III

SCIENCE AND RELIGION

In last lecture a long quotation was given from Mr Dewey's recently published volume *A Common Faith*. It is the best summary I have been able to find of this part of the general Humanist position. As we have seen, the author asserts the absolute primacy of "science." "There is but one sure road of access to the truth, the road of patient co-operative inquiry, operated by means of observation, experiment, record and controlled reflection." "There is but one method for ascertaining fact and proof, that conveyed by the word 'scientific' in its most generous and liberal sense." This is the intellectual corner stone of Humanism. Science alone can penetrate to the very core of reality and tell us what is the final truth about the cosmos and about ourselves. The text-books of all the sciences will thus give us the last word on Reality. What this in effect amounts to is that science must displace both philosophy and revelation, both of which have hitherto claimed to have the last word.

It is very important to realise the peculiar hold which this, I believe, quite unwarranted and, in the case of most of these Humanist writers, uncritical over-estimate of the place and function of natural science in the great domain of human knowledge, has upon their minds. They simply take it for granted, and believe that they have behind them

and backing them the whole formidable magnitude of scientific achievement, and, armed with this assurance, they feel themselves warranted to judge all other types of thought and experience.

The same obsession explains another feature of these books to which I have referred in the preceding lecture. They speak with a certainty that can be only called pontifical of the incredibility of the older faith. No infallible Pope could be surer of his ground than they are, or more clear that any other way of interpreting the universe than their own is due to some perversion. The supreme pontiffs would trace the delusion of those who differ with them to sin: the Humanists trace the delusion of all those who differ with them to "wishful thinking," that is, to emotional prejudice. Now in neither case have we to do here with personal megalomania. In all personal matters Pope and Humanist are alike, I have no doubt, modest and reasonable human beings. But in his official pronouncements the Pope speaks *ex cathedra*, believing that he has the whole true Church behind him, and that behind the Church is the Divine Trinity. So the Humanists believe that behind them they have the overwhelming authority of "science," and are unconsciously inflated by this conviction, to speak with an assurance to which neither the facts nor their own considerable abilities entitle them.

Now if this be so, it is obviously necessary, first of all, to get some clear idea of what we mean by science and the scientific method. The word is sometimes loosely used to describe every kind of accurate and systematised knowledge. The older

Huxley defined it thus: "By science I understand all knowledge that rests upon evidence and reasoning." Another scientific writer maintains that all intelligent knowledge is science. To my mind such definitions would include all real theology, philosophy and historical learning. The definition is far too wide to be of any use. The German use of the word *Wissenschaft* favours this wider and vaguer meaning. Clearly we need something much more precise. By the word Science in this volume I shall always mean what it generally means in English, that is to say what the Germans call "Exact Science," which for them includes all the sciences of nature and also mathematics. I would add to these the mixed sciences, psychology and sociology, because they deal with the facts of human nature in a purely inductive way. This is the same usage as prevails in France. To be more specific I would adopt Lord Acton's definition: "Science is the co-ordination of a great mass of similar facts into the form of a generalisation, a principle, or a law, which will enable us to predict with certainty the recurrence of events under like conditions." Karl Pearson[1] has given a like definition more briefly: "The classification of facts, the recognition of their sequence and relative significance is the function of science." The method of every science is to observe the facts and processes in its domain, to classify these, to frame hypotheses to account for them, and by experiment to verify or confute these hypotheses, and so gradually to discover a system of universal impersonal laws or uniformities of process, whether

[1] *Grammar of Science*, p. 60.

these processes be astronomical, physical, chemical, biological, psychological or sociological. The account of the world which emerges from this scientific method is always abstract, general or impersonal, and as the generalisations of science become ever wider and more abstract they tend at last to become purely mathematical. This is what is generally known as the scientific method, with which anyone can familiarise himself by the study of its text-books or its classics, Newton's *Principia*, Darwin's *Origin of Species* or Marx's *Das Kapital*. The ideal goal of science is to find a generalisation so wide that everything that happens in the way of natural process or personal and individual achievement can be deduced from the fundamental law and cited as an illustration of its range. The abstract and general swallows up the individual.

Over against this stands the religious interpretation in one or other of its many forms. William James has truly described the religious interpretation of the world as "personal-romantic," the scientific as "abstract and impersonal." The religious interpretation, and of this, for greater clearness of exposition, I shall take the Bible as the classical expression, believes that the Divine Personality is at the heart of all things, realising His purposes through all natural process, creating through it other personalities, caring for them, guiding them, ruling, over-ruling and educating them for ever fuller communion with Himself. Thus the Biblical interpretation of Nature and of life is shot through and through with purpose and meaning. All Nature is instrumental to the purposes of God, "fire and hail, snow and vapour, stormy wind

fulfilling His word." "He maketh the grass to grow upon the mountains." He made "the Pleiades and Orion," "the Bear and her train," and "He turneth darkness into morning and maketh the day dark with the night. He calleth for the waters of the sea and poureth them out upon the face of the earth." So too is it with the great tidal movements of the nations. "He will lift up an ensign to the nations from far, and will hiss for them from the end of the earth, and behold they shall come with speed swiftly . . . and there shall be none to deliver." So too is it not only with nations but with individuals. "God sent Moses his servant" after He had trained him and fashioned him for his work; through him He trained and fashioned Israel for its historic mission; and through Israel is fashioning and training humanity for the Kingdom of God. The roots of everything lie deep in the Divine Personality. Everything, therefore, is held together and controlled by purpose moving on to the realisation of supreme value. Such is the Old Testament conception, throughout, in the period of preparation. And when the "fulness of the time" comes, our Lord takes over the whole interpretation. "Be not anxious for the morrow. . . . The very hairs of your head are all numbered. . . . Seek ye first the Kingdom of God. . . . Your heavenly Father knoweth that ye have need of all these things." That this interpretation of Nature and of life underlies the apostolic teaching, and that the whole Christian morality at every point presupposes this personal care and love of God, is plain to the reader of the New Testament, and in every Chris-

tian age is illustrated in every classic of Christian biography and devotion. Everything here is "personal" and "romantic." All progressive Christian life is a continual personal adventure upon God, and ever increasing personal communion with Him. That this "personal-romantic" view of the world underlies the lives of the heroes and saints of Christendom countless religious biographies bear witness. Therefore the vital question to-day is whether these two interpretations of human life and of Nature, the abstract and general or scientific view, and the personal and romantic or religious interpretation, are compatible with each other, and if so, which is the deeper and more inclusive.

It is very important to note that while science makes no mention either in its pioneer works of investigation or its text-books, of God or His purposes, it does not deny Him in any one of them. It confines itself to facts and to uniformities of process, and uses a certain method in dealing with them. It is only brought into collision with these faiths when its spokesmen pass beyond the bounds of science and say that theirs is the only pathway to Reality. In science the exclusion of God and cosmic purpose from its manuals and classics is not due to unbelief. It is purely methodological. Science's business is to disentangle the enormously entangled, many-coloured skeins of natural phenomena, to classify them, to describe them, to discover conformities of sequence and recurrence among them, and so to enable men to predict and take account of them beforehand. Clearly it is possible for the most devout as well as the most irreligious to take part in that common labour.

