paths through which one may come to wisdom. It seems to me that there is a genuine sense in which the scientist may be considered the successor of the old craftsmen, and the laboratory, as much as the garden or the workshop, a place for shaping the stubborn fact of reality. And if this is so, the scientist is surely open to receive a fuller understanding of his activity through the Christian revelation. This at any rate is how I understand Coulson's conclusion⁴: 'to accept Nature as, in some senses, given: to receive the gift, and behave in a creaturely fashion towards it: to believe that it carries with it a meaning and significance, and to seek, in reflection, what that meaning is—this surely is to act religiously'. What is this but Pascal's 'toutes choses couvrent quelque mystère; toutes choses sont des voiles qui couvrent Dieu'? It is an easy step to understanding nature as a Christian does, the dwelling place of the Holy Spirit; 'Spiritus Domini replevit orbem terrarum', sings the Church at Pentecost. 'Behold, I make all things new.'

There is yet another feature of scientific research which I should like to elaborate. To spend one's life in a search for truth is obviously a good and harmless thing; it is worth much more if it costs a man something, if it involves a real temptation that must be overcome. Now obviously a scientist has no direct temptation to falsify his results; apart from the uselessness of such an action, which stultifies his whole aim of discovering the facts as they are, the fraud would be detected as soon as someone else tried to repeat his experiment. There are, however, subtler temptations to try

4 *op. cit.*, p. 33.

his integrity, which are connected with questions of interpretation. From the sketch I gave of the nature of scientific knowledge, it will have become clear what an intensely personal affair it is. Nothing could be further from a merely mechanical process—though a great deal of sheer routine work is of course involved as well. Yet ultimately all depends on the personal judgment of the scientist. It is he who has to weigh the evidence for or against his theory; to decide whether an observation may be disregarded for the time being, because it does not fit in, or whether it has to be accepted, though it destroy the whole elaborate structure that has been building up. Only the experimenter himself can do it; only he has the 'feel' of the situation. So the position is a complex one. The scientist is his own judge; he must have all the judicial coolness, remoteness if you like, which will enable him to make a correct decision. Yet all the time—and here I cannot do better than borrow Polanyi's own words⁵: 'far from being neutral at heart, he is himself passionately interested in the outcome of the procedure. He must be, for otherwise he will never discover a problem at all, and certainly not advance towards its solution.' He continues: 'problems of this kind can be resolved by no established rule, and the decision to be taken is a matter for the scientist's personal judgment; we now see that this judgment has a moral aspect to it. We see higher interests conflicting with lower interests. That must involve questions of conviction and of faithfulness to an ideal; it makes the scientist's judgment a matter of conscience . . . we recognize the note struck by conscience in the tone of personal responsibility in which the scientist declares his ultimate claims.'

This note of faithfulness to an ideal does seem truly to merit the use of the word 'moral'. One has to experience the long labour of months, years, required to work out an idea, the growing excitement as it seems to be being confirmed, the sudden crash as a new fact appears telling against it, and all one's labour seems wasted. There is real temptation here; not of course to anything so crude as suppressing the fact, but to explaining it away. For this can sometimes be a legitimate thing to do; many of the great scientific theories have been accepted for years in plain defiance of certain facts, which eventually were seen to fall into place. One's whole training in the tradition has to be brought to bear on the fact, to

⁵ Polanyi, *op. cit.*, pp. 24-26.

get its 'feel' right, to judge its significance; only you can do it: yet on your decision hangs the possible loss of a year's work, the possible rapid advancement (if you are a young scientist) to the position you covet. It is indeed a matter of conscience—a conscience schooled in the tradition, especially under the personal guidance and inspiration of one of the older scientists (for learning science very much depends on being apprenticed to a master, as in any other art). Ultimately it is a matter of individual, personal qualities. Not all men, not even all clever men, make good scientists. As Einstein himself has said, 'most people think it is the intellect that makes a great scientist. They are wrong; it is the character.'⁶

I have tried to bring out three characteristics of the work done by a scientist—the struggle it demands with 'irreducible and stubborn fact'; the sense of personal engagement with that reality; and the moral purification involved. If a Christian can reach sanctity through the labour of his hands, it seems equally clear that he can reach it through labour such as this. But it is mainly of the scientist who is not a Christian that I am thinking now. I have said that his work requires of him, or produces in him, or both, a character which is open to be acted upon by the Holy Spirit. The scientist is the man of goodwill, such as Newman asked for at the end of the *Grammar of Assent*, 'imbued with the religious opinions and sentiments which I have identified with natural religion', and so a fit subject to receive the truths of faith, his mind ready to be convinced by the Church if she will but speak to him. Yet even where he remains unconverted, a scientist may still do much good in the modern world. There is no doubt a real danger that he may be made use of by unscrupulous politicians for their own ends, or be pushed into a false position by the hero-worship of an ignorant public. To some extent it has already happened. But the scientist is usually on the look-out for such dangers, and is proof against them. He is not prepared to acquiesce silently in the abuse of the knowledge he has wrested from nature at such cost; and he does not like being mistaken for a prophet or a priest. To discuss this latter point would lead me too far from my subject, which has been the scientist himself, not the age which he has helped to make; but I cannot conclude without saying something of his attitude to the abuse of science. Respons-

⁶ Quoted Coulson, *op. cit.*, p. 48.

ible scientists are coming forward more and more (if not yet in the degree one would like to see) to condemn the immoral use of scientific knowledge. The atomic bomb forms an obvious example. Far too little was done, and the matter has now passed beyond anyone's control; yet who is to say what might not have occurred had proper guidance been given the scientists by those more expert in ethical matters? Oppenheimer⁷ spoke for many others when he witnessed to a sense of sin at the realization of what he had helped to make. There are other grave questions coming up for decision: to name only two, there is the possibility of controlling, to a much greater degree than hitherto, other men's minds and wills; and there is the question of a forcible limitation of world population. I believe that scientists are going to speak out about the moral aspects of questions such as these, and I believe they will be listened to. Obviously those scientists who are Catholics, though only a small minority, may be able to play a considerable part by their personal influence in forming the consciences of their fellow workers: a great opportunity, and a correspondingly great responsibility. Here again theologians must co-operate by explaining clearly the moral principles involved—a work of collaboration which could well take place at conferences such as these. I am sure that in this way much can be done, for as I have tried to show, the soil is good, and only awaits the seed. For good or ill the future lies with science, and I trust that the Church will realize it.

⁷ Quoted Coulson, *op. cit.*, p. 48.



THE SCIENTIST'S APPROACH TO FAITH*

E. F. CALDIN

THE scientist is first of all a person, set in the framework of family and society. The problems arising from his own make-up, and from the current social scene with its special stresses, will often bulk much larger in his life than anything concerned with science. However, there are some aspects of

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