JOURNAL OF

THE TRANSACTIONS

OF

The Victoria Institute

OR

Philosophical Society of Great Britain

VOL. LXXX

1948

LONDON:

PUBLISHED BY
THE INSTITUTE, 12, QUEEN ANNE'S GATE, WESTMINSTER, S.W.1

876TH ORDINARY GENERAL MEETING

HELD AT 12, QUEEN ANNE'S GATE, LONDON, S.W.1, AT 5.30 P.M. ON MONDAY, APRIL 12TH, 1948.

R. E. D. CLARK, ESQ., M.A., PH.D., IN THE CHAIR.

The Minutes of the previous Meeting were read, confirmed and signed.

The following elections were announced :—H. V. Goold, Esq., L.R.I., B.A., Fellow; Rev. E. W. Mills, Fellow; A. E. Hyam, Esq., Member; John Byrt, Esq., B.Sc., Member; Professor L. Ramm, A.B., B.D., M.A., Member; Capt. E. P. Flowers (late R.A.), Member; E. E. Oakes, Esq., A.M.I.C.E., Member; Rev. M. J. B. Fuller, B.A., Member (on transfer from Associate); Rev. Paul Faunch, Member (on transfer from Associate); Peter Hill, Esq., Member (on transfer from Associate); K. J. Frampton, Esq., Associate.

The CHAIRMAN then called upon Frank T. Farmer, Esq., B.Sc., Ph.D., to read his paper entitled "Physical Science and Miracle."

PHYSICAL SCIENCE AND MIRACLE.

By FRANK T. FARMER, B.Sc., Ph.D.

THE statement, "I would believe in miracles if I saw one happen" is a common criticism of the view that miraculous events do in actual fact take place. Those who criticise their existence are generally ready enough to admit that astonishing happenings, commonly called "miracles" do from time to time occur, but they attribute these to coincidence or freak of chance rather than to any supernatural processes, and are quite unconvinced that departures from the well-established laws of nature do ever manifest themselves. They point out (rightly) that in the case of any physical system capable of random variation there must necessarily be extreme departures from its normal state at times, and these inevitably attract attention while its normal variations pass unnoticed. It is always the odd extreme, whether in physical phenomena or in the wider world of human affairs, which catches people's minds and arouses interest often out of all proportion to its true significance.

This type of reasoning represents the commonest of all criticisms of the view that miracles are real.

Of the many alleged instances of miracles recorded in history the greater number have undoubtedly been concerned with healing of disease. This is a subject which has, not unnaturally, held the interest of people throughout the centuries; sickness is always a matter of vital concern to any class of people. The "miraculous" cures so recorded, however, rarely convince anyone who is disinclined to believe them in the first place, for it is well known that the healing of disease in everyday life often occurs in a manner which is wholly unexpected and which, not uncommonly, appears at the time to be supernormal in character. Unless we can say what course an illness would have taken if it had been left to itself, we can never decide with certainty whether recovery was a natural process or whether it was due to some supernatural power.

Similar criticism may be made of the "supernormal" explanation of the many other strange incidents which are continually being reported as miraculous—an unusual escape from death or the chance encounter of a long lost friend under the most unlikely circumstances.

Such considerations have made many people, among them many Christians, sceptical about the reality of miracles. They say, moreover, and not unnaturally, that since miraculous events cannot be proved to occur in our own time, we have no valid ground for believing they ever occurred in the past. Nature works according to definite laws and principles, and, in the absence of overwhelming proof to the contrary, it would be illogical to suppose that she capriciously departs from these at times for the sake of some anxious or suffering human being.

With the advance of science in the nineteenth century this critical point of view became much more widespread than it had been hitherto. For until relatively recent times a great many natural events which we can understand readily enough today were quite unintelligible, and it was no cause for wonder that these should be given an explanation in terms of spiritual instead of physical forces. There was no other known interpretation of them. During the last hundred years or so, however, the outlook has totally changed. We have reason now to believe that the whole behaviour of the physical world is governed by just a few simple fundamental laws. And, whether or not we can perform the necessary calculations relating to any physical system to predict what its future course will be, we believe that the future of such a system is determined, and that nothing we may wish or think about it can alter this course.

Such a view has far-reaching implications. It follows from it, for instance, that to expect the weather to change from what it would otherwise be today is really to expect a miracle to happen in the same sense (though perhaps not to the same degree) as it would be for water to flow up hill. This does not mean that we should not pray for rain; but it does not mean that in this as in every instance of the intervention of a mind with the working of the physical world something has happened in the determinism of matter which is not normally taken into account in the consideration of physical systems.

The deterministic view may be summed up by the well-known statement that the world is a vast machine. Its present condition is determined by the past and its future is determined by the present. All three are, to use a phrase of C. S. Lewis, "interlocked,"[1] and the material universe follows its inexorable course as laid down from the day when it was created. There is clearly no room for miracles if this is a correct picture.