But Naturalism takes this methodological omission and transforms it into denial. There is no rational connection between science and Naturalism, unless it can be shown that it is essential to science that it should claim to give a complete and final account of reality. We have here a distinction of basal importance, for unquestionably to-day the scientific account of the world is in the ascendant. It is taught in all our schools. It has been popularised in great numbers of admirable books. I think that at present the popularisation of science is being more efficiently carried out than the popularisation of religion in spite of all the pulpits in the land. Science, through the schools in particular, is reaching the masses in a way which is at present unattained by religion. Now it cannot be too clearly recognised that if the abstract impersonal view of the universe be taught and believed, to the exclusion of the other, there must be an end of all that has hitherto been believed to be the very essence not only of Christianity but of all religions. There will be no need of any persecution or anti-religious wars. The intellectual climate will do all that is necessary in a generation or two. Along with the Christian interpretation of the world must necessarily go the Christian morality. What is at the heart of that standard of the good life? Is it not that God being our Almighty Father we can safely throw the burden of our personal cares upon Him, slay selfishness and fear through faith, and so be set free to live disinterestedly for the love and service of our fellow-men, and go through the world relying on His Providence and Spirit to see us through? If,

however, I have to do in the last resort not with the Almighty Father, but only with a system of impersonal law, then the whole basis of the Christian morality is struck away, and it becomes no longer a reasonable life for mortal man. In such a world it becomes fantastic and out of touch with reality. This is what makes Mr Lippmann's gospel of disinterestedness so thin and so much of an anticlimax to his incisive and disturbing book. It seems to me to be the moral ideal of a cultivated Humanist who has a considerable balance at the bank and in the funds, rather than one that is possible for the great multitude of careworn humanity. And if men and women be not eternal children of the Eternal Father, if they are at bottom simply the more highly developed products of the simian stock, mainly animal by descent, with a comparatively brief human culmination, it seems clear that our whole way of regarding them must be different from that which follows if every human being is fundamentally spiritual, a spirit struggling still within the limits of the flesh upwards to its Father. I do not dwell upon these obvious consequences of Naturalism with the intention of prejudicing the argument. If Naturalism can show convincing grounds for its view of the world, then certainly we must face the full consequences as Mr Krutch and Mr Lippmann do with dignity and courage. But what is the case for regarding science as the one pathway to Reality? I think we can show plainly that there is no sound case at all. The argument consists of two parts; I shall endeavour, first of all, in this chapter to show that in the very nature of the case, because of its

self-imposed limitations, the scientific method can never give us a full and adequate interpretation of Nature and of human life; and secondly, in subsequent chapters, that when forgetting these self-imposed limits of science we press it into a use for which it is not fitted, the result is to give us an obviously mutilated and distorted picture of the universe, and in the end to lead us into a suicidal scepticism about knowledge.

I

We have already reached a definition of science. We have now to analyse it more closely. We have to show that in the nature of the case the scientific method is an instrument of the mind which is framed for certain definite purposes; that for these purposes it is extraordinarily efficient; but that when we forget that it has been constructed for these purposes and use it for others of a quite different nature, the results are disastrous. We may illustrate the main argument by a homely illustration. A razor (and here I am thinking of the old-fashioned and not of the new-fashioned kind) is a most efficient instrument for its purpose. Its weight, balance, shape and edge have all been determined through unknown ages of progress by adaptation to the purpose which it was intended to serve, but this has been achieved by limiting it and making it less useful for other purposes. Originally it was no doubt a knife, and could do the many things which a knife can do. Now it can do only the one thing, but it can do this very much better than it could be done by the more

generalised knife. If we use it now as a knife, we shall spoil it and do far less efficiently what the other can do without difficulty. Our argument is that Naturalism is in the position of a man who becomes so delighted with the consummate achievement of his razor that he becomes obsessed by it and uses it for all kinds of purposes, hacking, stabbing and carving with it, as if it were a knife or an axe, instead of the specialised instrument it really is. The results of such an obsession are in the end that the work he wants to do is not done, and that the instrument itself becomes discredited and spoilt.

In truth, with all the amazing achievement of science working within its own domain, there is that in its very nature which prevents it from ever giving anything but a very defective account of the whole. "Science," said a distinguished man of science once to the present writer, "is a net framed to catch certain kinds of fish and to let other fish through," and the best scientific thought of our day is moving towards a like conclusion. The thinking of the Humanist books is curiously belated as to this point. They give little or no sign of being influenced by what Mr Collingwood calls "by far the most important critical movement of the last half-century."[1] Let us hear what this acute thinker, in no way prejudiced by traditionalism, has to say on this "movement." "The modern world has with a curious unanimity changed its mind as to the nature of science almost within living memory. In the middle of the nineteenth century it was believed that science was the discovery of the

[1] *Speculum Mentis*, p. 180.

laws of nature; that is to say, the determination of the structure actually existing in the world of facts. A generation or more ago this opinion began to collapse, not owing to persons hostile to the pursuit of science, if such persons existed, but owing to the reflection upon their own work of scientists themselves, who began to form the belief that their scientific labours were directed to the attainment not of truth,[1] but of something else. . . . The whole point of this critical movement of the last half-century is lost if it is taken for a revival of abstract scepticism. It is not a revolt against thought as such, but against the specific form which thought presents as science, and this we know by now to be the abstract concept. . . . It is an attempt to show not that knowledge in general is impossible, but that science is not knowledge" (*Speculum Mentis*, pp. 181-82).

I do not understand the writer here as denying that science gives a very real and essential aspect of truth, but only as asserting that it cannot give us a final account of things, and here he has unquestionably behind him a great and growing agreement not only among philosophers, but even among many men of science, who indeed, as he says, have been the pioneers in this movement.

There have been two causes of this change to which Mr Collingwood refers. Half a century ago in the age of Darwin, Huxley, Tyndall and Spencer, the main opposition to the prevalent materialism of science in Great Britain came from the philosophers, especially from those of the Idealist school which was at that time in the ascendant in all the

[1] *I.e.*, absolute reality.

greater universities. Its defence of the freedom and spirituality of man was very able, and to a large number of those who are interested in speculative thought it seemed conclusive, but it had very little influence upon men of science themselves, and its reasoning was too abstract and difficult greatly to influence the outlook even of the *intelligentsia*, the educated public of the day. Thus the two streams of thought, Idealistic Philosophy and Science, went on for the most part running side by side and never meeting, but gradually the great change to which Mr Collingwood refers has become obvious, and a very important fact is, as he has pointed out, that the change began within the sphere of science itself. What had happened? It is, I believe, the practice in modern laboratories and observatories to have a periodic overhaul or, as it is called, a "calibration" of the scientific apparatus. The instruments are examined afresh and tested to see if they are still to be trusted, or have by wear and tear undergone such minute changes as may vitiate the accuracy of their results. Now, what has been taking place in the world of science has been a similar calibration of the instruments of scientific thought, a careful overhaul of the entire scientific method. This has disclosed certain limitations under which all scientific thinkers necessarily work. Thus it is no longer possible for anyone who is fully abreast of the subject to take the scientific account of the universe with the *naïveté* of the Victorian men of science who never questioned that science could furnish us with a final and authoritative account of reality. In addition to this calibration of the instruments, the progress of science itself, especially

within the last few decades, has greatly reinforced the work of these pioneers in that analysis of scientific thought of which I have spoken. The series of discoveries in the higher physics, which have resulted in the quantum and relativity theories, has been of profound importance in changing the scientific outlook. The time has not yet come for theologians and philosophers finally to appraise the full significance of these changes in the scientific outlook, or to build far-reaching systems upon them. Indeed Christian theology is built upon a different foundation altogether. It is built upon what it believes a revelation of God. Modern scientific thought, moreover, is still to some extent divided on some of the most interesting questions in the higher physics. It is obviously on the march, but its present positions are camps of the night, and it is occupying them on that understanding.

Yet in the first place, with regard to some of these changes in current scientific thought, there is reasonable certainty; in the second, it is reasonable also to point out that by these changes in the scientific outlook Naturalism, whose strength is that it leans so heavily on science, has in effect had that support withdrawn, and that science now refuses to express any opinion about that of which Naturalism is sure.

II

The first of these changes is the general recognition of the abstract nature of all inductive science. Fifty years ago the picture of the world as it was drawn by science was perfectly intelligible even to non-mathematical readers. It was represented as

at bottom consisting of practically infinite numbers of unimaginably minute spherical atoms propelled by unseen forces, colliding with each other, rebounding and forming component molecules which coalesced and separated according to certain uniform laws. The earliest form of this total sum of gyrating and racing world of atoms and molecules which science could imagine was a world of fiery mist, which in time concentrated itself into suns and stellar systems, in one planet of which the fire-mist had, after unknown transmutations, evolved into our world of sea and land and atmosphere, and had after many ages produced the world of living things, within which again there had emerged consciousness and finally the mind of man. But all the later developments, the materialism of the period maintained, were really simply arrangements and re-arrangements of the billiard-ball atom, propelled by forces of a purely physical kind. This was the materialistic Absolute, the last Reality, and however insufficient the philosopher or man of faith might find it, it was at least pictorially imaginable and intelligible.

