CHAPTER - V

THE CONCEPT OF CAUSALITY AND MODERN SCIENCE

5.1 Modern Science and Indeterminism :

It is, however, evident from the foregoing discussions that the controversies regarding the concept of causality in philosophy find so far no common point of agreement. And we have also noticed at the same time that neither rationalism nor empiricism nor transcendental idealism is an adequate solution of the problem. The rationalist's interpretatioin of the concept of causality has a teleological and metaphysical bias which is not amenable to scientific investigation and which falls beyond the reach of the commonsense. On the other hand, the empiricists have made causality only a psychological concept having merely the subjective necessity. Kant has tried to give an epistemological twist to the concept of causality by making the causality both subjective and objective with no successful results. He advanced a series of arguments to prove that the objective successioin as distinct from subjective sequence involves a necessary order which is the core of the causal relatioin. Here Kant argues that the concept of causality is bound up with the irreversible character of time, while this is not acceptable to quantum physics. The quantum physics has advanced arguments in favour of the reversibility in the ultimate process of matter. It does not hold that there is a strict causal relation in the atomic world, rather it argues that the relation is quite uncertain. Eddington who is a staunch supporter of this view argues that the status of the causal law is like that of statistical law. This later kind of law is based on the average behaviour of atom, and such a behaviour does not follow a strict causal law. Hence, we cannot predict any strict causal law on its basis, and, therefore, there is indeterminancy in the causal relation. The recent developments of quantum physics do not postulate strict law of causality that has been supposed by the so called physical science to happen in the behaviour of Nature. The traditional physical science has been characterised by a firm conviction

in the determinate behaviour of physical objects, that is, it has the belief that the physical objects behave according to the strict law of causality.. Consequently, it has presented Nature as a completely causally determined system. The cardinal assumption of this science is that a given state of affairs does uniquely determine the next state of affairs. On this view, it is admitted that we are given all the relevant data about the present state of the solar system, for example, we can predict any future state of that system. If we cannot do so, it is merely because our data are not sufficient. This standpoint essentially leads to the principle of determinism which has been carried on by scientist like Planck and others. According to them, this sort determinism is verifiable in all the phenomena with which science is concerned; we have the power to predict, and it is to be regarded as the test of the correctness of the hypothesis. This deterministic standpoint holds that the phenomena of life and mind are equally tied by the strict causality, and hence, the question of the freedom of the will does not arise at all. These supporters, then, believe that the strict causal relation holds good not only for the man-sized world but also for the world of atomic process. Thus the concept of causality has been a point of controversial issue not only among the philosophers but also among the scientists, and consequently the category of causality has been dealt with by the scientists as well.

This concept of causal relation in the deterministic sense has suffered a rude shock by some scientists like Jeans, Heisenberg, Eddington and others. These scientists are in favour of the causal indeterminism in the field of modern physics. They have tended to hold such an attitude because the latest trend of science in its search for the ultimate "stuff" and the fundamental causal principles operating there are not so much promising. The notion of the atom as constituting the ultimate stuff together with their laws are continuously receiving different shapes due to the brilliant contributions of the scientists like Dalton, Bhor, Newton, Einstein and so on. The result we have got so far is that the ultimate stuff of the physical world is composed of "electricity" which the scientists call "energy". But the study in this field of microphysics shows that the scientists can not know what this energy is; they know only what mathematical ratios prevail in their various

manifestations and nothing else. Previous to the nineteenth century, it is stated that light has only wave property but quantum theory holds that it has both wave property and particle property. And this is certainly one of the most amazing situations ever encountered by any science. Again, there are troubles regarding all the fundamental principles, e.g., the nature is uniform, the law of cause and effect has universal validity, the present is determined by the past and the future will be determined by the present. In the world of microphysics the physicist is not quite at home in the study of the inner mechanism of the atom. He finds, after repeated experiments, that the position of the particle cannot be determined in advance, i.e., the position and velocity of the electron can not be measured simultaneously and the particle within the atom does not move in perfect obedience to the law of causality. All these considerations have forced some scientists to conclude that the universality of the law of causality is violated in the sphere of the infinitesimal size of the atom. Hence, they are definitely of opinion that the law causality has already been abandoned in physics and has no chance of its future reinstatement. For strict determinism cannot be traced in the behaviour of the ultimate elements of the physical world. Such elements include the electrons as well as the quanta or atoms of energy. A quantum of light may take either of the two paths and its movement in either direction is a matter of probabilities. In one experiment the quantum will take one path, but when the experiment is repeated under the same conditions it will follow the other path. According to the supporters of this view, a statistical law of probability can be enunciated from the repetition of experiments, but such a law is not causal in the usual sense of the term. Again we also find the same fate in the case of the movements of the electrons; the chances that an electron will reach a position B from a position A can be given but its future movement is not uniquely determined by its present state. When a sufficiently large number of electrons are taken (in a piece of matter), the behaviour of the assemblage is, however, determinate and thus it seems to be causally determined. But when they are in isolated position, these positions are not causally determined. It may be thought that a closer observation of the electron would ascertain the conditions that cause it to jump one way rather than another. But in order to do this, we have to depend on inference because of the fact that we cannot observe

an electron here. When an electron is involved in interacting with the rest of the universe, only then it can be observed. The electron standing in solitary singleness is like a Lucretian atom; it is, then, unobservable in principle and as good as non-existent. It can be detected only by a process involving atleast one quantum of energy; and this one quantum is sufficient to disturb the motion of the electron in an unpredictable way, Heisenberg propounds the theory of indeterminancy which is called the Principle of Uncertainty; it is also called the Heisenberg Principle of Indeterminancy. It is a new and very interesting principle which he has constructed in connection with the experiments on the behaviour of electrons as waves and as particles. Not only this theory propounds uncertainty in the field of atomic physics but also it has striking repercussions in the field of ethics particularly in the case of the freedom of the will. The strange character of this new principle is shown by the fact that it has been held to destroy definitely the universal validity of the determinism in nature upon which science itself is supposed to depend. Here it seems to contradict the law of causality according to which every event in nature is fully determined by preceding events, the present being strictly the product of the past. The Principle of Uncertainty states that the causality in this strict sense of determinism does not hold good in the field of atom . It is hold that the physicists have means of measuring the velocity and position of an electron as it moves in one of its orbits within the atom. If the laws of mechanics upon which during the centuries science has been able to rely absolutely, hold good in the microphysical world, the experimenter should be able to determine where the electron will be at any given instant. But to their astonishment, the electron is not there but is found to jump about in an erratic, and bewildering manner. It seems indeed to jump from one orbit to another without traversing the intermediate space. What he holds is that an electron may have position or it may have velocity, but it can not in any exact sense have both. In other words, the more exact the determination of the position of an electron, the vaguer becomes its velocity and the more exact the velocity the vaguer the position. But unless both the position and the velocity of an electron are equally well determined, how can we predict its behaviour, the electron being essentially the moving particle, or rather, a "wavicle"? Bohr's early picture of the atom has contained an unobservable element. For we were asked