This "closed universe" conception has formed the background of scientific and philosophical thought for a long time. Yet it has been felt too, by many, that it does not represent the whole story. It does not, in particular, take into account the mind of man. Men make decisions and act on them. These decisions are derived from thoughts, ideas and emotions which are clearly not wholly physical in character, yet they result in actions which enter and become part of the physical world, and the course of a material system is altered from that which it would have been in their absence. Does this mean that physical laws have been disobeyed? Or do the thought processes going on in our minds somehow run parallel and hand in hand with the physical world so that no such conflict is produced?

To many people the idea that so "insignificant" a thing as the mind of man should be capable of interfering with the vast machine universe seems incredible, and they deny that any real interference does take place. To them the universe is essentially material, and the interference by mental events must be regarded as an illusion, not a real disturbance of the mechanism.

The human mind on such a view, is merely an *epiphenomenon*; it is the result of a particular configuration of molecules and atoms in the brain. When we think we are doing something

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[1] Lewis, C. S., *Miracles*, G. Bles, 1947.

from choice we are really doing the only thing possible, because our action represents the only way in which these molecules and atoms can move. The brain is like the pendulum of a clock. This can only follow the motion laid down for it by the person who made it and set it in motion; no other course is possible. Our thought processes are merely a "decoration" which we weave into the picture, making it appear that they are really causing things to happen in a way different from that due to physical law.

There can be little doubt that this view is totally false, since (apart from its physical difficulties) it simply does not fit in with experience. We know certain facts about the physical world which have enabled us to discover the familiar laws of nature; we have learned these facts by observing material objects. We know, also, certain other facts which are equally gained from experience, one of which is that we are influenced by such things as fears, affections, envies, dislikes, and so on, and all of these may lead in various ways to the movements of our muscles and of our whole bodies. If I am actuated by fear, I am likely to move in a different way from that in which I would move if I were actuated by love or sympathy; and the mere existence of two alternatives shows, when we analyse it, that physical determinism does not reign here.

R. O. Kapp in his valuable book, *Science versus Materialism*, supports such a view. He recognises that our bodies have a chemical structure much the same fundamentally as non-living matter and that, wherever physiological and chemical processes have been studied, they are found to be governed by the same basic laws as we find operating in the inanimate world. But the difference, he says, is that we, as living beings, are subject to a *double determinism* and not only to the determinism of physics. Every molecule of our bodies obeys all the laws of physics, but, in addition, it is subject to a further determinism imposed by the mind.

This view would seem to explain the difference between living and non-living matter were it not for the fact that where physical laws reign there can be no place for any *alternative* course which a double determinism might be expected to impose: as soon as we conform to the uncompromising laws of the inanimate world, there ceases to be any situation in which a second determinism could operate. If the non-material qualities of a living creature, therefore, have any reality at all, there is no alternative

but to abandon the rigid determinism applied to the molecules of which it is composed, and to allow the possibility that processes contrary to the laws of physics are somewhere taking place in them.

Eddington[1] arrives at this same conclusion, and says that we can only account for the observed behaviour of living organisms if we assume that in some part of their bodies there is matter which does not follow ordinary physical laws, and which is not deterministic. This he calls "conscious matter." When we think, and when we are influenced by an idea or emotion, the atoms in these parts of our bodies behave in a way which is *not* simply the result of their previous motion. A train of processes is thereby set in operation, which results in the contraction of a muscle or group of muscles. Once the initial disturbance is set up the whole process may, and in all probability does, follow the fundamental laws of non-living matter, but, somewhere at the beginning of the series of events, there must be the movement of an electron, an atom, a molecule, or an aggregate of these, in a direction and with a velocity which are not determined by the laws of dynamics, and which indeed contravene these laws.

Whether there must be a large number of such conscious centres in the brain, all of which act simultaneously and in harmony to produce each physical movement and each behaving as a "trigger" to its neighbouring molecules, or whether only a single electron need be controlled at any time by our thoughts or emotions, we have as yet no way of discovering.

The latter supposition would however appear to be a very improbable one, since it clearly requires that the whole system should be extremely well balanced and sensitive. In view of the fact that the process is going on all the time while our minds are at work, it seems difficult to conceive that a single atom or electron could initiate all the various movements that we make, every one of which corresponds exactly with the thoughts that happen to be in our minds at the time. The physical structure of our brains does not suggest that such a high degree of complexity is present in them*; and it seems much more likely

* Indeed the brain is not one of the most complex structures of the body, if we take ease of damage by molecular rearrangement as the criterion. The brain is far less sensitive to X-rays, for instance, than the glands or other seemingly less vital parts of our bodies.

[1] Eddington, A. S., *The Nature of the Physical World.*

that, taken in the aggregate, the conscious centre or centres are of an appreciable size and contain a very large number of molecules.

Physical Indeterminism.