Mathematics, it is true, was mixed up with it. The atoms were spheres and their pathways were no doubt geometrical lines and curves like the pathways of the stars, and atoms and molecules continued in fixed proportions, and so on, but the world in which all these things happened was a real world, where real things happened mathematically. But as the generalisations of physics have become wider and the abstractions more sweeping, the world of physical science has been becoming more mathematical and more difficult for the non-

mathematical mind to understand. The inner circle of the experts sit, as it were, "upon a hill retired," discussing the newer discoveries as news of them comes in from the laboratories of the world, in a language known in its fulness only by themselves. Every now and again someone in the inner circle, or more usually from one of the concentric circles around it, steps forward and addresses the multitude, who, confident in the good faith and mastery of the pundits, sit eagerly but vainly endeavouring to understand what they are saying. What is quite clear is that the higher physics is well-nigh disappearing in mathematics.

But as physics is the basal science this can only mean that if science gives the ultimate account of the world, all sciences built upon it must in the end be resolvable into mathematics too. Even psychology and sociology must, when carried to perfection, be resolvable into mathematical formulæ, and the final truth about all human beings will be represented by diagrams and algebraical formulæ. We are here obviously moving in the region of *reductio ad absurdum*. Sir James Jeans in a recent article, in which his gifts of lucid exposition disclose only too plainly his perplexity over finding what was believed to be solid matter or real energy disappearing in abstractions and symbols, seems to think that this is Idealism or something very like it. No, Idealism has never committed itself to a position like that. It has always believed in a universe that was more than mathematics, and an absolute Being that was more than a mathematician. But, without travelling into that fascinating but intricate discussion, we may content

ourselves meantime by saying that all these recent developments seem to show quite clearly what Kant said long ago, that all physical science is a kind of imperfect mathematics, and that the more perfectly it develops its peculiar method of abstraction, the more clearly does this come out. That is why as science reaches its highest generalisations, as in physics, it becomes more and more mathematical, till, as we ascend into the highest and most abstract region of all, we seem to be moving in a region in which matter and energy have disappeared altogether in mathematics. But whither has it disappeared? It has only disappeared from the mind of the investigator. But it is still "out there" in the external world. It has slipped through the meshes of the net. Whatever Sir James Jeans may say about the physical universe, there must always surely be something for the investigator to be mathematical about.[1] The symbols that he handles are symbols of something, and that something is more than mathematics. And whatever the naturalistic investigator who insists that his methods alone can give ultimate reality about men as well as things may say about you and me, we are certainly not, and never will be, reducible to diagrams and algebraical formulæ. Yet the very methods of thought, which, pressed to the end, seem to lead to such absurd conclusions, are methods which led to most impressive results in their earlier stages. There is here plainly a paradox which demands closer examination. The nerve of the matter is the mental process of "abstraction."

[1] The theory of emergent evolution as a way of escape from this preposterous conclusion is referred to in a later lecture.

Let us try to get a clear idea of what this process of thought which is so essential to science really means.

Mathematics represents abstraction carried to its full extent, but it is very important to note that all science whatsoever is in its very nature an abstract account of the world, and that no merely abstract account can possibly be adequate. I hope to show in this and in following lectures that very much of which "we must take account," and which therefore is real, must slip through the meshes of the net of science. The point is of such vital importance that it demands elaboration. Every one of us is continually practising the intellectual method of abstraction, which in its rudimentary forms is just attending to those things that for our immediate purpose are essential, and ignoring, or abstracting from those things that for the moment and for our purposes are not essential. No human being can live and thrive who does not learn this very essential discipline of the human mind. But it is every whit as essential to remember that though for the time we have ignored these other things, they are there all the time, and when their time comes will certainly demand that we take account of them and remember that they are real also. It is essential to living and thriving that we should be able to abstract, but equally essential to living and thriving that we should not suppose that our ignoring of them means that they do not exist. If we do that our own existence will be hard and brief!

But, advancing from preliminary observation to what more immediately concerns our purpose, we

may illustrate this method of abstraction from the processes of thought common to us all. The human mind comes into consciousness in an immense panorama of things and events, which crowd in upon it through all its senses—and together make "a big, blooming, buzzing world of confusion," to use the words in which James describes the world of the child. Man would be utterly overwhelmed by the multiplicity of these objects and events, he could never face up to them or acquire any foresight or control of them, if he had not been able to devise the marvellous intellectual tool of the concept. It has been truly said that by far the greatest inventors of the human race are the unknown inventors, the men who discovered how to make and use fire, to tame horses and cattle, to plough the soil, to invent the alphabet. But greatest of them all is the unknown inventor of the concept. This, above all, is what has given man such mastery as he has over Nature. What is the concept? It is that product of man's mind which is expressed in the common noun: tree, cloud, river, man. Who could think, who could communicate his thought to other men, without the constant use of these common terms? Yet there is nowhere anything in Nature corresponding to any one of these terms, there are only individual trees, clouds, rivers and men. The concepts and their corresponding common nouns are highly abstract or generalised symbols of classes of these objects. How do we make them? We first classify the world of objects into groups, just as we might sort out a tangled mass of threads into groups of similar colours, putting the green, red and blue by themselves. We abstract everything

except its colour from each object, and classify according to colour. So in forming the concept man we ignore or abstract all the differences, colour, weight, height, size, age and personality, and fixing only on what all men and women have in common, we call the concept or abstraction by the common noun, man, and take it as a symbol of all the men and women that ever were or will be. This method alone enables us to handle the mass of knowledge which would otherwise overwhelm our finite intelligence. The concept is then an abstract symbol. Everybody is continually using concepts. There is no one so uneducated, so savage, so rude as not to use common nouns, and therefore to classify objects and make symbolic abstractions. Common-sense knowledge uses this method of classifying and forming of concepts and common nouns largely with a view to describing the external world. It enables men to pool their individual stocks of hard-won knowledge so that they become a common stock which is handed down from one generation to another. Science which, as has been said, is only an extension and refinement of common sense, uses its concepts partly for this purpose of description, but very largely for another purpose. Already in common-sense everyday knowledge men had discovered the vital importance of the element of recurrence in natural phenomena. Consider the value to primitive man of the knowledge that day follows night in interminable succession, and that each expands and contracts in the course of the year. Consider again the immeasurable worth of his discovery of the sequence of the seasons for sowing and reaping, for fishing and hunting, for

provision for and protection from the rigours of the winter. Foresight of the processes of Nature was soon discerned to be the master secret for the control and use of Nature. Foreknowledge was plainly power, and the way to foreknowledge lay in deeper knowledge of the processes of Nature. So impelled at first by this practical motive, man adventured forth on the life or death quest for uniformities or "laws" in Nature. I do not say this initial practical motive is now the only motive in scientific discovery, but that it has been and is at its heart all along, is, I think, sufficiently clear. It is the simple truth that the more of such uniformities man can discover in Nature, the greater is the power that he wins for exploiting Nature for his ends, and protecting himself against her destroying powers. For the detection of such uniformities of sequence means the growing certainty as to what Nature will do in the future, and "forewarned is forearmed."

Once launched on this quest for laws, science proceeds after the same fashion as common sense did in forming the concept, that is to say it classifies things and processes into species, genera and laws, always seeking for the points in which phenomena resemble each other, and abstracting from, that is ignoring, the points in which they differ. The astonishing practical success of this generalising and abstracting method of thought is known to us all. Of countless illustrations that might be given my memory yields none more impressive than that given to me in my student days by observation of the working of a transit instrument. I went with other visitors to an observatory to the specialist in charge

of the transit instrument, and asked leave to see it in operation. Turning to a time-table which hung on the wall behind us, he informed us that in five minutes he would be able to show us a certain asteroid in transit. When the moment came there glided into the field of vision a tiny spot of silver, and slipped like a ghost across it. No Royal Express could have kept more accurate time. That is prediction carried to its highest power, and attained, strange to say, by that process of abstraction, the very exercise of which consists in knowing what facts to ignore. That represents science working as a special method within a sphere peculiarly adapted to its use. In astronomy the distances and magnitudes are so vast that any minor errors that may lie beyond the possibility of discovery by our most powerful telescopes and most accurate observations and calculations, do not affect the broad results.