here to imagine electrons revolving round a central nucleus and occasionally jumping from one orbit to another; but they could be detected only when they were executing those jumps and not while steadily revolving ontheir orbits. But modern science is chary of all unobservable elements as shown in Einstein's rejection of absolute space. "Heisenberg replaced Bohr's scheme by one that involves only observable factors. This is why the electron is regarded as undetermined in its movements which are jumps we can alone observe."[1] Thus the fundamental difficulty of determining, i.e., ascertaining the place of an electron moving at a certain velocity is expressed in a general way by the uncertainty relation originally formulated by Heisenberg. His theory of indeterminism as already shown above states that the measurement of an electron's velocity is inaccurate in proportion as the measurement of its position in space is acurate and vice versa. And the reason behind his statement of this sort is not at all difficult to find out. We can ascertain the position of a moving electron only if we can see it and in order to see it we must illumine it, that is, we must allow light to fall on it. Now, the rays falling on it impinge upon the electron and thus alter its velocity in a way which it is impossible to calculate. The more accurately we want to determine the position of the electron, the shorter must be the light waves employed, the stronger will be the impact, and the greater the inaccuracy with which the velocity is determined. The statements like the above, although constantly made in recent years, somewhat overstate the said difficulties. What really happens is this : The conditions of measurement are such that it is impossible to determine at a given time the position and velocity of a particle. The very means which we use to determine the one disturbs the other - the measure of one quantity disturbs the determination of a complementary quantity. There is, therefore, a definite limit to the accuracy with which both the position and velocity can be simultaneously determined.

Now, a remarkable new interest has lately been given to the ancient problem of the freedom of the will by the discovery of the Principle of Uncertainty or the Heisenberg Principle of Indeterminancy in the science and physics. As interpreted by some of the scientists, this theory seems to hold that science itself, whose

---

1. Bhattacharya : *Causality in Science and Philosophy*, p.175.

deterministic theories of nature have always presented difficulty in accepting the freedom of the will, has come to akcnowledge a certain freedom in the realm of natural phenomena. Since from the beginning of scientific study of natural process it has been argued that nature is uniform, that the law of causality is of universal validity, that the present is determined by the past and that the future will be determined by the present, natural laws rule always and everywhere throughout the universe so that predictability is always possible and reliable. It is on this view that if we know the position of heavenly body and its velocity, we can predict just where it will be at any time in the future. Consequently, the human will as a part of natural phenomena is thus causally determined and has no freedom. But the Heisenberg Principle of Indeterminancy have raised, as we saw before, the question regarding the universal validity of the strict law of causality. Even after a repeated experiment we can not detect such causal determinism in so far as the position of the particle can not be determined in advance by any measurement because they do not follow any strict causal law. The scientists like Heisenberg hold the positivistic attitude that the world of our perceptions is the only world, and our human measurements are the final data for our knowledge of the external world. The unobserved electron does not exist for us and it does not exist in any intelligible sense. If so, it appears that in the world of atom as it is known to us indeterminism exists. We do not know beyond this world of our perceptions that indeterminism does not exist. Now if we believe in the noumenal world in the Kantian sense and also believe that the human will is a part of this noumenal world, then we cannot say that the human will is not determined. Since it is obvious that we, the human beings, are parts of phenomenal world, some sort of indeterminism exists in the case of the human will, and, hence, the argument against the freedom of the will would seem to have lost its force. Though many of us cannot accept indeterminism in the sphere of physical world, yet we should say that no description of these forces in the usual terminology of scientific determinism would be adequate to explain the free activity of our will. Jeans also is an upholder of the theory of indeterminism and says, " In more general terms, we may say that the law of causality acquires a meaning for us only if we have infinitesimals at our disposal with which to observe the system without disturbing it. When the smallest

instruments at our disposal are photons and electrons, the law of causality becomes meaningless for us, except with reference to systems containing immense number of photons and electrons. For such systems the classical mechanics has already told us that causality prevails; for other systems causality becomes meaningless so far as our knowledge of the system is concerned; if it controls the pattern of events, we can never know it."[2] What these statements evidently show is that it is futile to discuss whether the motion of an electron conforms to a causal law or not. When a physicist tries to follow the motion of an electron inside an atom, he can do it only by making it discharge a full quantum of radiation. Now, the emission of a quantum of radiation is so atom shaking an event that the whole motion of the atom is changed, and the result is practically a new atom. A succession of quanta may give us scraps of information about various stages of the atom but no record of continuous change. In fact, there is no such continuous change to record, since every departure of a quantum breaks the continuity. Hence, it is meaningless to speak of the causal determination of an electron inside an atom when it is put under observation and we can not, therefore, argue that the electron is causally determined. Jeans admits that he has not yet been able to demolish the physical determinism as advocated by Planck and Einstein. In fact, he comes in the end to realise that the entire science would be left hanging in the air if the assumption of the uniformity of nature - "like causes produce like effects" - were not justified and explained. The explanation, he says, is of two kinds. In the first place, the sort of indeterminism implied by the quantum theory is confined to the limited process of nature. In the second place, he realizes that even these events which have been called only indeterminate are governed by the statistical laws. Billions of electrons and atoms are also there in all man-sized phenomena, and for the discussion of such phenomena as are perceptible to us, these may be treated statistically as a crowd. But these crowds obey statistical laws which now take control of the situation, with the result that the phenomena can be predicted with almost the same precision as though the future motion of each particle were known. Stebbing says, "In such a case, statistical laws will be the *basis* from which the

---

2. Jeans : *Physics and Philosophy*, p. 144.

predictions proceed, but the predictions will be made in accordance with a deterministic procedure."[3] Jeans says that on the man-sized scale and indeed far below down to pieces of matter far too small to be seen in any microscope - nature is, to all appearances, strictly deterministic; like causes produce like effects. Thus, the uniformity of nature is re-established except in the realm of the infinitesimal, and science can justify the assumption on which her existence rests. But Jeans is not clear about the nature of the causal relation, and he questions the uniformity of nature in the sub-atomic sphere. If, however, it is meaningless to speak of determination where we can not ascertain the causal relation without disturbing it, surely our only conclusion should be that there are no facts against the uniformity of nature. What is, then, obvious here is that Jeans does not support the law of causality or the uniformity of nature but accepts the middle position between the Humean and the Kantian. Consequently, we are led to think that we see cause and effect running through everything, because the phenomena of the man-sized world seem to conform to the law of causality. The reason is not that they obey statistical laws which produce an impression of causality on our organs of perception. Jeans says, "Our experiences of our man-sized world create in our minds habits of thought which take causality and space-time representation for granted. We can not imagine anything else because we have never experienced anything else."[4]

Eddington, however, does not believe in the principle of causal determinism and argues that determinism has lost its root and that it is useless to search for the strict causal law in the domain of modern physics (theoretical). He says, "It is a consequence of the advent of the quantum theory that *physics is no longer pledged to a scheme of deterministic law.* Determinism has dropped out altogether in the latest formulations of theoretical physics and it is at least open to doubt whether it will ever be brought back."[5] Eddington has been influenced by the development of modern quantum physics which, he says, does not hold any strict causal relation in the atomic world. The orbital rotation of the infra particles