Until the beginning of the present century it was thought that the behaviour of particles of atomic size was determined by precisely the same laws as those which govern larger pieces of matter, namely Newton's laws of motion. On this view any material system was wholly determinate in character. The above argument for the existence of a centre of conscious matter in the body, on this basis, seems to stand quite unassailable.

With the coming of modern physics, however, a new factor has been introduced, namely, indeterminism within atoms themselves. Heisenberg first drew attention to this. He showed that there is a limit to the precision with which the position and velocity of an electron can be measured in any given circumstances. We can either determine the position accurately and leave the velocity in doubt, or we can determine the velocity accurately and leave the position in doubt. There is a complementary relationship, by which the product of the "uncertainties" in the two measurements is always equal to a small, but nevertheless finite, quantity, Planck's Constant. This conception was something entirely new to physics, and has been, consequently, the subject of much criticism and speculation.

The basic contention of Heisenberg was that there is an uncertainty in the measurements themselves. This, in itself, does not seem of great significance. We are familiar with imperfections in measurements in the larger world and, indeed, expect them. They arise from the use of imperfect apparatus. In atomic phenomena, however, the situation is different, since the limit is imposed by something outside our control; it is imposed by the finite sensitivity of the most delicate measuring device known to us, namely a single quantum of light. The clumsiness of this, in comparison with an electron, causes it to "blur" the experiment, and so prevent any precise result being obtained. The limiting factor is not one of skill on our part, but is inherent in the make up of matter itself; it is beyond even our mental powers to find a way out of it.

Blunders were sometimes made in early atomic physics by

visualising mechanical models of atoms and electrons and from these deducing the way in which real atoms should behave. By doing this, physicists fell into the trap of supposing that matter of atomic dimensions was the same kind of stuff as that which we can handle or otherwise be conscious of with our senses, and several false lines of thought were started in this way. As a reaction against this certain physicists insisted that we ought only to consider as real those things which can actually be observed and measured. If we cannot observe a certain type of particle, however certain we may be that it is present, we have no right to suppose it exists. The same is true of concepts such as momentum and position; if they cannot be determined experimentally, their existence must be regarded as unreal.

In this way indeterminacy of measurement came to be regarded with much greater significance. An electron now came to be thought of as being hidden in an " envelope of uncertainty "; within that envelope its position was not determined by physical law, but only by probability. We could describe it by saying, " it might be here, but it is more likely to be there "—its reality was no more substantial than that. This was something strangely new to physics. It meant that there was an arbitrariness right at the heart of physical phenomena where causality had hitherto been assumed to be firmly established.

It is sometimes said that all physical laws are ultimately statistical in character and only appear to be exactly obeyed because we deal in practice with large numbers of molecules. Thus, in a gas every molecule is moving and colliding in a random manner, yet the large scale quantities we measure, pressure, temperature, etc., are known to obey quite exact laws. Nothing in our measurements could tell us what a particular molecule is doing at any time, but the molecules taken together behave according to precise laws.

It is clear that the " indeterminacy " in this instance is merely an expression of our ignorance of the precise position and velocity of every molecule at any time, a " crypto-determinism " as Prof. E. T. Whittaker[1] describes it. In theory we could observe the motion of every molecule separately, and then calculate precisely the behaviour of the whole gas at any future time; and according to this classical view there would be no arbitrariness or uncertainty in the result.

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[1] Whittaker, E. T., *Proc. Phys. Soc.*, **55**, 459 (1943).

We may well ask whether the indeterminacy in electrons which we have been considering is a real physical indeterminism or whether it also is merely an admission of our ignorance of some hidden factor that we cannot measure. Opinions among physicists differ on this issue. Von Neumann[1] concludes from a mathematical analysis that the phenomena of atomic physics cannot be explained as a mere ignorance of hidden parameters and that there is a real arbitrariness at the root of things. Pelzer,[2] on the other hand, indicates a way in which such hidden parameters might enter in physical phenomena and shows that there is at least a reasonable justification for assuming that atomic processes are in fact determinate. Many physicists believe that this is the case; and that Heisenberg's indeterminism is no more than a lack of knowledge on our part. Later we shall have occasion to revert to this point in considering the miraculous.

The idea that an arbitrariness might exist in the physical world was hailed by philosophers, who immediately suggested that here was the key to the problem of free will. This loophole in the strict causality of physics provided just that way of entry for which they had been seeking, by which a non-physical entity, mind, could act on the material body. All the mind had to do, they said, was to influence the electrons within their range of indeterminacy and so bring about a movement of some part of the body in the way that the mind had selected. There was no need to postulate any departure from the laws of dynamics, as had previously been necessary. Here was the link between the mental and the physical which they had been seeking so long.

Such an easy going conclusion however, is far from adequate. It is doubtful, indeed, whether an influence by the mind upon electrons within the fine limits which physical indeterminism allows, could account for any of the large scale movements of our bodies which occur. It would be necessary, if this were so, to have an extremely delicately adjusted system if each response is to occur in exactly the correct manner for every thought and impulse in the mind. As we have already noted, the available evidence does not suggest that the brain is of this character.