Astronomical magnitudes at least appear to conform strictly to mathematical laws and determinism. Whether the apparent necessity has behind it any individuality or freedom lies quite beyond our ken. But beyond all question such individuality does appear, and increases the more we ascend from the material world into the world of living things, and most of all into the realm of human beings. It is a commonplace of the poets, and I do not know that it is questioned by the biologists, that no two living creatures are quite alike. Leibnitz tells the story[1] that "A clever gentleman of my acquaintance talking with me, in the presence of the Electress of Hanover, thought that he could easily find two

[1] Quoted by James Ward, *Realms of Ends*, p. 64.

leaves exactly alike. The Electress challenged him to do so, and he went up and down a long time seeking in vain." Some of us may have tried like experiments with like results. The same is true in greater degree with higher organisms. Complete resemblance between living things is never found. Only superficial observers think that it is. Closer observation always reveals some difference. A good hill shepherd can distinguish each of his sheep, and I have known them do this by touch alone. Twins that seem alike to strangers are rarely so to their own kindred. Most conclusive perhaps of all, to readers of detective romances at least, is the famous finger-print department in Scotland Yard, which rests entirely on the unqualified principle that every man has his own finger-print, which is different from that of every other person.[1] When we pass, finally, from the physical embodiment to the spiritual personality of human beings, the principle of the lonely individuality of each human being needs neither to be proved nor illustrated, for everyone admits its truth.

Now here is a fact which of itself refutes the idea that science is the only pathway to Reality. For the interest of science is not in individual beings at all, but in generalisations, concepts and laws. It does not, of course, completely ignore individuality. It notes its existence, but having done so, hurries on to that in which its interest really lies and which is its own domain, *i.e.* the characteristics which every individual has in common with all other

[1] The further truth that all these individual finger-prints can, up to a point, be classified and arranged because of their resemblances and that only by such grouping can the system be worked at all, illustrates the utility of science even in dealing with human beings.

individuals. Why does it do this? Because it is afraid of being choked and overwhelmed by the multitude of the individual things and characters in the world. It knows that it must practise economy of thought. It wishes to get clear concepts, which can only be got by dropping individual traits and for the time ignoring them. It wants concepts, laws and schemes which can all be got only by abstracting from individuality. But individuality is there, none the less, and all the time. To test the matter—*experimentum crucis*—try to give a strictly scientific definition of your most intimate friend. He belongs to the genus *homo sapiens*. Well that is something! He is, further, of the masculine gender. He is of your own nationality, of a fair complexion, of a certain height, weight and temperament, is a great mathematician, and so forth. All the way you have in the background the idea of a group like him, though growing less in number as you become more definite in your description. Now, however you may go on piling up the abstractions, you never get the real man. He is eluding you all the time you are speaking in general and abstract terms, and when at last you speak his proper name, instead of common nouns about him, a kind of knowledge leaps out of the mist that is not scientific knowledge at all because it is no longer abstract but intensely concrete and individual. It is like, and I believe it partly depends upon, the intuitive knowledge we have of our own personality. But that intuitive self-consciousness in the strict sense of the word is not scientific knowledge, it is the presupposition of all knowledge, of all feeling and all will.

The decisive proof that "Science is a net framed to catch certain kinds of fish and to let other fish through," and that one of these escapes is individuality, is found in the impossibility of writing any adequate human history in terms of pure science. Let us look again at Lord Acton's definition of science: "Science is the co-ordination of a great mass of similar facts into the form of a generalisation, a principle, or a law, which will enable us to predict with certainty the recurrence of events under like conditions." Now it is clear, to begin with, that human history is a part of reality. The experiences and achievements of human beings are, to say the least, as real as the movements of the planets. Yet it is equally plain that if a purely scientific history of any people were written in which the aim of the writer were what is here stated, namely the disclosure of uniform laws with a view to prediction of the future, the result would be a grotesque failure, utterly unlike the living and breathing tragi-comedy of human life. It would be only one degree more absurd to try to describe a day in the life of a man or woman in the formulæ of algebra. The methods which have been so triumphant in dealing with atoms or stars would break down in hopeless confusion in dealing with human life.

This is most obvious first of all in our complete inability to predict accurately the future of human action. We can predict and reckon upon the path of an asteroid, but who can predict the pathway of a man? What would not the cabinets of the great Powers and the little Ententes of to-day, what would not the Stock Exchanges of the world, give

for such knowledge? Yet all the economists and psychologists of the earth cannot give them such knowledge. The science of history is anything but complete because there is no power of accurate prediction. The endeavour has been made to meet this very obvious difficulty by saying that this is because the science of man is at present in its infancy, and an illustration has been suggested from the battlefield. We can tell from our present knowledge of cannon and explosives with remarkable accuracy just where a projectile will fall: as yet we cannot determine the path of the bursting fragments, but that uncertainty is due simply to the imperfection of our present knowledge, and the time will come when we shall be able to do this with absolute precision. So one day, by the pursuit of purely scientific methods it is claimed, we shall be able to predict with complete accuracy the life-pathway of every human being. Ideal science could do it, it is said, if given the time and the means of investigation. It has been the very nerve of our argument that science alone can never do it, because in the very centre of his personality every human being is free and individual, is unique in his kind, and so eludes all the meshes of the classifying and generalising methods of science, and science as we have seen takes little account of what is individual. Yet that does not imply that science has no work to do in explaining history. It can indeed greatly enrich history, for it is part of the paradox of human life that the individual can only attain his full personality in society and that he has very much in common with his kind. Every competent historian, therefore, must be expert in sociology, which is a

mixed science. He has to be able to weigh all that Maine and Maitland have to tell him of social groups and political and ecclesiastical institutions and all that the Marxians have to say about the economic evolution of the race and its influence upon religion and art. History is something more than the story of its personalities, obscure and heroic. But to ignore these, or, which is much the same thing, to make them mere automatic exponents of social tendencies and laws, is to make a dull caricature of the great epic of history. To attempt to write a purely scientific history, then, would be to flatten out and distort the whole subject, and to do the plainest violence to the reality, for the simple reason that individuality plays a far greater part in the course of human events than it does even in the sphere of biology. Individual men and women are unquestionably great and potent factors in the course of history. They are, moreover, creative figures. They bring something new into the field, not simply a re-arrangement of the old material. They cannot therefore be explained as instances of general laws. Mohammed, Joan, Luther, Napoleon, Lincoln, Florence Nightingale, what general laws can explain any one of them? Can the final truth about any one of them be given in abstract terms? Surely the idea is absurd. Yet if science gives us the final and all-determining word, how are we to evade this preposterous conclusion? Such figures refuse to be blended in the group. They pass easily through the meshes of all merely generalising thought, and by so doing each one of them is a demonstration of the inability of science to penetrate to the heart of reality. The great historian

has quite a different kind of intelligence from the great man of science. He needs, it is true, to have the same tenacious patience, thoroughness and generalising power, the power of seeing deep affinities and resemblances, where others see no connection whatever, but he needs also a far richer equipment of insight into individual human character, of imagination, and of the sense of the worth of human life. He needs these not simply for the embellishment of his subject but for penetrating the actual realities of his theme. The sphere of the man of science is man, but while the historian needs that kind of knowledge, he needs also to know men, and that I submit is quite a different thing. It is not too much to say, then, that the whole theory which we have been discussing in this chapter and which is the very corner stone of the Humanist thinking, breaks down on this fact alone, that it cannot adequately explain human history. For some time many believed that it could. Scientific thought has been pressing through the realm of biology into history and seeking to resolve it all into historical sociology. That is has accomplished much here that needed to be done has already been fully admitted. So recently as a quarter of a century ago Professor James Ward, in a masterly review of the whole field covered by his earlier book on *Naturalism and Agnosticism*, could state the position as follows: "We have only to think of comparing some classical work of science—say Newton's *Principia*—with one of history—as for example Clarendon's *Great Rebellion*—to realise completely the diversity of the two realms (namely of Nature and History). Regarding the scientific

idea of Nature as a rounded whole, we may say that the world of science and the world of history have little or nothing in common. Their terminology, their categories, and their products are wholly different, and so too are the philosophical questions to which they severally and immediately give rise. The one never reaches the individual and concrete, the other never leaves them."[1] Dr Ward, in this introductory chapter, was summarising a very full argument in a very few pages, and in such compression may have overstated his own position. Yet I hardly think that to-day even those who most deeply share his main conviction, that human individuality eludes the generalising and abstract nature of science, would use the closing words as fairly describing the present position. But just as biology reacted most potently on the older sciences by showing the insufficiency of their categories to explain the new phenomena of life, so, if I rightly read the situation, is the invasion of history by science and the comparative method reacting most potently on that transformed science.