3. Stebbing : *Philosophy and the Physicists*, p.204.
4. Jeans : *Physics and Philosophy*, pp. 282-83.
5. Eddington : *The Nature of the Physical World*, p.294.

of an atom does not obey any strict causal law, and hence, the relation is quite uncertain. In the year 1935, Eddington says "Ten years ago practically every physicist of repute was, or believed himself to be, a determinist. He believed he had come across a scheme of strict causality regulating the sequence of phenomena."[6] Then the so-called primary sciences had the aim to explain and fit as much of the universe as possible into such a scheme of completely deterministic law. But the question is : what is the ground of so much ardent faith in the orthodox hypothesis that physical phenomena rest ultimately on a scheme of deterministic law ? In this connection Eddington's answer is that there are two reasons on which this conviction was based. In the first place, the principal laws of nature which have been discovered are apparently of this deterministic type, and these have shown the triumphs of prediction in physics. In the second place, the current epistemology of science presupposes the deterministic scheme of this type, "... knowledge of the physical world has to be inferred from the nerve-messages which reach our brains, and the current epistemology assumes that there exists a determinate scheme of inference (lying before us as an ideal and gradually being unravelled)."[7] The so-called physical sciences have been controlled by these and other reasons. The methods, definitions and conceptions of these sciences are so bound up with this deterministic hypothesis that the limits of causal determination were then looked upon as the ultimate limits of physics. The scientists inspired by this idea used to apply this sort of scientific method and thus the causal explanation to all phenomena including both vital and mental, and they did it in the hope of making biology and psychology in a true sense scientific. Thus, what is called scientific explanation is nothing but another name for the causal explanation or causal determinism.

However, Eddington has tried to assert that the causal determinism is to be thoroughly discarded from the domain of modern physics. In so far as we are concerned with the relation in causality, we have seen in our foregoing discussions that sometimes it has been interpreted as irreversible one and it runs one way.

---

6. Eddington : *New Pathways in Science*, p.72.

7. Eddington : *The Nature of the Physical World*, pp. 286-87.

This one way causal relation is called asymmetrical which defines the strict causal law from cause to its effect. Further, there are philosophers who do not allow any sort of irreversibility in the causal relation. They have regarded the causal relation as wholly symmetrical one where it does not run only from cause to effect, i.e., not one way; the relation may come from the other side also. Now, if physical science is classified into primary physics and secondary physics, then we see that primary physics accepts the view that the causal relation directs from cause to effect but this relation is symmetrical. While the secondary physics speaks of causality but does not favour the strict causal law. This position, therefore, really involves the uncertainty principle in the concept of causality. The modern atomic physics is not interested in the strict causal relation, and it believes that A and B happen together. Now this sort of causal relation is based ultimately on the statistical laws, and the latter is again based on the average behaviour of atoms. In the atomic physics the scientists have arrived so far that the quantum jump of an atom is quite uncertain. So, if we want to make prediction about the future, we have to depend on the average behaviour of the atom. Here we say and also hope that the law which remains undiscovered will be as like as the law discovered at present. Eddington says, "Hitherto whenever we have thought we have detected causal marks in natural phenomena they have always proved spurious, the apparent determinism having come out in another way. Therefore we are inclined to regard favourably the possibility that there may be no causal marks anywhere."[8] However, the concepts of causality and generalization are very important notions in his treatment of causation. This is because he has defined the concept of causation in terms of the generalisation. He says in his '*New Pathways in Science*' that causality can be explained as the generalisation from the particular experienced fact. We do experience facts or events, and there we observe the common regular association of two states called cause and effect. On the basis of these observations of two events happening together, we generalise the causal law. Now what is said here is that this is an extreme generalisation from experience. But such a generalisation is not always trustworthy, and, consequently, we cannot be certain about its future

---

8. Eddington : The Nature of the Physical World, p. 290.

application and prediction. Thus, statistical laws are really indifferent to the principle of causation. If such is the status of the statistical laws and if causality is explainable ultimately in terms of the statistical laws, or the former is reducible to the latter, then modern physics, according to Eddington, is not at all interested in maintaining the strict causal relatiion.

It is Eddington's view that modern scientific researches have proved this sort of indeterminism in the atomic physics. Besides, he does not accept the so-called notion of cause as an intrinsic power to produce an effect always. This is because we cannot say before hand by observing the thing when it is placed before us that such and such effect will be produced from it. We cannot say before hand what the exact reading of weighing machine will be when a body is placed on it. This shows that a body has no such intrinsic nature as mass, velocity, etc which will produce an effect necessarily according to its nature. The cause has no intrinsic power to generate an effect laways and, therefore, there is,no strict causal relation between cause and effect. Like other philosophers of this tradition Eddington also holds that causality is a succession of events in time, and hence, this time factor is also included in the concept of causation. Thus he thinks that a cause is one which preceds the effect and the effect is naturally the succeeding state of the cause, implying no relation of necessity. According to him, whether or not there is a causal scheme at the base of atomic phenomena, modern atomic theory is not now attempting to find it out, and it is making a rapid progress because it no longer sets this up as a practical aim. Both the quantum physics and the physical world may be regarded as thus indifferent to the view that there is any strict relation between cause and effect. If there is no absurdity in thinking of causal indeterminism in the sub atomic process, then there should be no difficulty in thinking of the physical world as wholly made up of the "whimsical" elements, and hence that the physical world, too, is causally undetermined in its happenings. Here we should not go on arguing that causal determinism has been disproved but we should rather say that such a determinism has to be proved itself yet. Science has not been able to produce enough evidence in favour of determinism. In so far as the causal determinism is based on the statistical law which is itself further

based on ordinary experience, we have to consider this determinism as wholly an 'unsupported hypothesis'. So, Eddington remarks , "It is impossible to trap modern physics into predicting anything with perfect determinism because it deals with probabilities from the outset."[9] Herbert Dingle has, however, supported Eddington's view that the law of causality is statistical law which is undetermined. He observes that Eddington has been able to overcome the dogmatism which really shrouded the concept of determinism which was held by the earlier scientists. He says, "I think Eddington is right in his contention that those who claim causality and even determinism - as a necessity of thought are more dogmatic than those who take the contrary view. My reasons, however, are totally different from his. To me he seems to remove the dogma of causality and substitute that of statistics."[10] What he wants to indicate here is that the contention to establish determinism seems to be paradoxical from the standpoint of our consciousness which is the epistemological subject here. It is an undeniable fact that our consciousness or mind in its knowing activity establishes the relation among experiences. Hence, it implies that outside our consciousness we cannot possibly know anything, for in that case it would be a contradiction in term. Then our knowledge of electrons, light, etc., shows that they are no more external objects which lie outside our consciousness but which my mind has actually created and established the relation among my experiences. This sort of epistemological standpoint seems to imply no inherent necessity or causal determinism among the phenomena that we experience. Consequently, the concept of causality is only a regular sequence of events where we say that a cause is always associated with its effect, and that we assert only on the basis of our past experience. In no case, the concept of cause compels us of inherent necessity to predict the effect; the same cause will produce the same effect is only a matter of our belief. If so, then causality in modern science is only a probability, no better than a statistical law. Many scientists have now a tendency to favour the view that causal laws are approximately valid, and do not support the view that the sequences of events involve any necessary relation. So we can arrive at the conclusion that even modern science cannot but accept

9. Eddington : *New pathways in Science,* p. 105.
10. Dingle : *Through Science to Philosophy*, p. 309.

the Humean concept of causality and nothing else.