It is important to note here that if in fact the mind works by operating on electrons within their arbitrary limits, its behaviour

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[1] J. von Neumann, *Mathematische Grundlagen der Quanten Mechanik.*
[2] Pelzer, H., *Proc. Phys. Soc.*, **56**, 195 (1944).

would *still be contrary to the laws of physics.* If the same process occurred in non-living matter it might well manifest itself in a way that the physicist would call " miraculous " ; for example, it might cause the separation of hot and cold molecules in a liquid, contravening the second law of thermodynamics. That such things do not happen in the external world shows that, whatever precisely living matter may be it does not obey the same laws, wholly and simply, as does non-living matter. It constitutes, in some degree at least, a miraculous system.

Normal Miracles.

The above considerations suggest that we may divide miracles into two groups, which we may call *normal* and *abnormal.* The normal are those which we find occuring every day in the mind of every living being under the influence of thoughts, instincts, emotions, etc., and it is only because they are so extremely familiar to us that we do not recognise their profound significance. They are miracles in the sense that they are unpredictable by any dynamical calculation from events that have gone before; they are a new " creation," thrust into the material world from outside and are not linked by any mechanical process with that which is already there.

By way of contrast, we may enquire into abnormal miracles, which bear no such familiar characteristics and occur, if at all, only on the rarest occasions. They will be considered separately.

The normal operation of our minds on our bodies has been the subject of many discussions, and it has been characteristic of such discussions that they have tended to become discourses on the existence or non-existence of free will. This subject is of profound interest, but it should not be allowed to obscure the issue we are considering. Many of our actions are certainly influenced by our previous experiences and by the state of our subconscious minds, and often when we think we are making a free choice, we may not really be doing so at all but instead may be following an inevitable course. Thus it is often argued that it is unnecessary to assume that there is any interference with the physical behaviour of our bodies at all; they are machines like the rest of the world and are obeying physical laws in just the same way.

This argument carries little weight, since the need to assume an interference with physical laws does not arise only from the existence of free will in the mind; it arises from our reaction

to any non-material cause. We respond a thousand times a day to emotional or instinctive impulses. These cause our muscles to move just as much as an unconditioned impulse would do, if it could exist in our mind. It would be necessary to show, therefore, if we are to evade the above conclusions, that all such impulses are, in fact, just the mechanical interactions of molecules and atoms instead of the mental processes they seem to be. Thus, if I feel sympathy towards a person and go to his help, it would have to be shown that the quanta of light from that person and a multitude of other objects, falling on my eyes, and causing photo-electric effects in the retina, in conjunction with vibrations through the air on to my ear drums and other sensory experiences of this nature, result mechanically in the movement of molecules in my brain in a particular way, and in the contraction of such muscles as cause me to move in the way I do; and that if the influences had differed in some minute detail I would have moved in a completely different manner. Such a theory may be upheld, but it requires an almost inconceivable stretch of imagination to account for our many varied actions in this way. Moreover, it is not what experience leads us to believe; it can only be regarded as highly speculative in character.[1]

Should our illustration not prove convincing, however, we may consider a further instance. Let us take for example the process underlying a creative act such as the invention of a calculating machine. Here the mind works in a different capacity, namely that of producing from an idea in the abstract a device of an ingenious and complex character. The idea is generated in the mind by a creative process. Following that process, the inventor causes it to be expressed in material form by the action of his mind on his muscles: thus a non-material entity gives rise to a tangible physical instrument which has no previous counterpart in the world of matter.

Such a process is typical of a multitude of things we do in art, in science, and in our everyday lives. It represents an intrusion from without into the mechanism of our bodies and provides the strongest evidence for the type of miraculous process we have been speaking of as taking place in the material substance of our brains.

Whether free will exists or not, therefore, we can say that

[1] West, G. D., *Nature*, **154**, 464 (1944).

our minds are the focus of an interaction between the non-material and material worlds, and in this respect a miracle is happening in precisely the sense in which a physicist uses the word when he is thinking in terms of his mechanical laws.

Considerations of a similar character are true also of animals. For instance, the instinct which makes a bird care for its young cannot be explained adequately as a purely mechanical process, but only as the action of non-physical and physical parts of its being combined.*

These and many other examples may be described as *normal miracles.* They occur all around us every day, and, to a physicist, they can be described in no other terms than as an interference with the laws that govern ordinary material particles. They are miracles of a special, but very common, type.

Abnormal Miracles.

The healing of disease is an everyday occurrence. We all recover from minor ills without any special attention. There is little doubt, however, that the state of our minds plays a definite part in the process of recovery. A confident, cheerful disposition is one of the greatest healing factors we know.