It is quite unbelievable that the sole final reality behind the great drama of human story is the endless grouping and re-grouping of space-time patterns moving without purpose or meaning according to certain mathematical laws. Yet if Nature be a closed system, and if the fundamental system be physics, there can be no escape from that conclusion. And on that view, it must be said, in that weird world of ultimate scientific abstraction, Cromwell differs from Napoleon, and both from Jesus Christ,

[1] *Realms of Ends*, p. 2.

only as one space-time pattern may differ from another.

The more honestly the historian faces the full realities of history, the more faithfully he uses the scientific method to explain all that it can legitimately explain, the more will it become overwhelmingly clear that science can never explain more than an aspect or a fraction of the whole, and that the endeavour to make it do so leads to mere caricature. Our greater historians are neither fanatics nor pedants, but men with some sense of reality, and so we may look with hope to the progress and the study of history, and also to the "calibration" of the methods whereby we study history.

Mr H. G. Wood has summed up the position in a paragraph in his recent excellent volume on *Christianity and the Nature of History*. "The history of historiography in the nineteenth century is largely taken up with attempts to develop history as a science on the analogy of the physical sciences. In the twentieth century historians have come to realise that such attempts must necessarily fail. Beyond the realm of scientific generalisations, the realm of relatively stable factors in human nature and its environment, the realm of measurable repetition, lies the realm of personality, of concrete events and causes, of the particular, the non-repeatable and non-predictable, and the historian cannot accomplish his work without taking account of this latter realm. His task is to trace the development of a unique story, not to discover illustrations of general laws."

III

There is another result of this "calibration" of scientific method which seems to me of possibly great importance for the reconciliation of the scientific and the religious and ethical view of the world of human life.

The aim of all science is, as we have seen, to discover law and uniformity in all natural processes, and so to win complete accuracy of description and prediction, and thereby mastery over Nature. The classical expression of this aim is found in Laplace's Essay on Probability. After dismissing free will as a simple illusion, Laplace proceeds: "We ought then to regard the present state of the universe as the effect of its antecedent state, and as the cause of the state that is to follow. An intelligence who for a given instant should be acquainted with all the forces by which Nature is animated, and with the several positions of the beings composing it, if, further, his intellect were vast enough to submit these data to analysis, would include in one and the same formula the movements of the largest bodies in the universe, and those of the lightest atom. Nothing would be uncertain for him; the future as well as the past would be present to his eyes. . . . The human mind in the perfection it has been able to give to astronomy affords a feeble outline of such an intelligence. Its discoveries in mechanics and in geometry, joined to that of universal gravitation, have brought it within reach of comprehending, in the same analytical expression, the past and future states of the systems of the world. . . . All its

efforts in the search for truth tend to approximate it without limit to the intelligence we have just imagined." [1]

It is clear that Laplace is thinking of Nature as a closed system, and also essentially as a material system, every part of which is determined by measurable forces. Nothing, therefore, which happens within the causal system can be influenced or changed by any power, divine or human, that is not part of "Nature." Man's body, nervous system and brain being part of this closed system of physical Nature must be as rigidly determined as the movements of the planets and the tides.

Now, not only does such a scheme of thought deny the freedom of God; it is a complete negation of human freedom as well. The debate between believers in necessity and freedom is ancient and inveterate and continues in our own day. But the determinism of most of the philosophers of to-day is what has been called "soft determinism." This variety of determinism holds that we are determined only by our own characters in reaction with our environment, and may, therefore, be called self-determined. But the determinism of Naturalism is what is called "hard determinism," or fatalism. It holds that every thought and feeling and volition is determined by the mechanism of our brains and bodies, and that these are simply so many cogs in the wheels of the great world-machine. To demonstrate this, and nothing less than this, is the aim of science as conceived by Laplace and by all naturalistic thinkers, and their great support has been the Newtonian science.

[1] Quoted by James Ward, *Naturalism and Agnosticism*, vol. i, p. 4.

Kepler, Galileo and Newton, it is true, never dreamed of such consequences being drawn from the system of scientific thought which they framed. They limited their methods to certain regions of the physical universe. But as the eighteenth century wore on, and science grew in boldness with its wonderful achievements, the prescient genius of Kant discerned whither it was tending. Laplace wrote his famous essay in 1812. Just thirty-one years earlier Kant wrote his *Critique of Pure Reason*, and within the next decennium completed the triad of *Critiques* from which nearly all the later idealist philosophy takes its origin. Kant's aim, and in general that of his successors, was to oppose the hard determinism which was already appearing on the horizon, and to assert the freedom and rights of the human spirit.

Kant's solution of the problem, with its two worlds of the phenomenal or apparent, and the real, or noumenal, is well known. The former is the sphere of the pure reason, and by this he meant in effect the Newtonian science, the latter is the world of the practical reason, or morality, with its postulates, God, freedom and immortality. Later idealistic thought has in the main held with Kant that, inasmuch as the spiritual world was the real world, the world of science was of only relative validity, and so has not taken the fatalistic conclusions of naturalistic science too seriously. Scientists, as has been said, have for the most part, heeded the philosophers very little and have gone on their own road seeking to extend their generalisations and develop their own methods. They have, on the whole, ignored

philosophy, or when they did philosophise, have either tended to Naturalism or have taken a definitely religious view of life. The strength of the naturalistic argument lay in the domain of physics and astronomy, in which the mechanistic case seemed to be established, not only by the width and grandeur of its generalisations, but the precision of their verification. Laplace, it will be seen from the words quoted, based his faith that one day scientific knowledge would establish the reign of determinism throughout the universe, upon what it had already done in astronomy, mechanics and geometry, and in particular in establishing the law of universal gravitation. And in another famous address, given sixty years after that by Laplace, the great Berlin physiologist Du Bois Raymond, attaching his argument to that of Laplace says: "As the astronomer predicts the day on which, after many years, a comet again appears in the vault of heaven from the depths of space, so this 'mind' (*i.e.* the mind of the Laplacian calculator) would read in its equations the day when the Greek Cross will glitter from the mosques of Sophia, or when England will burn its last lump of coal." [1]

Starting from this apparently secure base of operations the new sciences of biology, sociology and psychology advanced to the demonstration of deterministic causation and law in these new fields, and to it they have always returned for new confidence. Seeing that physics and astronomy lay at the very basis of all other sciences, it could not

[1] Also quoted by Ward, *Naturalism and Agnosticism*, vol. i, p. 42, and more fully by Lange, *History of Materialism*, vol. ii, p. 308.

but be that these too could be brought within the sway of mechanical causation. Here is the ground for the confidence with which Laplace dismissed man's belief in free will and responsibility as a mere illusion. It is in no way surprising that the attempt should have been made and sustained. Nor need we wonder that the defence should have been equally stubborn. For if free will be an illusion men may very naturally ask what confidence they may henceforward have in any conviction which they possess. It is clear that all men of goodwill know that they ought to do certain things and blame themselves when they do not. A scientific man knows, for instance, that he ought to be unreservedly loyal to truth, and blames himself if he allows any personal motive of gain or fear to divert him from seeking and speaking it. Yet it is also surely clear that if we are absolutely determined to every thought and volition by the mechanism of our brain, then the words "ought" and "blame" express mere illusions. The fatalist may be able to drug his own conscience in this way for a time, but he will most certainly blame other people who shirk their duty to truth or treat him with cruelty and injustice. In other words, he will judge them as people possessing free will. So the battle has gone on between naturalistic thinkers entrenched in physics and astronomy, and those who believed in their own self-knowledge and the validity of their moral convictions. Meantime science has gone on with its investigations and the refining of its methods, and as it has done so it has made a disquieting discovery. It was believed that the whole vast structure of physical and

astronomical nature could be explained as a completely closed system of causes and effects, as Newtonian science put it, or otherwise as a system of unbroken uniformity of process. From the atom to the planet, from the planet to the galaxy, from the galaxy to the astronomical universe this great system of determinism persisted unbroken throughout all space, and throughout all time; it had come down phase after phase in unbroken sequence. But as physical science pursued its triumphant course into the nature of light, heat and electricity, it was led on into the sub-atomic world, and as the science of thermodynamics came into being, revolutionary changes began to happen. It was declared that what by its very name, the atom, was declared to be indivisible, was really a system of smaller units of electric energy, electrons, protons, neutrons and so on. Moreover, it was discovered from the study of the radiation of heat, light and electricity, that many of the phenomena could only be explained on the assumption that these forms of energy were not radiated in continuous waves as had been the prevailing view, but, as it were, in jerks, or packets of energy, like a stream of bullets rather than waves. Each of these packets was called a Quantum. The apparition of the quantum has had a most disturbing effect not only upon the existing theories of wave motion, and the structure of the atom, but on the conception of the "Laws of Nature" and the whole theory of mechanical determinism. For whatever may be true of the large-scale physical phenomena "strict determinism cannot be traced in the behaviour of the ultimate elements of the physical