5.2 Modern Science and Determinism :

We have noticed in our previous discussion that the principle of indeterminism has ultimately led itself to favour the Humean concept of causality. We have seen Eddington saying that determinism in the traditional sense faded out of theoretical physics. The most significant question here is whether the law of causality obtains in the happenings of nature as we know them. The inevitable answer seems to be that causation in the sense of producing its effect always or necessarily does not belong to the physical world and the realm of the subatomic processes. Consequently, if we mean by the concept of causality the necessary relation between cause and effect, then we must conclude here that the subatomic world does not display any such causality among its elements. This conclusion is due to the fact that electrons which are among the ultimate constituents of the physical world seem "whimsical" and unpredictable in their movements. In this connection, we have seen that Heisenberg's principle of indeterminancy expresses the fact by saying that we can not determine with equal accuracy both the position and the velocity of an electron at any moment. The development of relativity theory (Quantum theory) is also a challenge to the physical causality or determinism. It is the claim of the relativists that the dictum 'every event has a cause' is broken down. Pap says, "... such events as individual electron jumps from one atomic orbit to another, or impacts of individual electrons at particular positions on a screen or disintegrations of individual radioactive atoms, are not predictable. And such prediction is alleged to be not only practically but even theoretically impossible."[1] Now, against this sort of indeterminism of modern physics there are some scientists who argue that indeterminancy is not proved by experiment, and hence, the indeterminancy of subatomic processes is only theoretical. Their contention is that this indeterminancy is a subjective indeterminancy or uncertainty not justifying a conclusion as to objective facts. Planck, Einstein are chiefly the faithful advocates of the principle of determinism. But Planck's view is of special

1. Pap : *An Introduction to the Philosophy of Science*, p. 307.

importance because he is the father of the quantum physics that has undermined the empirical support for the doctrine. According to him, it is not the principle of causality itself which has broken down in modern physics, but rather the traditional formulation of this principle. Since the empirical observation does not help us to follow the movement of each individual molecule in its very intricate labyrinth of processes, it need not be supposed thereby to imply that there is no strict law of causality operating in the subatomic stage. So Planck says, "And the non-fulfillment of the statistical rule in particular cases is not therefore due to the fact that the law of causality is not fulfilled, but rather to the effect that our observation is not sufficiently delicate and accurate to put the law of causality to a direct test in each case. If it were possible for us to follow the movement of each individual molecule in this very intricate labyrinth of processes, then we should find in each case an exact fulfillment of dynamical laws".[2] Thus the validity of the law of causation for the world of reality is a question that cannot be settled down only on grounds of mere empirical abstraction which we did find in the attempts of the scientists like Eddington and others. Our observation must be made sufficiently delicate and accurate in order to find out the rigid determinism , and if it would be possible for us, then we could see that the movement of each molecule must follow the strict causal law. Planck in his book *Where Is Science Going ?* has introduced a scientific method which is a valuable contributioin in Science. It is interesting to know what method is pursued by this distinguished founder of the new quantum physics, which has done so much to revolutionize physical science. In the first place, Planck flatly rejects the theory of the Positivists that we know nothing of the world beyond our own immediate sensory experience, and that we have no concern with any such world. To the positivist any object, such as a house or tree, is just a complex of our immediate sensory perceptions. According to them, it is meaningless to say that at the back of the sensory experience there is a real object. Planck rejects this positivistic theory and believes that science today rests on a broader and more stable foundation. It makes the postulate that there is a real external world existing independently of our knowing processes, although

---

2. Planck : *Where is Science Going ?* p.145.

this world is not directly knowable. This world is indirectly knowable and the complete knowledge of it is a goal ever to be approached but never to be fully attained. According to him, the means through which the scientist comes to know the nature of the physical world around us are *measurements.* In making these measurements and in all our observatioins and experiments we must use every effort to eliminate all sources of error arousing either from our instruments of research or from subjective tendencies of our sensory organs. These measurements and observations constitute the raw material which the scientist uses in constructing the picture of the external world. So, to the question 'how is this picture gained?", the answer is that the all-important thing is the constructive work of the scientist himself, he must make us some 'hypothesis'. He may give rein to his own spirit of initiative and allow the constructive powers of the imagination to come into full play. He must try to organise into one law the results of his experiments and experiences. The hypothesis must be free from inner logical incoherence, and the deductions from it must agree with the research measurements and experiments. And consequently, Planck's description of scientific method shows how largely science springs from the mind of the scientist. Planck asserts that the strict causal law is to be found in all the branches of knowledge like physics, biology, psychology, and so on. Consequently, these areas cannot avoid causal determinism in any way. In classical dynamics, mechanics in the law of gravitation and electrodynamics, the law of causality has been formulated for exactness and strictness. If the spatio-temporal conditions are known, we can predict all happenings in any given physical picture, and it may be expressed by a system of mathematical equations. Planck says, "According to the law of causation as expressed in the equations of classical dynamics, we can tell where a moving particle or system of particles may be located at any given future moment if we know their location and velocity now and the conditions under which the motion takes place. In this way, it was made possible for classical dynamics to reckon before hand all natural processes in their individual behaviour and thus to predict the effect from the cause."[3] In this connection, it should be

---

3. Planck: *Where is Science Going?* p. 142.

noted here that the quantum hypothesis has been responsible for the disputes into the system of classical relativist physics. Because of this quarrell, some scientists tend to hold that we can not say anything about the influence by which the fundamental physical law can be formulated. But Planck firmly believes and says, "... the quantum hypothesis will evantually find its exact expression in certain equation which will be a more exact formulation of the law of causality."[4] Besides this law of causality, physical science accepts statistical laws. But such laws cannot go without the strict law of causality because in each case of statistical law there is an assumption that the strict causal law is working. When we find in a particular case that the statistical rule is failing, it is not due to the fact that the law of causality is not holding good but due to the fact that our observation is not accurate to follow the law of causality in the right direction. If we can follow the movement of each molecule in this very complicated processes, then we should be able to find out the exact fulfilment of the dynamical laws. Physical science is using two different kinds of method for its investigation, viz, macroscopic method and microscopic method. The macroscopic method deals with the object of investigation in a broadway or in a symmary manner. Here the observers deal with big quantities in wholescale manner and hence, chance and probability exist only to these macroscopic observers. These observers remain content with the mass value and know only the statistical laws. On the other hand, the microscopic method is more complicated; it tries to know all the details in its procedure. These investigators try to know the individual values and apply them to the dynamical law. This method is used to the search of molecules and atoms, and seeks to correct its treatment towards the microscopic degree. Here this microscopic method tries to change statistical law into a dynamic and strict causal process. Consequently, precision and strict causality exist in the microscopic method. Planck here seems to lay an emphasis positively on using the microscopic method for the search of the causality in the subatomic level.