Clearly, therefore, our minds unconsciously, as well as consciously, react on the molecules of our bodies, and cause them to function in a way in which they would not function alone. Indeed, it seems very probable that our whole living structure depends all the time on a non-material influence from our subconscious minds, to maintain its proper function and to repair the minute damage which is constantly occurring. In principle, our very existence as living organisms seems to depend on this interaction between the mental and the material parts of our being.

In all these considerations it is immaterial whether the interaction of mind and matter is through an indeterminacy of electrons, or through some completely unknown interference with physical law by the mind. The interference is seen to take place, and on this account the body is not just a deterministic mechanical system but is a centre of miraculous events.

Other phenomena of a less familiar character are of interest in this connection, and may be referred to briefly here. Tele-

* Mechanical in the physicist's sense, not in the sense commonly used of "by force of habit."

pathy is one of these. There is little doubt that some interchange of thought between widely separated people does occur, and there is much evidence, too, that a similar process takes place among animals. Ants for instance are known to influence each other over considerable distances and the influence is independent of any physical barriers that may separate them. Numerous other instances are known too of responses between animals which cannot be accounted for by electro-magnetic waves or any of the other physical processes that are frequently put forward by way of explanation.[1] They are in a category outside known physical agencies. Whatever may be the explanation of these phenomena, it seems clear that a transfer of an idea or thought pattern from one individual to another does in certain circumstances take place.

As for ourselves we normally think of our minds as being attached in some way to the molecules of our brains. If this is so, such instances of telepathy suggest that they are able to " reach out " at times and exert an influence on other minds at a distance; they escape momentarily from their material prison. Perhaps the process is similar to the way in which they reach out to the remote cells of our own bodies and exert a co-ordinated healing influence on them. At any rate it seems that the mind is not as completely bound to the material substance of the brain as is usually assumed and can, under some conditions, operate through distances.

There are various other phenomena which are relevant to this consideration and mention should be made here of those classed as " occult." Although this is a branch of knowledge in which little is known with certainty, there seems ample evidence to support the existence of such manifestations as Levitation and Telekinesis.[2] The fact that these phenomena are associated with a mind (that of a medium) in an abnormal or strained state, suggests that the effects on matter which occur are due in some way to the mind of the medium " reaching out " from its normal body to these remote objects and influencing them in a way not unlike that in which it influences its own body under normal conditions. If this is so, then the various phenomena concerned would seem to be further examples of the way in which a mind can contravene the normal physical laws, and they need not be

[1] Duncan, F. M., *Wonders of Migration*. Sampson Low, 1947.
[2] Duffy, B. J., *Food for Thought*, 1944.

regarded with such amazement and scepticism as is customarily shown towards them. They are miraculous in the sense that they are a departure from the normal behaviour of material objects. But they are no more contrary to the laws of physics than the processes which are going on in our brains all the time and which we regard as entirely natural.

Other phenomena[1] than telekinesis accompany the activity of a medium, but we should be going too far afield if we considered these. We may, however, notice that each involves the breaking of some physical law which in the normal world is rigidly adhered to, and in this respect they are all related and can be grouped together. In the instance of the lifting of objects at a distance the law of conservation of energy is broken; in the instance of the brain it is more probable that the law of conservation of momentum is broken. In other instances, such as materialisation,[2] it appears that the law of conservation of matter is broken. If we accept any one of them there can be no valid reason to deny that the others also take place in suitable circumstances. Physically, one is no more incredible than another.

The examples we have just referred to are interesting because they cannot be accounted for simply as an interference with the *motions* of molecules within a particular mass of material. They represent something more radical. This seems to suggest that the process of interaction of mind on matter is not achieved through the loop-hole of Heisenberg's indeterminism. This will only explain the rearrangement of particles with the same average energy, and while this might be the key to our mental processes it cannot account for the other phenomena which call for an explanation.

We make no pretence in the above discussion to have explained any of the phenomena that have baffled science for such a long time. The instances we have given are intended to show that, to a physicist, many everyday occurrences are, in fact, in the nature of miracles, using the word in the sense in which he habitually uses it, and that there is no foundation for the materialistic belief regarding our minds and bodies which is so prevalent. Many things in the world remain obscure; but we now know enough to say that, even if they should some day be understood, they will not come within man's simple scheme

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[1] Geley, G., *Clairvoyance and Materialization*. Unwin.
[2] Schrenck-Nötzing, A., *Phenomena of Materialisation*. Engl. Trans., 1920.

of physical laws. He must leave room for the non-material, the mental, as well as the physical.

If the mental aspect is allowed, why not also the possibility that a much greater Mind may sometimes interfere with the events taking place in the physical world, now, in the past, and in the future experience of men ?

Discussion.

Dr. R. E. D. Clark (Chairman) said : On behalf of the Institute I should like to say how grateful we are to Dr. Farmer for his interesting, valuable and stimulating paper.

