

best account of science that could be given was confused and doubtful, the task of investigating nature seemed to be more difficult and less important than that of becoming a philosopher. In the seventeenth and eighteenth centuries science appeared to be simple, systematic, and not beyond the capacity of a philosopher, so that such men as Descartes, Leibnitz and Kant could acquire a mastery of both fields. To-day, science has grown to such a bulk and complexity that scarcely any scientist, let alone philosopher, has a clear view of its general outlines. Thus we have passed from mediaeval philosophers ignorant of science, through scientific philosophers of the seventeenth and eighteenth centuries, to twentieth-century scientists, ignorant of philosophy. Yet science in its researches into its own foundations is once more meeting the problems of metaphysics, and there is good hope that its own desires will cause it once more to seek a fertile union with divine Philosophy.

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THE PLACE OF SCIENCE IN MODERN CULTURE¹

NATURAL science is concerned with understanding the working of material nature. The subject of this paper is the positive contribution which natural science, given its true place among the other activities of man, might make to the world. At the outset, it is essential to distinguish between science and the applications of science. When a certain knowledge of nature has been won, it is often possible to apply it to the control and manipulation of nature—to devise new techniques for handling matter. Modern industry is becoming more and more dominated by technology based in this way on applied science. The emphasis on the use of science in modern life is such that most of those who write on the 'place of science in society' are thinking primarily of the place of technics in society, and treat science only in relation to technics. But the question of the place of technics in society raises problems wholly different from

¹ From a paper delivered to the Newman Association Conference at Ampleforth, August, 1944.

that of the place of science in society, and a lack of clear distinctions here can lead to a wholly false conceptions of the functions of science. That technics (which presupposes science) will be of major importance to this nation, it is impossible to deny; that science has significance only as a basis for material prosperity is not, however, a legitimate conclusion. Science is concerned with understanding nature, not with manipulating it for economic purposes. The great human problems centreing round the rapid growth of industrial technology must here be left aside, as being only indirectly connected with the functions of science in modern culture. It will be assumed without further argument that the great functions of natural science are concerned with the development of the mind and will, in leading men to live a life which is at once rational and supernatural, and thereby to exert a Christian influence in the world.

I.

Scientists, and others with some education in science, are faced with the problem of the influence of science on their thought and practical life, and hence on those of their fellow-men. For life is one; the scientific part of life affects the rest; a scientist becomes, in and through his scientific work, a better man or a worse, and his influence on his fellow-men is correspondingly helpful or harmful. It is therefore important to understand how science ought to be integrated with the rest of a scientist's life, and how this bears on his social influence.

The key to this matter is that scientific life is a type of life lived according to right reason. It is a version of rational life, an adaptation to a particular activity of the principles common to all rational life; consequently, if rightly lived, it should develop those qualities which make possible rational living in other departments of life. First, it demands the experience of the senses; not haphazard experience and hearsay evidence, but careful observation and intelligent searching; a mind alert for novelty but trained also in cautious verification, humbly obedient to facts. Second, it demands that observation shall be interpreted by reason, which brings order into the data of sense; it requires rigorous logic, controlled imagination, and intellectual insight; clear analysis and wide synthesis. It requires that we learn about nature from experience (as distinct from spinning myths) and that we interpret that experience by reason (as distinct from merely remembering or applying it). Third, it is characterised by a continual interplay of experiment and theory: experiments suggest hypotheses, hypotheses in turn suggest experiments which may verify them. Scientific life, then, requires a

rational unity of thought and action.² Fourth, it is a developing tradition: neither a code of unalterable rules, nor, on the other hand, a formless collecting of varying authenticity, devoid of established criteria for judging new developments. That is, the scientific spirit will tolerate neither a sterile immobility nor a rootless fickleness; scientific beliefs need periodic overhaul, and constant adjustment by the principle of 'workable compromise.' Fifth, as a consequence, scientific life requires freedom: freedom of thought, of discussion, of publication, and above all of investigation.³ Sixth, scientific work is a social as well as a personal enterprise. All scientists must take on trust a vast body of facts established by their colleagues and predecessors, and it seldom happens that any important field of scientific investigation is monopolised for long by one man. Consequently, the practise of science requires both personal integrity and respect for one's colleagues; tolerance for others' opinions, and determination to improve one's own; the attempt not to overstate one's case, nor to underrate others'. Thus a mental 'climate' is favoured which is a balance of appreciation and criticism.

All the six general principles named belong also to other studies and indeed to any rationally-conducted enterprise, from philosophical research to the running of a farm. Every student can recognise in them the principles of his own speciality.⁴ But in pursuing natural science we use a special adaptation of those principles, a particular version of rational method. Historians use another version, philosophers another; craftsmen, business men, housewives, all have their own special rational habits adapted to the work in hand. The method of natural science is not the sole and universal rational way of reaching truth; it is one version of rational method, adapted to a particular set of truths. The point needs emphasising both to indicate a common mistake and to show how to correct it. Large numbers of people have been misled into thinking that the procedure of natural science is the royal road to truth in every field, that what cannot be proved by science cannot be true, and that such propositions as 'The soul of man is immortal' are meaningless or at any rate unprovable. The mistake here lies in confusing part with whole—scientific method with rational method. But we can substitute for the mistake an

² It may be noted that the primacy lies with thought; experiments are undertaken for the sake of understanding, not vice versa. This agrees with the philosophical tradition of Plato, Aristotle, and St. Thomas, and not with 'activism,' which exalts action above contemplation.