Planck certainly believes in determinism in biological science also. But what

---

4. Planck: *Where is Science Going?* p.143.

is obvious is that the data in such a science are more intricate, and hence, it is very difficult to use and apply the microscopic method in this field of science. Yet the physiologists have been trying to solve the biological problems and arriving at the laws regarding the matter in question. But most of these laws are statistical laws and, therefore, subject to exceptions. When an exception occurs, we cannot blame causal law; it is not due to the failure of any causal law but due to our inability in carrying on the suitable observation and experiment. Planck is here very much confident that biology is now gradually approaching to the explicit assumption of the universal causal relation. He says, "Yet I have no hesitation in saying that even in the most obscure problems, such as the problem of heredity, biology is approaching more and more to the explicit assumption of the universal validity of causal relations. Just as no physicist will in the last resort acknowledge the play of chance in inanimate nature, so no physiologist will admit the play of chance in the absolute sense."[5] It is equally his contention that psychology cannot avoid the the assumption of strict causal laws in its field. The human 'will' is certainly a controversial issue in this connection. There are many thinkers who are of the opinion that the human 'will' is absolutely free. Therefore, an important question arises here : Is determinism applicable to human affairs such as human behaviour or free will? This question can also be put forward in otherwise thus : Are individual human actions governed by any deterministic law like the motion of planets or do these behave like the electrons or photons in being statistically lawful? To clarify this position we may refer to Pap's reply according to which human behaviour is also determined. "Whenever a human with (acquired or inherited) disposition D_1, D_2... is exposed to an environment of kind E, then he reacts by doing A".[6] So the human behaviour is guided by the principle of causality. He argues that there is no incompatibility between 'free will' and 'determinism'. The alleged incompatibility arises from the superficial sense of 'free action'. A force action is that action which is desired and preferred by the agent. Here Pap wants to say that one must distinguish desiring from deciding. Deciding is not just the desire to perform, for

---

5. Planck : *Where is Science Going ?* p. 147.
6. Pap : *An Introduction to the Philosophy of Science,* p.333.

looking to the consequences of a desire we often decide not to act according to the desire. A free action may be defined as that action which is decided by the agent. So 'determinism' and 'free will' are within the same boundary line. If all the physical forces determining a particle's motion and the particle's initial state are given, then no physicist would allow that it could have moved differently from the way it moved. Similarly determinism entails that given all the causal antecedents, nobody could have desired or decided differently. Planck also is of the opinion that the view of absolute freedom of the human will is not correct. He holds that there is a strict causal behaviour and will is determined. But to infer validly the behaviour of an individual is to depend on our knowledge of his background such as climate, education, environment etc. If it is possible to collect all these data, then it is not impossible to find out the causal determinism even in the case of human conduct and will. Planck says, "Just as at each and every moment the motion of a material body results necessarily from the combined action of many forces, so human conduct results with the same necessity from the interplay of mutually reinforced or contradicting motives, which partly in the conscious and partially also in the unconscious sphere work their way forward towards the result."[7] We must admit here that sometimes we face the problem of explaining human action because of its complexities. But this sort of inexplicability occurs in the case of ordinary people. While the psychologists do not have such problems; they know the reason or cause of human behaviour and will.

Therefore, It is no doubt that Planck is firmly convinced of the view that quantum physics, biology and psychology are to be regarded as strictly deterministic. Though the controversy between determinism and indeterminism in modern science is not an easy issue which can be settled down logically, yet we can not but admit that in physics it is not possible to search for anything new without the presupposition of the principle of determinancy. This is the reason why we have not yet been able to get rid of determinism from the domain of science. Planck has already admitted that we could be able to see the causal

---

7. Planck : *Where is Science Going* ? p.153.

determinism in the subatomic processes if our observation were accurate enough to exhibit all the relevant spatio-temporal conditions. He admits that sometimes we may face the imposibility of applying the causal principle to the inner processes of the atomic physics in the present state of affairs. But he set himself definitely against the view that from this inapplicability we are to conclude that the process of causation does not exist in the external world. To overcome this complexity, he has urged that we must recognise the change of meaning in the term 'event', and has already introduced this meaning when he speaks of the system of mathematical equations with reference to the causal determinism. According to him, theoretical physics does not consider an individual measurement as an event, because such a measurement always contains accidental and inessential elements. He says that in physics we mean by an event a certain merely an intellectual process. It substitutes a new world in place of that given to us by the senses or by the measuring instruments which are used in order to aid the senses. This other world is an intellectual structure and to a certain extent arbitrary. It is a kind of model or idealisation created in order to avoid the inaccuracy inherent in every measurement and to facilitate the exact definition. Such a model does not and need not contain only observable magnitudes at all but only symbols. The adoption of symbols brings one decisive advantage which does permit a strict determinism to be carried through. Now, the laws of the "world image" are all deterministic but the forecast of any event in the sense- world is always subject to a certain inaccuracy inherent in such translation. Planck argues that to conclude that the law of causality as applied to physics has been definitely refuted is to confuse between the world of symbols and the world of sense, and jump to a conclusion without sufficient justification. So it is far more natural to avoid the difficulty by another method, a method which has often rendered good services in similar cases and which consists in assuming that it is meaningless, with respect to physics, to ask for the simultaneous values of co-ordinates and of the velocities of a material point or for the path of a photon of a given colour. Then Planck boldly declares that the law of causality cannot be blamed because it is impossible to answer a meaningless question; the blame rests with the classical picture of the world image. Thus, the classical world image has failed and something else must be put in its place. Planck has the conviction

that quantum physics has done this ; the new world-image of quantum physics is due to the desire to carry through a rigid determinism. The material point which had hitherto been for this purpose a basal part of the world picture has lost its supremacy. It has been resolved into a system of material waves which are the elements of the new image. For determining the conduct of an electron when it impinges on a crystal, it is now possible to apply definite rules of calculation. Hence Planck comes to the conclusion that there is fully as rigid a determinism in the world image of quantum physics as in that of classical physics. The only difference lies in the symbols used and rules of operation employed. The uncertainty in forecasting events in the world of the senses disappears and in its place we have an uncertainty with regard to the connection between the world-image and the world of the senses. In other words, all inaccuracies in the matter are due solely to the transference of the conceptual symbols to the sensory world and vice versa. Planck says that physicists are ready to put up with this double inaccuracy and regards it as an impressive proof of the importance of determinism in the conceptual system. So causality is only conceivable as a form of the theoretical system and is incapable of experimental verification. The statistical laws in Planck's view are dependent on the assumption of the strict law of causality functioning in each particular case. Hence he has said that the non-fulfillment of the statistical rule in a particular case is due, not to the fact that the law of causality does not function , but to the fact that our observations are not sufficiently delicate and accurate to put the law of causality to a direct test in each case. If it were so, then we could be able to see that the strict causality is equally operating there.