The paper raises so many points and covers so wide a field that it is difficult to know where to begin and what to omit. In my comments as Chairman, therefore, I should like to confine myself to a discussion of one point only.

Dr. Farmer has called attention to a matter of fundamental importance which has been much overlooked of late—the question of the existence of " conscious matter " in the central nervous system. On this point I should like to make a few additional comments which would seem to be relevant.

The brain is a highly " divergent " system, that is to say it contains mechanisms able to convert an exceedingly *small* stimulus, such as a small potential difference, into a large scale event. We see this in a particularly striking way in, say, strychnine poisoning, when very small stimuli result in convulsions. It is not, therefore, intrinsically impossible that an action of the mind upon a single electron within its normal " envelope of uncertainty " might be magnified into a bodily movement. But if this actually takes place we should expect bodily movements to arise spontaneously—since probability alone, in addition to volition, will, in the course of time, bring our electron into all possible positions within its " envelope." Since this is *not* in accordance with experience, domination by a single electron centre would appear to be out of the question.

May we not seek an analogy from recent findings concerning the physiology of the sense organs ? An immense number of fibres connect the retina to the occipital cortex and each obeys the " all or none " rule—it is either stimulated or not stimulated.

Whether or no stimulation occurs is largely a matter of chance (*i.e.*, stimulation of such a fibre lies within the normal "envelope of uncertainty"). But the sensation of light is not registered by the stimulation of a single fibre—were it otherwise we should be incapable of distinguishing between real light and random electronic fluctuations. The synchronization of responses by a number of nerve fibres is necessary before the sensation of light can be evoked. In the ear the circumstances appear to be similar.

Analogy would suggest, then, that *if* the mind functions by acting upon individual areas of "conscious matter," within the limits imposed by the Heisenberg principle, then there must be a number of such centres and the "miracle" which the mind performs must lie in the synchronization of the fluctuations in the centres. The mind, in short, must act by ensuring some kind of non-physical action-at-a-distance.

Another argument for the existence of a number of centres would appear to be furnished by the work of Lashley on the brains of animals. This has conclusively shown that one part of the cortex can generally take over the functions of another. This suggests that "conscious centres" are numerous and well distributed in the cortex.

If we assume that the brain contains many "conscious centres," it is not necessary to suppose that it is inordinately complex. It becomes, in fact, more like a *manually operated* than like an *automatic* telephone exchange. This would appear to agree with the X-ray evidence cited by Dr. Farmer, and it is then no longer necessary to assume that the brain is "an extremely delicately adjusted system."

However, none of those considerations invalidate Dr. Farmer's contention that the ordinary functioning of our minds must, in the fullest sense of the word, be "miraculous" in its nature. In his valuable work on *Miracles*, C. S. Lewis has reached an identical conclusion and it is refreshing to learn that Dr. Farmer has reached the same view as a result of an approach from a scientific rather than from a philosophical angle.

Dr. E. WHITE said: I was very much interested in Dr. Farmer's suggestions concerning the possible way in which the mind acts

upon the matter of the brain. No doubt he is familiar with the researches carried out by means of the electroencephalograph. In one experiment, which I witnessed, the subject was sitting quietly with his eyes closed, and the waves recorded on the moving tape showed a regular form and rhythm. The subject was then told that he would be given a simple problem to solve in mental arithmetic, which was then given him. From the time of the announcement of the problem (how many pence in half-a-crown ?) the waves altered very considerably in form and in rhythm. As soon as the problem was solved, they returned to their original form. It is believed that the waves represent the common denominator of changes of electrical potential in a very large number of cortical cells. If this is so, may we not infer from the above experiment that the change in consciousness consisting of a conative mental effort affects a large number of nerve cells at the same time ?

Concerning the healing of tissues, certain experiments performed by suggestions made to a subject under the influence of hypnotism show that physiological changes can be brought about, *e.g.*, flushing and sweating of an area of the skin. Further it has been found possible to produce a blister on the skin by suggestion, and even to affect the rate of healing of a blister by the same means, without the subject having any conscious memory of the suggestions made during hypnosis. Other evidence may be added to show that the processes of the body under the control of the autonomic nervous system (*e.g.*, heart beat, rate of breathing) are modified by mental processes going on in the unconscious mind. It would appear that healing processes are not brought about by the direct influence of the unconscious mind upon the tissues, but *via* the mediation of the autonomic nervous system.

In reference to what the chairman (Dr. Clark) said about centres of consciousness, modern neurological investigations show that the limited motor centres described by Hughlings Jackson are not adequate to explain all the phenomena of motor activity. A number of accessory motor centres in the brain have been discovered.

Probably we must abandon the conception of a centre, or centres of consciousness. It seems more likely that in consciousness the brain acts as a whole, although there are certain centres directing particular groups of muscles in voluntary movements.

I should like to thank Dr. Farmer for his interesting paper, which deals with many important questions relating to mind and body.