world." "The behaviour of a quantum of light, as, for example, in which of two directions it will go, is found to be a matter of probabilities. In one experiment the quantum will choose one path. In a repetition of the experiment repeated under identical conditions it will choose the other path. If the experiment be repeated a great number of times, the percentage of the times the quantum chooses one path or the other can be reckoned up. It is then possible to enunciate a law specifying the probability that in any given occasion the quantum will take one path or the other. The same holds good of the motion of an electron. The chance that it will reach position A can be given. But its future conduct is not uniquely determined by its present state. When a sufficiently large number of electrons are taken, as happens in any piece of matter with which science deals, their individual idiosyncrasies cancel out, as it were, and the resultant behaviour of the assembly is determined."[1] In this passage there emerges the conception of statistical law. All the laws of the new science of thermodynamics are, I believe, of this statistical character. They describe the way in which great aggregates of very small units behave. Actuaries are very familiar with such statistical laws. At first sight our vast modern insurance business must seem to take insane risks. No single human being knows the day of his own death. If he were to venture on a wager of any amount with another man on that event he would be regarded as a reckless gambler or a mere fool.

[1] J. W. N. Sullivan, "The Physical Nature of the Universe" in *The Outline of Science*, p. 110.

Yet you will find scores of insurance companies in the world to-day prepared to take on just such a wager with you, and what seems more reckless still, with as many other takers as will deposit with them a small annual stake or premium. And the directors of these companies are about the last people whom we would call either gamblers or fools. What lies behind this paradox? Oddly enough what saves them from ruin is their apparently reckless desire not only to take on a wager with you, but to take on all comers. To take on an insurance wager with you alone would be little better than a gamble, but to take it on with a multitude is safe and far-seeing business. Indeed it is found to be true that the greater the number of wagers the surer are the profits. Now the principles on which actuaries work are not causal laws at all. They are all based on the observed fact that while some people live short lives and some live long lives, the average becomes more and more constant the greater the number of lives that enter into the computation. There is freedom, variety and individuality to an indefinite degree among the units, but there is a limit to this freedom. They oscillate to and fro above and below a line, but in experience the oscillations above the line tend to cancel out those below and the line remains more or less constant. The average constants are the principles on which the actuary works. They are statistical laws. In our day, as is well known, there has been a great extension of insurance. We can take out policies not only for life and fire, but for all kinds of risks, burglars, sickness, accident, and so on. Yet in spite of this we are persuaded

that we are free agents in the fullest sense of the term. But, as we all realise, our freedom is limited, and it is on the facts of this limitation and the multitude of policy holders that modern insurance depends. Neither actuaries nor directors give a thought in the way of business to necessitarian theories of how this singular tendency of one variation to cancel out another comes about. They can get on perfectly well without them. They are content with the observed facts.

Now something like this is what has happened in science. Just as our insurance system has grown up on a developing system of statistical principles, so thermodynamics has grown up on statistical laws which were discovered to be true of aggregates of apparently undetermined units and quanta of energy. Different as these quanta are from free human agents in most particulars, there is an odd analogy between them too, which justifies Dr Oman in saying that Quantum Theory "suggests that Nature from the beginning individualises itself, and that mind with its centre of meaning and its relation to the universe by its own understanding and action is not a mere incursion into its order."[1] Moreover, the question has arisen whether a very large part of what have hitherto been supposed to be "iron" laws of Nature, that is to say laws of the rigorous determinate type, are not really statistical. Eddington's account of the matter is that formerly all the great laws of physics and astronomy were believed to be strict causal laws of the type contemplated by Laplace and Du Bois Raymond, but that with the rise and growth of thermodynamics

[1] *The Natural and the Supernatural*, p. 249.

the conception of statistical law came into prominence as a secondary type of law, and more and more it has been supplanting the older type, even in those regions in which the classical laws reigned supreme. Instead of being regarded as causal laws they are many of them regarded as being simply limiting cases of statistical laws. That is to say, any exceptions to them are so improbable that they may conventionally be taken as invariable without any danger.[1]

Now it cannot be denied that the scientific picture of the world here outlined is very different from that imagined by Laplace and Du Bois Raymond and the science of their time. In that older world of thought human free will and active intervention in the system of Nature seemed something as alien as a rock in the sky. Strict causation and a closed system of Nature are in absolute contradiction with a free human will freely controlling its own bodily actions.

But within a world of statistical laws there may

[1] The passage is so important that I give it verbatim: "But, further, it is now recognised that the classical laws of mechanics and electromagnetism (including the modifications introduced by relativity theory) are simply the limiting form of Quantum Theory, when the number of quanta or particles concerned is very large. This connection is known as Bohr's Correspondence Principle. The classical laws are not a fresh set of laws, but are a particular adaptation of the Quantum laws. We have already mentioned that it is when a very large number of individuals are concerned that the prediction of the secondary scheme has a high probability approaching certainty. That is how they come to be mistaken for causal laws whose operation is definitely certain. Now that their statistical character is recognised they are lost to the primary scheme. When Laplace put forward his ideal of a completely deterministic scheme he thought he had already the nucleus of such a scheme in the laws of mechanics and astronomy. That nucleus has now been transferred to the second scheme. Nothing is left to the old causal scheme and we have not yet found the beginnings of a new one." *New Pathways in Science*, pp. 77-78.

be a very real human freedom and activity just as there is room for the play of individuality, passion and action within a workable system of life insurance. A world system under which there was room for both a limited measure of indeterminism in the units and certainty as to the aggregates would seem to be a system in which there would be room for a limited freedom and initiative, and also for inveterate habit on the part of individual human beings.

The point at which the Laplacian system seemed to trench most drastically on human freedom was the mysterious point where man's brain and mind appeared to meet. That this was the case was plain from the extraordinary crop of parallelist theories which sprang up in the closing years of the nineteenth century[1] when the materialist conception of Nature was at its zenith. The difficulty was on that view to find any place at all for the mind and will, and even for the consciousness of man. If everything physical were part of a closed and rigidly determined system of causes and effects, then the entire conscious life of man was a kind of accidental and inexplicable accompaniment. If every motion of the body could be completely explained by its physical antecedents, then there was no need for consciousness or for will or for thought. Yet every writer of natural history spoke of pleasure and pain as factors in evolution, and common sense refused to believe that a man's will could not move his body, and it was impossible to believe that the truth of an argument depended upon molecular changes in the brains of the arguers

[1] Enumerated in Prof. MacDougall's *Body and Mind.*

and not on its own merits. Hence there arose the incredible theories that the two processes of material changes in the brain and of consciousness ran on parallel to each other, corresponding point for point but never meeting or interacting. The motive for this, as I have said, was the preserving at all costs of the closed physical system knit together by strict causality, and the incredibility of the parallelist theories is to my mind a *reductio ad absurdum* of the " closed system " theory.

Have the new theories of the indeterminacy of the units of energy and the statistical constancy of the aggregates thrown any new light on this problem ? Eddington believes that they have, but his argument, it should be observed, does not, as some think, depend only on his belief in the indeterminacy of the units of electric energy of which the cells of the brain are the aggregates. The basal indeterminism of these units, if I understand him rightly, makes it possible for the mind to influence the brain, seeing that in the units of which it is composed there is no causal nexus to break or alter. Now were the brain mere dead matter the influence of mind would be inappreciable. It would be overwhelmed and swamped by the statistical average laws. But the living brain is not a mere aggregate. It is a unity corresponding to the unity of the mind. It is an organised whole organised so that it is peculiarly susceptible to the influence of the mind.