Besides Planck, Einstein is also a staunch supporter of the principle of determinism. We cannot but admit a great weight when Einstein asserts that he is entirely in agreement with his friend Planck in regard to the stand which he has taken on the principle. His hope is that determinism is bound to return to the scientific explanation of sub-atomic phenomena and, hence, he had an unshaken faith in determinism. According to him, indeterminism is quite an illogical concept; even the facts can not give us any warrnty of our belief in this principle. If we say that the average life span of an atom is undetermined in the sense that it is not

caused, then we are talking nonsense. This is because to say that something is indetermined is to relate it to something else, otherwise this sort of indeterminism will have no meaning. It is only on the basis of the relationship to something else that we can be able to follow the activities of something. Thus, to say that the arrival of a train in Berlin is undetermined is to talk nonsense unless we say in regard to what it is undetermined. If it arrives at all it is determined by something. And the same is true of the course of atoms. This type of determinism does not mean that something must be causally determined in the sense that every event proceeds necessarily from another event which we call the cause. On the contrary, it is to be understood in the sense that it must be related to some other things. So this sort of determinism is subjective and relative. Thus Einstein thinks that the principle of causality has received so far a crude formulation in the hands of the previous thinkers, and much of the misunderstanding is due to this causal interpretation. When Aristotle and the scholastics have explained what they meant by a cause, the idea of scientific expreiment has not properly been grasped. They are found to be concerned exclusively with the definition of cause in the metaphysical sense. In this sense every effect is connected to its *Causa Sui* or First Cause with the absolute or metaphysical necessity; here nothing is contingent in so far as the causal relatioin is concerned. But Einstein does not ascribe the determinism to nature in this sense that every event is produced necessarily from another event called cause. Newton is also dissatisfied with this Aristotelian metaphysical conception of cause; he has described the regular order in which events happen in nature and constructed his system on the basis of mathematical laws. He believes that when we speak of one event being the cause of another, events in nature are controlled by a much stricter and more closely binding law than we suspect today, . But Einstein thinks that such a conception is confined to one happening within one time section which is dissociated from the whole process, this rough way of applying the causal principle is quite superficial. He says that we are like a child who judges a poem by the rhyme and knows nothing of the rhythmic pattern, or we are like a juvenile learner at the piano, just relating one note to that which immediately preceds or follows. According

to him, quantum physics has presented us with very complex process and we must further enlarge and refine our concept of causality to meet them. This shows that Einstein is entirely in agreement with Planck. We have seen that Planck believes that science is a conceptual picture of an independent world which it tries to represent. Here the view of atom is a mere mathematical device, justified by its calculated results which are confirmed by experiment. This mathematical analysis must conform to certain essential features of the electron but this knowledge which is so confined to mathematical specification has not yet been able to lead us to be in a position to infer the nature of the physical reality that is supposed to obey this specification. This position too is a consequence of the view which has set up a distinction as well as a barrier between knowledge and reality which is supposed to have an independent existence of its own. This amounts to the acceptance of the representative theory of knowledge which has its own difficulties and which has been confronted by Einstein's theory of Relativity in its metaphysical setting. According to this theory, we cannot get hold of the absolute reality which lies independently of our knowledge. If ultimate reality is thus independent of us, we cannot suppose that our categories and concepts ever represent it adequately, however hard we may try to refine and enlarge them. Indeed all our ideas are only human ways of apprehending reality and it is questionable whether any knowledge of the independent reality is available in the sense of being an accurate picture of it. In this case one may regard that the physical world is causally determined but the laws which we ourselves discover are only approximate generalisations not based on any causal determinations. Therefore, Einstein seems to hold here that this current quantum physics is not based on the principle of causal determinism, although it regards the physical world as causally determined through and through. But he recognises no barrier between knowledge and reality and as such makes science to be concerned directly with the physical world. That is why, he is all out for making science thoroughly consistent with the law of causality and holds that the validity of scientific laws rests finally on the law of causality. But it may, however, be asked whether

this realistic outlook of Einstein may be justified by his own Theory of Relativity. We know that the realistic outlook is bound up with the assumption of the bifurcation of nature into the knowing subject and the object known, and it is this distinction on which the older physics is based. The Theory of relativity (1905) first shows that this can not be entirely so; the picture which each observer makes of the world is in some degree subjective and thus only relative. Even if the different observers all make their pictures at the same instant of time and from the same point of space, these pictures will be different (unless the observers are all moving together at the same speed). If so, no picture of reality drawn by us can be objective in an absolute sense. In this sense, we can never get hold of an absolute; it is meaningless to refer to it at all and regard it as the ultimate real. The world of our experience is a joint product of the subject and the object. It is the only world which is real for us, and the laws discovered by us are true of this world and not of any other. Therefore if the statistical laws do not need any support in the law of causality, such laws do not by themselves lend support to our belief in physical determinism. But no laws discovered by men are final and hence such statistical laws may at some future date turn out to be inadequate or they may perhaps be shown to be consistent with the general law of determinism. At present, however, we would not be justified in concluding from such laws the presence or absence of determinism in the physical world, even though they have been formulated in order to meet the peculiar conduct of electrons. Philipp Frank says, "We know today that with the help of positions and velocities we can not set up any causal laws for single electrons... This does not exclude the possibility, however that we shall perhaps some day find a set of quantities with the help of which it will be possible to describe the behaviour of these particles in greater detail than by means of the wave function, the probabilities."[8]

However, the latest position is that the assumption of the law of determinancy

---

8. Philip : *Modern Science and Its Philosophy*, p.123.

is essential. In physics, it is not possible to search for anything new, without this assumption; it has been accepted as the underlying principle of scientific inquiry . The concept of causality means the necessary connectioin without which the physical system is meaningless. Ewing says , "That there is enough uniformity in nature for science to develop successfully has been shown empirically by the history of science itself, but science could never have been started without presupposing causality."[9] Indeterminism or uncertainty arises because our knowledge about the atomic rotation is inadequate and our microscopic experiments are not accurate and if it is not so, causal determinism is unavoidable. Harris says, "In the course of the process of change, these relations do not change and are, in fact, irreversible, not because the temporal reality is static - quite the reverse, because the metric is a fixed scale, within which the divisions and demarcatioins stand in mutual relations that are of necessity unalterable."[10] Popper also holds that we cannot avoid the idea of causation and its determinancy. He says, "The belief in causality is metaphysical. It is nothing but a typical metaphysical hypostalization of a well-justified methodological rule - the scientist's decision never to abandon his search for laws. The metaphysical belief in causality seems thus more fertile in its various manifestations than any indeterminist metaphysics of the kind advocated by Heisenberg. Indeed we can see that Heisenberg's comments have had a crippling effect on research"[11]. So the principle of indeterminism as upheld by Eddington and others is not, in fact, real. The recent scientists have a tendency to support Planck and Einstein. Stebbing holds that Eddington in fact denies the illusion of the older concept of determinism which was held by the earlier scientists. But the determinism is not at all an illusion as considered by the recent thinkers. Against the principle of indeterminism we may, then, argues that these scientists are basically interested in replacing it by the principle of determinism because it is not possible to search

9. Ewing : *Kant's Treatment of Causality*, p.237.

10.Harris : *The Foundations of Metaphysics in Science*, p. 476.