³ Cf. J. R. Baker, *The Scientific Life*.

⁴ Obviously I am here dealing only with studies in so far as they depend on natural reason alone, and not on revelation—that is, theology and all dependent studies are excluded from consideration.

important truth, if, agreeing that science is not to be divorced from other rational pursuits, we find their connection in this : that science is not only a version but a *microcosm* of rational life.

By this is meant that in studying science and becoming familiar with that form of rational activity, one is led to understand rational life in general : one grasps that principles of all rational procedure through the practice of one form of it. It should then be easier to adapt those principles to other studies and to life in general. No doubt the same applies to any discipline ; yet there seem to be certain advantages in natural science as an introduction to rational method. The phenomena are relatively simple ; they are not far removed from sensible experience ; they can often be repeated at will, under controlled conditions ; they do not require for their understanding a mature wisdom or knowledge of the world ; they do not make direct contact with problems of morals, still less with metaphysics. Mistakes in science have no such disastrous effects as errors in theology, or in principles of government. Moreover, science prepares the mind for philosophy⁵ ; it suggests problems which it cannot solve, provides examples of abstract argument, and serves as an introduction to rigorous thinking. Scientific work, then, should be a school of rational behaviour ; a microcosm of rational life. Only when the microcosm is confused with the macrocosm is there a danger in the study of science.

These views may be applied to the question of the ' social function of science.' There are in fact two quite distinct (though not separable) ways in which scientists as such discharge their responsibilities to their fellow-men. One is through the application of science to make easier the material conditions of life. But the ease and frequency with which science is misapplied make this quite inadequate as a justification for its existence. A much stronger case can be made for science as a social force in terms of its approach to truth than in terms of its usefulness. Those whose work is primarily concerned with science itself, whether in teaching or research, can fulfil a highly important social function simply by their living devotion to the conservation, advance and propagation of scientific life. For if science can be made a real school of rational life, in virtue of its being a type and microcosm of rational procedure, it cannot help contributing to the personal development of those who follow it. Anyone who has seen the general intellectual development which can result from the proper teaching of science at a university must admit that the academic scientist can contribute not a little to the personal

⁵ Cf. Maritain, *Science and Wisdom* ; Heydon, *The God of Reason*.

growth of young people.⁶ And society at large benefits from such personal development; for its vitality depends upon the vitality of individual people and their intellectual and moral ideals. Again, it will probably be agreed that the fundamental values of reason, and in particular the value of truth and the dignity of the human person, stand in great need of buttressing. And it may be that natural science will be one of their supports. For science has an advantage over history, or philosophy, or literature, as a representative of reason, in that so long as it remains alive at all, it cannot be wholly false to the true rational spirit. False science is easily disproved, by experiments reproducible at will; moreover it would fail if attempts were made to apply it. No one can coerce nature; it cannot be persuaded by the will nor affected by the imagination; whereas most other studies are liable to perversions which are much more difficult to eliminate and may greatly weaken the work of whole schools of thought and generations of scholars. At all events, while the prestige of science stands so high and the other learned disciplines so low in the common estimation, scientists have a special responsibility to uphold reason in science and reason in general.

In this account of the primary 'social function' of science, I have tried to retain what was positive in the older apologetic of science, which represented its value as due to its loyalty to truth, and to complete the argument by restating it in terms of the good of *persons*. For duties are owed ultimately not to ideals, such as truth, but to persons, who alone can be the subjects of rights and duties; speculation is incomplete unless it is directed to the good of persons. At the same time the view outlined cannot be accused of favouring a selfish and irresponsible attitude on the part of the scientist.

II.

So far all that we have said has been concerned with the purely natural plane; we have said nothing of man as raised by grace to share in the divine nature. Can a scientist find inspiration in scientific work for his Christianity? Can scientific life be so lived in Christ as to be a microcosm for the rest of Christian life?

Bearing in mind those characteristics of science which show it to be a type of rational life, we may observe that the personal develop-

⁶ That scientific training is in practice often narrowing, and that scientists in real life are commonly less cultured than they should be, must be blamed not on study of the scientific microcosm but on neglect of the macrocosm. Many scientists are conspicuously lacking in the qualities which science ought to promote, because their education has been over-specialised. Reform of the education of scientists is overdue.

ment to which science can contribute is twofold : a discipline of mind and will on the one hand, and a positive development of the mind (by knowledge) and of the will (by love) on the other. Here, it seems, is the point of insertion of Christian life into scientific life. Christian life is essentially positive; by grace our whole nature is to be perfected and our life brought into a participation in the life of God himself—a participation in his knowledge, by faith, and in his love, by charity. And this perfecting of nature by grace requires a corresponding discipline, training, 'asceticism' in the original sense—the troublesome business of setting mind and body, will and emotions, in their right relations; of subduing the discord which we all find within us. The rhythm of Christian life, then, is discipline and union with God : Cross and Resurrection. This new and super-human pattern of life should act like a leaven, permeating every part of human activity; all human operations can be disciplined and vivified by the life-giving power of Christ, and can in turn be used in the service of the Christian reintegration and rebirth. This suggests how natural science can take its part in the personal Christian life of a scientist.