Bergson has a conception of the human brain and nervous system not unlike this. " When we consider," he says, " the mechanism of voluntary movement in particular, the functioning of the nervous system in general, and in fact life itself

in what is essential to it, we are led to the conclusion that the invariable contrivance of consciousness, from its most humble origin in elementary living forms, is to convert physical determinism to its own ends, or rather to elude the law of conservation of energy whilst obtaining from matter a fabrication of explosives ever intenser and more utilisable. It will then require an almost negligible action, such as the light pressure of the finger on the hair trigger of a pistol, in order to liberate at the required moment in the direction chosen as great an amount as is wanted of accumulated energy. The glycogen lodged in the muscles is in fact a real explosive, by it voluntary movement is accomplished; to make and use explosive of this kind seems to be the unvarying and essential preoccupation of life, from its first apparition in protoplasmic mass, deformable at will, to its complete expansion in organisms capable of free actions." [1]

Now if all this reasoning is sound it is clear that Laplace's conception is unattainable. The admission of free will, as James Ward said thirty years ago in his great book *Naturalism and Agnosticism*, "lets contingency into the heart of the physical universe" as well as into history. And if man be free to influence and change the course of events, it seems certain also that, to say the least of it, God should have a like freedom. This, as we shall see, is as vitally important for religion as the freedom of man is for morality.

But is the case proved? It is well known to all who have followed the discussion that there is a sharp division of opinion on the matter among our fore-

[1] *Mind Energy*, Lectures and Essays, pp. 35-36.

most masters of physical science, Einstein, Rutherford and Planck (the discoverer of the Quantum) and others being on the one side, and Jeans, Eddington, Weyl and others on the other. The former hold fast to the older view of causality and rigorous determinism. They urge that the apparent indeterminism of the electrons and quanta is due simply to our ignorance, and that if we knew more about them we should find them as determinate in all their movements as the large-scale aggregates of these elements. It is of course impossible either to prove or disprove this view, and the Heisenberg Principle of Uncertainty, one of the more notable discoveries of sub-atomic physics, in effect means that we can never know. I do not think it is at all unfair to say that the conviction of this eminent group of men of science is due to philosophic faith rather than to observational science. Eddington's argument is that, so far as the actual practice of scientific method is concerned, all the laws of Nature[1] that were originally regarded as

[1] Eddington's language in 1933 is stronger than it was in 1925. In his essay on "The Domain of Physical Science," in the volume *Religion, Science and Reality*, he distinguishes between the great "field laws," the law of gravitation, the law of conservation of mass and energy, the laws of electric and magnetic force, and the conservation of electric charge and other laws. He says that "violations of these laws are inconceivable," and distinguishes between them and the statistical laws such as "the laws of gases and thermodynamics, which deal with crowds rather than individuals." Eight years later he uses more uncompromising language. In an article in *Philosophy*, vol. viii, he writes as follows: "The dual source of regularity (*i.e.* the absolute causal laws of the older science and the new statistical group laws) is no longer accepted. The changes that have occurred in the fundamental conceptions of physics in the last ten years have brought it about that all the observed regularities are now attributed to the second group—all the primary determinate laws have disappeared. The result of an analysis of physical phenomenon up to the present is that we have nowhere found any evidence of determinate law."

causal laws, have in the ordinary practice of scientific method been transferred to the category of statistical laws. His opponents, so far as I have been able to discover, do not question this, but say that if we knew all we should find that underlying all these, there are causal laws. If we knew all, even about the quantum, we should find strict mechanical determinism. Eddington's reply is that inasmuch as we admittedly have no proof of this; that as on the one hand the whole work of physical science can be carried on more efficiently in practice without assuming determinism; and that on the other we are immediately conscious of our own freedom and responsibility, the continued assertion of the old determinism is entirely gratuitous.

We may freely grant that, however this scientific debate be determined, it will not solve the whole problem of free will and necessity. The controversy does not directly touch the philosophical issue between free will and what William James has called "soft determinism," that is to say, the determinism which says that all our actions are necessitated by the reaction of our character on our environment. The difference between "hard" and "soft" determinism is that in the former view we are necessitated by that which is without, and in the latter by that which is within ourselves, uncoiling itself like a spring. In neither case can we think of man as having real freedom of choice. Nor does the controversy deal with the philosophic questions as to what may lie behind the indeterministic results of science which it formulates in its statistical laws. There may be a background there which, if we could reach it, would show us

if not mechanical causality, yet purpose and final reason behind the apparent chaos of indeterminate units.

But this, I think, we can say with confidence, that the Laplacian mechanical determinism can no longer claim the support of physical science. Freely following its own star this has in practice discarded the old causal laws for statistical methods, and by so doing has put that particular argument for hard determinism definitely out of action.

But if it is out of action as against the freedom of man, it is out of action also as against the freedom of God. If it is no longer possible to say that Nature according to science is a rigidly closed system of mechanical causation which excludes the possibility of man in his freedom changing the "natural" course of events, it seems to me that it is no longer possible to say that it is irrational to hold that God may not change the "natural" course of events, if on other grounds we have good and sufficient reason to suppose that He has done so. On the religious interpretation of the world, Nature is the divine "instrument" which God uses for spiritual ends. The function of science is to tell us all that it can about this instrument. But no one who believes in the transcendence of God can ever accept the world view of Laplace. "Whoever holds the notion of the living God as paramount can never maintain that exact acquaintance with His instruments is enough to make plain all that God will do or suffer to be done."[1]

No religious man can be satisfied with a view of the universe in which God is regarded as the

[1] James Ward, *Naturalism and Agnosticism*, vol. i, p. 43.

creator of the Laplacian world, even though we tack immortality on to it at the end. The Deism of the eighteenth century tried it, but did not last. Under it the system of Nature usurps the place of the living God and speedily becomes the ultimate Reality. It is reported that when Laplace himself was asked by Napoleon what place God had in this system, he replied, "Sire, I have no need of that hypothesis." The believing man, therefore, need have no regrets that the system of hard determinism is disappearing from science.

IV

There is yet another point at which the process of "calibration" of the instruments of which I have spoken affects the power of science to give us that final account of the universe claimed for it by Naturalism. It explains what Mr Collingwood means by saying that "science is not knowledge" but "supposition." I should prefer to put the matter much more guardedly and say that in its very nature science can only give us partial knowledge.

The Victorian men of science, of whom the older Huxley was a typical representative, in their contendings with the traditional religious thought of the day, made much of the fact that whereas the religious interpretation of life was essentially a prejudiced view, science was absolutely impartial and disinterested and therefore incomparably more worthy of credence. As we have seen, the Humanist books of to-day repeat that charge to weariness. All religion and all idealist philosophy are tarred with

the same brush, they are forms of "wishful thinking." Science alone is absolutely unimpassioned and neutral.

Now is this really the case? It is no doubt true of a large part of scientific procedure. The true man of science must be constantly on his guard and practise the most rigorous self-discipline in observing, classifying and generalising the facts and laws with which he has to do. He has to be scrupulously just to all the relevant facts, even the most baffling and annoying facts. How high and austere is the standard of science in this respect needs no assertion. It has indeed raised the whole standard of human knowledge in every department of learning and of thought, and not least in the realm of religion. But behind and beneath the rigorous use of the inductive method the true man of science has one deeply rooted conviction which sustains the impartiality of method, and that is the belief or faith or prejudice that Nature is orderly in all her processes. If he comes on some hard problem, which after repeated efforts he cannot solve or bring within the order which he has discovered, he never blames Nature or supposes that he has caught her wandering from her uniform way. It never occurs to him that he may have run into a patch of disorder within the world order. He blames himself alone and recoils only to spring again. If he fails again and again, still he never thinks of blaming Nature; he is sure that Nature is orderly throughout, and a desire to prove that in this case, as in all the rest, there is an explanation somewhere, impels him on in restless labours until the solution is found. That motive sustains

all the vast labours of science throughout humanity to-day. If that strange conviction that Nature is orderly throughout were shaken, it would kill science. If the poison gas of doubt about the ultimate order of Nature once got into our laboratories and observatories, it would bring them all into a slumber of death. Now, how does man come by this all-impelling conviction? It is perfectly clear that it is not by any kind of demonstrative proof. The whole of existing science has come from the endeavour to demonstrate that which men have somehow come to believe independently of and prior to that demonstration. Nobody has explored anything but a fraction of Nature, yet science approaches every new region with the presupposition that however confused it may seem to be, there is order behind the confusion, and that it is her business to discover it. How do we come by that faith? The Humanist is not in a position to say that we have an intuitive or *a priori* conviction on the point. Perhaps we have, but in that case science cannot be the sole pathway to Reality; the mind must have independent sources of practical certainty without which science could not even begin to be. But that I think is not a theory which Naturalism or Humanism can afford to admit. Indeed I see on that naturalistic basis of Humanism nothing for it but to describe this profoundly important prejudice in favour of order to a simple act of will. It is a postulate and not an axiom. Therefore, as Mr Collingwood has said, all science rests to begin with on an unproved supposition. But man cannot will anything persistently without some practical motive. There is certainly an