11.Popper : *Logic of Scientific Discovery*, p. 248.

for any law or anything new without assuming this determinancy. It is for this reason scientific thinking cannot but accept the principle of determinism. We are not yet able to assert empirically that there is no hard and fast rule in nature, and that the fact carries this warranty has already been explained by Einstein in the case of the arrival of a train. His intention here is to point out that when something happens, it happens by being related to something else and determinism can not be avoided in this sense. However, we may interpret this controversy of determinism and indeterminism finally in terms of the philosophical attitude which one holds, and, consequently, it is in some sense a support of a particular philosophy. If we believe that there is a real external world independent of our sense-perceptions and our measurements - a world in which the principle of causality and determinism rein supreme and universal, then we shall see that the principle of Indeterminism arises merely from the limitations of our experiments in the microscopic world of the atom. If, on the other hand, we believe that our perceptions and scientific measurements are the only and the ultimate data for the construction of the order of nature or if we hold with the positivists that science is not concerned with anything beyond our perceptions and our measurements, then we cannot escape the conclusion that there reveals a kind of indeterminism or contingency in the inner world of the atom. Thus, it appears that in the world of atom *as it is known to us*, indeterminism exists. Of the world of reality beyond the sphere of our perceptioins, it is, therefore, said that science knows nothing and makes no claim either of indeterminism or determinism. In our world of perceptions indeterminism exists, while we do not know that it does not exist beyond the world of our perceptions. Though all the persons who are tough-minded realists will insist on the universal reign of determinism and the absolute ability of the law of causality, yet it may be emphasised that from the positivistic standpoint we have no logical ground to assert this strict causality, neither we have the ground to deny it, but what we experience is only the sequence of events in time.

This also shows that the recent findings of science have led the scientists essentially to the hot controversy between two opposite views, viz, Determinism and Indeterminism. We have noticed there that, the turning - point due to the discovery is that the electrons which are among the ultimate constituents of the physical world seem "whimsical" and "unpredictable" in their movements. According to Heisenberg's principle of indeterminancy, the strict law of causality does not work here because we cannot determine with equal accuracy both the position and the velocity of the electron at any moment. Eddington also holds that the 'quantum jump' of an atom is uncertain. Then the question is : what is the status of a causal law ? His answer is that a causal law in modern physics is as good as a statistical law which is based on the average behaviour of atom, and as such it implies the indeterminancey in the concept of causation. On the other hand, some scientists like Planck and Einstein argue that there is certainly the determinism in causality. According to them, there is no doubt that it is difficult to calculate the orbital rotation of atom but it is not due to the fact that there is no causal determinism in the movements of an atom. This alleged failure to detect the strict causality arises because of our experimental difficulties, and hence, the law of causality can not be made equivalent to the statistical laws. Besides, it is not possible to search for any law or anything new without assuming this causal determinism. But it is also equally true that this controversy is not an easy issue which can be solved logically. It may,however, be said that determinsim in causality is a claim which remains unproved and, consequently, it is required to be proved positively. On the other hand, we can say against indeterminism that it is not proved by experiment because this sort of indeterminancy arises out of the experimental difficulties. Thus, it appears very hard to settle the issue. We can say here that this difficulty is the outcome of our dividing nature into knowing mind and the reality that is known by us. The mathematical equations of both the forms of the new quantum theory - the wave mechanics and the matrix mechanics - are completely deterministic in form. So far as these equations go, the future of the

world seems to follow uniquely from the past. But what is obvious is that this unrolling is not, however, of the course of events but of our knowledge of them. If so, then we can not know the ultimate realities, and the world of our experience, as Kant holds, is the joint product of the subject and the object. But Einstein, as we have already seen, holds that since the ultimate realities are unknowable entities, it is meaningless to refer to them; rather he says that the world of experience is the only real world for us and the laws dioscovered by us are, as we have seen, true of this world only and not of any other. Now these laws are mere statistical laws which involve probabilities in future events. If the causal law is thus explained in terms of statistical laws, then causality in science is the expression of the repeated experience which involves probability but no necessity. If so, the concept of causality as adopted by Hume and Mill reappears here. But Whitehead completely disagrees with the Humean concept of causality that we are not directly aware of any necessary relation. According to him, causation is a perceptual fact and we can predict that the future events will be same as the past and the present. Consequently, this standpoint goes equally against the Kantian notion of causality according to which causal relation is not derived from sense-experience but a category of the understanding or the knowing mind. Causality in this sense synthesises the particular facts in terms of cause and effect and provides the universality and necessity to this relation among the events we experience. But causality, according to whitehead, is not a mere repeated experience as the Humean tradition holds but it is positively a perceptible universal relation. Again this universality is not imported by the category of the understanding as Kant argues, but it is objectively there in the perceptual facts.

Whitehead has, constructed his own theory of causality on the basis of his theory of perception (feeling as he termed). The so-called theorists, according to him, have not been able to interprete the nature of perception properly and hence, their views of causality are based on the wrong conception of perception. The

ıotion of perception, if properly analysed, involves two modes, viz, presantational immediacy' and causal efficacy. These are two elements which the exponents of the concept of causality have not been able to distinguish. When we perceive something as in our visual perception, our perception in this sense has a limited capacity. If a grey stone, for example, is the object of our visual perception, then our sight can not go very far; it perceives only the sensum grey in the geometric space. But our consciousness perceives so many things than which is visually perceived about the stone. At the time of visual perception of the stone in question, our consciousness can perceive that this stone has a past history and a future too, or that it has weight and can be used in many ways. Whitehead holds that our visual sensation cannot reach all these things but is confined only to the moment of perception. Then the sensum in terms of its spatial region is that which we ordinarily understand by means of sense-perception or immediate awareness, and this is what Whitehead means by 'presentational immediacy'. He says, "Perception which merely, by means of a sensum, rescues from vagueness a contemporary spatial region, in respect to its spatial shape and its spatial perspective from the percepient, will be called 'perception in the mode of presentational immediacy."[12] Now the presentational immediacy, according to him, only reports the contemporary world with its relationship with the perspective background. The contemporary world does not give us any information of causal relations among the events. The events A and B are said to be contemporary if they are free from any sort of influence on each other. We are here instantly or immediately aware these events i.e., the awareness of the events which is called a cross section of the world. He says, "Presentational immediacy illustrates, by means of sensa, potential subdivision within a cross section of the world."[13]