Dr. NORMAN S. DENHAM: Miracle, as usually regarded, involves the abnormal, and is held to transcend the laws of Nature. Though manifested in the transformation or renewal of the material, it is always accompanied by what may be termed psychical or spiritual determination. Besides this, miracle takes place in the realm of the immaterial. Indeed, the transformation in such cases is not explicable by atomic laws, or by indeterminism within the atom. In the case of a man converted to God, the changed life issuing in alterations of speech, dress, habits and associations, is indicative of a fundamentally new, purely spiritual outlook. Once earth-bound, his sphere and interests are heavenly.

Dr. Farmer's main concern, however, is with the commonest and most spectacular type of miracle, the healing of disease. He justly maintains that the course of the material system is definitely changed because of mental processes, by what R. O. Kapp calls "double determinism"—a dual imperative of mind and physical law. The "conscious matter" of Eddington seems to call for "conscious mind." Mind, being indeterminate, necessarily dominates the matter which the Creator has provided to subserve the needs of the organism. It is irrational to regard the psychic impelling of the brain-cells, causing unfamiliar processes, as due to indeterminism within the atom. The organism is surely a useless entity without the mind, witness the lunatic, or a thousand accidents in animal life calling for adaptation and adjustment.

An animal will automatically crouch to deceive its prey or to elude its enemy. A bee will find a deadly hawk-moth in its hive, and it will at once be sealed up. A swan will pull a bellrope because in that way only will it be fed. The psychic process leading to unusual action is essential to its existence. It is a soul, not a physical thing only. If, as Dr. Farmer affirms, there is reasonable justification for assuming that atomic processes are determinate, then indeterminism within the atom has no effect upon the large scale movement of bodies.

We welcome the Lecturer's affirmation that our very existence as living organisms seems to depend on interaction between the

physical and non-physical parts of our being—also his statement as to the grouping of miracles as *normal* and *abnormal*. The *normal* could be defined in the words of Holy Writ, "By faith we apprehend that the worlds were framed by the word of God, so that things which are seen were not made of things which do appear." Of the *abnormal*, we remember that "Jesus . . . was moved with compassion . . . and He healed their sick."

Dr. Farmer describes as *normal* the miracle unpredictable from events which have gone before, and cites the calculating machine. Plastic surgery also might be instanced, where a surgeon grafts portions of the patient's limbs to a deficient facial member, and produces a new ear, nose or lip. By no means could we maintain that the mind of man does not interfere with and control matter. Much further evidence along the same lines is available from psychic research which seems to give us a vision of the powers now largely latent which it may please God one day to release for man's good.

Written Communications.

Mr. E. H. Betts: Either man must be left to his own devices to discover God, were it possible, by experiment and observation, or else God must Himself break in upon the world of Nature in which man finds himself. This He could not do apart from a display of the supernatural, unless we identify God with the works of His hands (which is pantheism).

Christianity then, which is essentially God's Self-Revelation, *is* miracle, and must call for miracle. There is no escape from this.

What then is the relation between science—not merely physical science, but any true science—and miracle? The relation is that in both, man's position, in the ultimate, is that of viewer—of looker-on. In both, the whole question is one of evidence. We accept the so-called laws of science because they are firmly based on numerous well-attested observations. We Christians likewise accept the miracles of Christianity because they have been satisfactorily attested. Logically the two things are homologous; epistemologically they are complementary. My belief in the law of gravitation and my belief in the miracle of 2 *Kings* 6: 5 which seems to controvert it are equally founded, being logically of precisely the same status. Allowance for miracle is *inherent* in the very nature of inductive, *i.e.*, observational, science.

Those people who think of the laws of science as constituting a completely deterministic system are guilty of the old and all but universally besetting sin of over-generalization. Heavy bodies sink in water. We know that this is "true" because there have been observed innumerable instances of it. But to conclude from these exceedingly numerous instances of actual and recorded observation, that heavy bodies have always sunk, and will always sink in water, and that the rule can have no exception, is invalid. It is to mistake induction for omniscience.

It is not within the competence of science to negative Miracle. For we must remember and insist on the fact that there are *no* laws of science which are any better founded logically than the simple one just instanced. However elaborately the observed data may be worked up and however beautifully they may have been crystallized in shapely formulæ, they are in effect simply condensed observation, and have no other status. This point is elementary but it is often overlooked and needs constant re-assertion with emphasis.

We have, therefore, no need to look wistfully to the physical indeterminism of Heisenberg in the hope that there, perhaps, the thin end of a logical wedge may be inserted to prise open some room for miracle. And as to prayer, its petitions are selected, if he who prays be spiritually intelligent, by one criterion, *viz.*, Is this within the will of God? Super-physical phenomena are envisaged in the Christian story of the past, *e.g.*, *John* xx : 19, 26; super-physical events in the future are our lively expectation, *e.g.*, 1 *Thess.* iv, 2 *Pet.* iii : 10, 12. In the meantime "the just shall live by his faith," and this can even move mountains.