æsthetic interest involved in pure science, an alluring but austere beauty in scientific demonstration, and so there is an insatiable desire to discover this beauty. It is plain also that there is a practical interest of a very comprehensive kind. Man's interest is, obviously, that the world should be orderly, for only if it be so can he foresee what Nature is going to do, and only so can he describe it in terms of human thought so that he and his fellow-men can share a common knowledge, foreknowledge and mastery. But again, if all this be true, what becomes of the purely disinterested nature claimed for science? It is absurd to say that morality and faith are vitiated by being interested, while science alone is pure and disinterested and therefore alone to be trusted, when all the later rigorous impartiality of the investigation is sustained by the desire to demonstrate that which the investigator greatly desires to be true—the orderliness of the natural world. This becomes plain when we remember the exultation with which the great advances of science of our own time have always been hailed by the intelligent public. They give mankind a new sense that it is winning in its long battle with Nature, and this does not apply only to the triumphs of science that revolutionise the practical arts like that of healing, but to purely theoretical conquests which are verified by Nature, like the discoveries of Einstein. What, then, are the proximate aims of science in making this fundamental supposition or postulate of universal order in Nature? The modern analysis of the scientific method of which I have spoken reduces these aims to two—the description of Nature and

the power of predicting what Nature will do. All science sets out to give, first of all, a coherent description of the immensely complicated world of phenomena, which is ever sweeping around and over man like a moving panorama over which he has no control, but which has terrible control over him. We may compare him to a slave at the mercy of a formidable master who can award pleasure and pain, life and death to him at his sovereign will. In such a case it is obviously of vital importance that the slave should be able to give to himself and his fellow-slaves in like case some intelligible understanding and description of his master's motives and methods, in order that they may foresee what he is going to do next. If slaves are not to be utterly helpless and passive, they have got to make some kind of sense of the way in which their master acts. Now so long as Nature is a mere complex of "happenings," and all her processes "the mere drift of cosmic weather, doing and undoing without end," as William James has called it, there can be neither understanding nor description nor foresight. Men must remain permanently mere victims, and they cannot get together and co-operate either to please or master their tyrant. The first great step is to find out if there is any intelligible method or order in the beatings or in the gifts which their master bestows upon them. They make, then, that primary vital supposition, they assume that there is order. The next step is to find out what that order is. They have to find it in rough outline, and they have to describe it to themselves and to each other before they can get any farther out of the helpless prison

of their servitude. What they need is something more, however, than description. It must be a kind of description which will enable them to foresee what he is going to do next. Description and prediction, then, impelled by the will to live, these are the aims of all men's common-sense knowledge of Nature, and all science grows out of such lowly beginnings, for it is, of course, simply an immense expansion and refinement of such common-sense knowledge.

To sum up what has been said under this head, the whole structure of science rests thus upon a postulate or supposition, for which so far as Naturalism goes no justification can be given except that for practical reasons man has postulated or demanded it, because he needed it badly. Experience has proved that it has worked, and we may hope that it will work still indefinitely. But how do we know that it will always work? There may, for aught we know, be regions in the vast physical universe beyond mathematics. Quantum Theory and the principle of indeterminacy are reminders that continuity and general law may not give a final account of that universe, and that uniform order may not explain everything even in the physical world. The difficulties in which in this region science finds itself to-day, the necessity in which it finds itself of using two different and apparently incompatible conceptions of the nature of energy, and meantime of going on with both, are a sharp reminder of the danger of taking for granted that as yet even its fundamental conceptions give us any full and adequate account of reality.

We have already seen good reason to believe that

there may be room in the universe for freedom as well as necessity, regions in which the postulate of universal uniformity of law is no longer valid. Had it been an axiom that everything that happened in the physical universe was subject to uniformity, then all our apparent sense of freedom and responsibility must be treated as illusion. But it is altogether different with a postulate. We use it experimentally and not dogmatically. We carry it as far as it will fairly go. But if there are facts which it cannot explain, it must yield to the facts.

Yet again if it is lawful and right to postulate cosmic order as the basis of science, why should it be unlawful and wrong to postulate moral order in the universe as the basis of all moral action? I shall endeavour in the following chapter to show that such an order is as necessary to the validity of our moral convictions as the order of Nature is to the validity of science. But it may be that both the cosmic and the moral orders which are impersonal systems are taken up into a freer, larger personal system.

The cumulative result of all this self-criticism of science has been such as to make us feel that we cannot expect to find in it a complete or even a momentarily satisfactory explanation of the great riddle of the world. It ignores too much ever to be able to explain this infinitely rich and varied universe. So much we can surely already see from a simple analysis of the scientific method. The truth is that if we carry the naturalistic version of science clear through to its ultimate issues, it must end in

scepticism. For what is the account of the scientific reason given by evolutionary Naturalism but this, that it is an instrument formed by the human race to enable it to survive in the struggle for existence. It does not give us truth, it gives us only what it is supremely useful for us to believe to be true. In all our reasoning in this chapter we are not on this view seeking the truth, we are in quest of a mere utility, and this applies to every kind of knowledge whatsoever. Truth is inaccessible, or non-existent. All that we can ever attain with all our striving after realities are utilities. Such are the conclusions of Pragmatism, and to me at least that is only a refined form of scepticism. A very large part of the interest and vitality of the quest for truth, truth at all costs, would at once fade out of human life and human thought if mankind were to become persuaded that there was no such thing as truth or reality, only utility, nor would the situation in any way be saved, even if the utility were not personal but racial utility. And to me if Naturalism be true, not only such great names as duty and goodness and virtue, but truth itself must all be merged in the one devouring category of utility in the struggle for existence.

I cannot but believe that if science is to maintain its splendour it must find some other philosophy than this which arrogates to itself the name of the philosophy of science. It needs for its basis something or Some One in Whom is a reality above the battle of utilities, Who has so made the human intelligence, that like the human heart, it is "restless until it finds its rest in Him." Science, in a word, for its stability and honour, needs either God

or "something very like Him." In the disinterested love of the truth, the whole truth and nothing but the truth of the man of science we have a form of the love of God, and therefore the conflict between science and religion is only apparent and transitional. Science needs religion for its basis too much to be permanently alienated from it. On the other hand that religion needs science who that realises the gains that science has brought to religion can doubt? What Christian would be willing to abandon the new vision of the greatness, wisdom and power of God which the science of the past centuries has already brought to Faith? What enlightened Christian would be willing to go back to the old three-storied universe of our forefathers, with its six thousand years of human history? For there is truth in Seeley's eloquent protest that our religion to-day greatly needs the help that science can give it to think more worthily of the glory of God: "In too many Christians the idea of God has been degraded by childish and little-minded teaching; the Eternal, the Infinite and the All-embracing has been represented as the head of the clerical interest, as a sort of clergyman, as a sort of schoolmaster, as a sort of philanthropist. But the scientific man *knows* Him to be Eternal; in astronomy, in geology, he becomes familiar with the countless milleniums of His lifetime. The scientific man strains his mind actually to realise God's infinity. As far off as the fixed stars he traces Him 'distance inexpressible by numbers that have name.'"[1] This is most true. Science has given us a new manifestation of the greatness of

[1] Seeley's *Natural Religion*, pp. 19, 20.

the universe, and some new apprehension thereby of the greatness, the wisdom and the power of Him who made it. Religion cannot do without it. It is impossible to receive the new revelation of the wisdom and greatness of God without seeking a greater idea of His character, His purity and His love.

The new knowledge of God which has come to us through science should surely bring with it to all men and women who believe in Him already the desire to win some new knowledge of His grace commensurate with that splendour of wisdom and power. But to speak of that at this point would be to anticipate a later stage of our argument; and for that we have not yet secured an adequate ground.