To take first the 'negative' aspect : discipline. All learning implies a twofold attention, to 'brute fact and iron law' and to the synthetic interpretation thereof. It therefore forbids a man to consider only his own selfish claims, and shifts the centre of interest from his own life to other lives, other things, other events. Following von Hugel, we may say that the pursuit of knowledge demands 'courage, patience, perseverance, candour, simplicity, self-oblivion, continuous generosity towards others, willing correction of even one's most cherished views.'⁷ All this is especially applicable to natural science. In particular, acquaintance with science heightens enormously one's appreciation of the bruteness of brute fact and the ironness of iron law, through the bracing, purifying contact with matter, which can make a considerable contribution to the asceticism of a man of science. There is constant friction and effort, which the Christian will use as so many occasions for a realistic self-surrender to the will of God, as expressed in the order he has established in nature—so many small chances to help carry the Cross. These considerations seem to apply equally well to all stages of scientific knowledge, and to applied science and technology as well as to pure science. In view of the large numbers of people preoccupied with technical problems, in factory and laboratory, it seems that such principles ought to be more widely understood.

⁷ von Hugel, *Mystical Element of Religion*, vol. ii, p. 349.

If we turn to the positive or re-creative aspect, we find that, not only do many minds find real illumination in the details of the working of material created things, and therefore a new window on God himself (for truth cannot but illuminate Truth)—but further, that to live in the knowledge of well-established laws of nature, and to apply them as part of one's daily work, continually calls to mind the presence and creative activity of God. For the order of nature is not upheld without the creative power of God; this power did not act merely at one instant of time, but acts continually throughout all time. Science (if used in this way) will dispose a man to find God everywhere; and it is no long step for the Christian to pass from his presence as Creator to his intimate presence by grace in the soul. The will, moreover, is not left out of this movement. In recalling the presence of God it is easy to adore and love him, however momentarily. And, for the scientist whose mind is illumined both by the truths of revelation and the truths of science, and whose will is set to love God, there is a yet more intimate way in which science and Christianity may meet. The scientist is a priest of nature. Every created thing and every created person shows forth the splendour of God—that is, praises him. Non-living and non-rational things praise God by following his laws—a river in its flow, or a bird in its flight, for example. Men praise God by offering their whole selves freely and lovingly to him; they can praise him consciously, deliberately, with understanding and love in place of blind obedience. And through his intellect, through his understanding of nature, man can become the mouthpiece of nature, and make articulate its silent adoration. He offers back to God not only his own self, but the whole material universe, whose obedient dependence upon God he recognises and of which he is the highest member. He is the spokesman of nature and so its priest; for the office of a priest is to express outwardly the inward self-giving of men to God, in their adoration and desire of union with him. This priesthood towards nature is exercised in many ways—by craftsmanship, for example, and by art; but here we are concerned only with the scientist. Clearly it is his knowledge of nature which gives the special colouring to the scientist's praise of God on its behalf. It is his insight (however imperfect) into the inner order of the workings of nature, that gives the peculiar quality to his priesthood. It is not difficult to see how all this can be fitted into Christian life, especially when it is remembered that all Christian life can be related more or less directly to the Christian participation in the priesthood of Christ and hence in his redemptive work.

A revolution in the scientist's personal life could be brought about

if these principles were lived. Whereas for the irreligious scientist the centre of gravity is commonly himself, or society, or some abstraction like 'progress,' for the Christian it should be God—Pure Act, the most intelligent and most alive of all beings, who is yet 'closer than hands and feet.' The pagan scientist commonly tends to have less admiration for the ingenuity displayed in nature than for the cleverness of men in finding it out; the Christian should be readier to wonder at nature, as he learns its workings, than to exploit it. The former is impressed with the extension of the fields of knowledge; the latter should appreciate also the immensity of the unknown wonders of God beyond their frontiers. The one tends to an anthropocentric, and the other a theocentric, humanism. And if the old standards of integrity in science are to be kept, we shall have need of more God-centredness and less man-centredness. Science depends for its integrity upon the personal virtue of scientists; the ignorance and pride of modern scientists are beginning to undermine it. It is for Christians who are also scientists to insist upon those personal standards of humility and disinterestedness which alone makes science possible.

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THE RELIGIOUS SITUATION IN 'EASTERN POLAND'

THE annexation by Soviet Russia of certain territory which after 1920 had again been part of the Polish State is now a thing not only accomplished in fact but recognised by those powers strong enough to have a say in the matter. We have heard a great deal about it (and doubtless shall hear more) from the several sides and from various aspects. The only people whose views we have not been able to hear are those most affected, the inhabitants of 'Eastern Poland'; the great powers have not asked them to express their choice.

It is not easy to estimate what would have been the result of a free plebiscite (a really free plebiscite would probably have been un-