I am glad that though in his excellent paper Dr. Farmer follows a different route he reaches the same destination. "A much greater MIND may sometimes interfere with the events taking place in the physical world, now, in the past, and in the future experience of men."

Mr. A. CONSTANCE: Miracles are contradictions of known laws: contradictions which no amount of further knowledge will or can explain. God makes His own laws, and is in no way bound by them. To seek logical explanations of them is to take step after step backward in a series of regresses (in the style of Dunne's *Serialism*),

each of which finds us looking at the backs of our own heads. Dr. Farmer, in an otherwise logical and well-informed paper, makes this serious blunder: he views his universe from that position designated by Dunne as the "second observer" position. He gets as far back as this position and no farther—he sees himself in his universe, examining laws and miracles and seeking some explanation of them, while remaining in the third dimension. If there are, as we have every reason to believe, an infinite series of observers, behind each of us, and an infinite series of dimensions, then what becomes of all our "explanations" of miracles?

I am sorry that Dr. Farmer says nothing of Biblical miracles, and feel that it is particularly regrettable that he makes no mention of that supreme miracle of all time, upon which the faith and hope of every Christian rests: the Resurrection of our Lord and Saviour Jesus Christ.

Lieut.-Col. P. W. O.GORMAN also wrote commenting on Dr. Farmer's paper. He doubted if theologians would find Dr. Farmer's division between normal and abnormal miracles easy to accept. The word "miracle" had not hitherto, he said, been used by theologians to embrace everyday events, such as the ordinary working of men's minds. A true miracle is a supernatural event due to God.

AUTHOR'S REPLY.

I am much indebted to the Chairman for his comments. If the action of the mind is in fact by way of the uncertainty of position or velocity of electrons we should, as he points out, expect a randomness to show itself beside the ordered movements of our muscles. The situation is analogous to an electrical amplifier in which, as is well known, it is impossible to separate a small input voltage from the voltages due to thermal agitation, etc., and inevitably the unwanted potentials are amplified as well as the wanted. It seems clear, therefore, that if the mind does work through the uncertainty principle it must operate simultaneously on a large number of electrons synchronized to some plan. Lashley's experiments are very interesting, as Dr. Clark points out, in bearing out the same contention.

Dr. White refers to the electroencephalograph. It we are right in interpreting the voltages developed in the brain as due to the summation of potentials in a very large number of cells, and not some other chemical or physiological mechanism, then the regularity of the waves observed certainly points to an interesting synchronizing of the actions of the individual cells by the mind. This would, as Dr. White says, imply a widely distributed influence of the mind on the material of the brain, and not action at some localised point.

Dr. White gives interesting evidence that the healing processes in various parts of the body are controlled by the subconscious mind. This would certainly seem to be true. It must be remembered, though, that cells even completely separated from the body, and grown as tissue cultures, are also capable of withstanding certain destructive forces, if only those of thermal agitation, and they have therefore some inherent capacity to combat injury. This seems to apply to every part of every living creature ; and we should probably be wrong, therefore, to say that healing forces derive *entirely* either from the subconscious mind, the conscious mind or the non-material part of each individual cell.

Dr. Denham says, if I interpret him correctly, that it is silly to imagine that any living organism could have no non-material part, for nature abounds with evidence that their behaviour is not the result simply of pushes and pulls of molecules, but is due to something non-physical. With this I fully agree. But it has to be remembered that the contrary view is still held by many, among whom are the majority of scientists at the present time. It has been my attempt in the present paper to try to carry the analysis materialistic a step further and to show where the fallacy in the outlook arises.

Dr. Betts says miracles are necessary if God is to reveal Himself. I would disagree with this if he means miracles in the ordinary sense of the word : God can and does reveal Himself through the minds and actions of men, and this is surely the main channel through which He works. If we accept, however, that every action through the operation of the mind is a miracle in the sense referred to in the paper, then I would agree that it is only by interference in some way with the world of mechanism that any mind, God's or our own, can make itself manifest in the material world. There

can be no revelation of personality of any kind without such intervention—a fact the importance of which surely cannot be too strongly emphasised in relation to modern scientific thought today.

Mr. Constance says I make the serious blunder of viewing the universe from the " second observer position " and limiting myself to three dimensions. This is a shrewd criticism indeed, and I do not deny it ! But surely all the vast realms of physical knowledge which mankind has gained have been derived under these same limitations, and if the limited premises discredit our arguments about miracles they must equally discredit those upon which all science has been based. Science embodies a great store of truth —truth none the less valid because miracles also happen—and we are surely not in error in approaching other aspects of truth with the same human limitations. Biblical miracles are of the past and carry little weight to most modern thinkers ; they are, as Mr. Constance says, apprehended by faith ; but we have also something which can be apprehended by reason, and this is perhaps more likely to influence those who have no confidence in historical records and seek the truth in their own experience.