Besides, the presentational immediacy, there is another mode called 'causal efficacy' which whitehead considers to be the most important aspect of the theory

12. Whitehead : *Process and Reality*, p. 143.
13. Ibid. pp. 145-146.

of perception. It is important for the existence of external world and also for the concept of cause. In order to find out the causal efficacy, we have to search for it in 'the viscera and memory', and it is because of this causal efficacy that the presentational immediacy reports the contemporary world with its relationship with the perspective background, and gets the reference to the past as well as to the future . But this is possible through the 'symbolic reference' which is the interplay or interconnection between the two modes of perception. Whitehead has defined the symbolic reference thus, "The human mind is functioning symbolically when some components of its experience elicit consciousness, beliefs, emotions, and usages respecting other components of its experience. The former set of components is 'symbol' and the latter set constitutes the meaning of the symbols. The organic functioning whereby there is transition from the symbol to the meaning will be called 'symbolic reference."[14] He holds that this symbolic reference is in need of a common ground. The common ground means here that in every case of our presentational immediacy we get some common components in each particular experience and we directly recognise it as identical in each case of our perception. Now our apprehension (consciousness) brings the experience into a unity of feeling. It comes, then, from the subjective form by means of the similarity or identity of relation which we perceive in a thing or event on various occasions. That is, we find some components in common to the similar world of events. It is on this common ground of perceived events that the symbolic reference is based, we perceive this common ground directly in the presentational immediacy and indirectly in the causal efficacy. Now what is given in the presentational immediacy is given as objectified from the settled past. The objectification of actual events (entities) is the act of reason. Our perceptual process not only includes the particular sense like the sensing of colour, etc. but also includes the whole situation with the geometrical relationship of the external world of the settled past and also forms the potential relationship between the contemporary

14. Whitehead : *Symbolism, Its Meaning and Effort*, pp. 7-8.

event and the future one. What whitehead wants to assert here is that from our past experiences of perceptions of events we infer the causal relationship about future events. And our reason establishes the unity between past events and the future ones. In this connection, Whitehead says, "The perceptive mode of presentational immediacy arises in the later, originative, integrative phases of the process of conscience. The perceptive mode of causal efficacy is to be traced to the constitution of the datum by reason of which there is a concrete percepient entity. Thus, we must assign the mode of causal efficacy to the fundamental constitution of an occasion so that in germ this mode belongs even to organisms of the lowest grade; while the mode of presentational immediacy requires the more sophisticated activity of the later stages of the process, so as to belong only to organism of a relatively high grade."[15]

Again, Whitehead's theory of feeling is also a help to understand his treatment of causality. He says that a feeling is our experience of an atomic occasion, and each atomic occasion of our feeling is connected objectively with another. According to Whitehead, our apprehansion (consciousness) provides these objectification to the atomic occasions and also produces the conformity of feelings. Now, the simple physical feeling, according to him, is the act of causation; the initial data which is the actual entity is the 'cause' while the feeling about the data is the 'effect'. He says, "A simple physical feeling is an act of causation. The actual entity which is the initial datum is the cause, the simple physical feeling is the 'effect', and the subject entertaining the simple physical feeling is the actual entity 'condiioned' by the effect. This 'conditoned actual entity will also be called 'effect'. All complex causal action can be reduced to a complex of such primary components. Therefore, simple physical feelings will also be called 'causal' feelings."[16] The simple physical feeling is a most primitive type of perception, it does not involve any act of our consciousness. The first

15. Whitehead : *Process and Reality*, p.200.

16. Ibid., p.276-77.

stage of simple physical feeling is the creativity which transcends the actual entity. The cause is objectively constitutional part of the effect as being the feeler of the feeling reporduced in the effect with the partial equivalence of subjective form. By the mediation of the cause we find that causal feeling has its objective and initial datum. These antecedent data enter into the feeling of effect. The way from cause to effect is the cumulative nature of time. Now, in simple physical feeling there is a 'vector' character which transforms the cause into effect, it represents the reproductive character of nature and the objective vividness of the past. By virtue of the strength of this feeling, time is conformation of the immediate present to the past which is called by Whitehead 'conformal' feelings. He says, "simple physical feelings embody the reproductive character of nature, and also the objective immortality of the past. In virtue of these feelings time is the conformation of the immediate present to the past. Such feelings are 'conformal' feelings."[17] Now, a simple physical feeling has the character of 're-enaction', 'reproduction' and 'conformation' which have more accurate expression in the eternal objects. These characteristics of the feeling about the eternal physical object give the determinant of definiteness of the objective and the subjective aspect of cause, and effect. According to Whitehead, there are eternal objects determinant of the definitenss of the objective datum which is the cause and there are eternal objects determinant of the definiteness of the subjective form belonging to the effect. Thus, when there is re-enaction there is one eternal object with two-way functioning, namely, as partial determinant of the objective datum, and as partial determinant of the subjective form. In this two-way role, the eternal object is functioning relationally between the initial data on the one hand and the concrescent subject on the other. It is playing one self-consistent role in obedience to the category of objective identity. On the other hand, the subjective form of our feeling belong to consciousness. The raw datum for this subjective form is primary feeling or propositional feeling. These data get a distinct form in the consciousness by

17. Whitehead : *Process and Reality*, p.278.

means of alliances. In consciousness the past history of the individual event is collected from the faint recesses of the unconscious. An object takes a definite shape in the consciousness by the act of affirmation, negation and contrast. Emmet has explained this causal theory thus, "So "causation" becomes the reproduction in one actual occasion of the feelings of another, or, more precisely, the conformity of the feelings of the present occasion to the feelings of others. This is particularly important in the *case of* those routes of successive occasions we call an enduring object for instance, an animal body over a certain interval of time. In this case, we have not simply a bare succession of atomic occasions but a peculiarly full objectification of each successive occasion into the next, so that there is a continual reproduction and conformity of feelings."[18] Thus, it is clear that whitehead's theory of causation is in support of the view that the relation between cause and effect is always universal; it is applicable to the past, present and future in so far as nature is interrelated and dynamic in character. We can perceive this universal causal relation when we perceive two events in succession, and perceive it easily by the reason of our consciousness. At the time of perception, our consciousness plays an active role; it finds the common ground by observing the similarity of relation on various occasions. It is because of this fact that we can establish the causal relation about future events too by our act of reason, and this process is completely based on facts. Here it is obvious that causation, according to Whitehead, is neither merely a matter of habitual expectation nor a category of the understanding (or thought).

Whitehead , therefore, concludes that the problem which we often find in the theories of causation is due to the wrong conception of perception. Accordingly, he is radically different from both Hume and Kant. He blames Hume and Kant that neither of them have understood the problem of (immediate) perception properly. Hume has explained the relation of causality in terms of merely a psychological

---

18. Emmet : *Whitehead's Philosophy of Organism*, pp. 142-143.

habit that arises out of the repetition of the events in succession without having any metaphysical ground. The mind, according to Hume, is a passive receipient which receives the impressions in succession of two events. Now if we seek for the causal connection in the manner of this repetition of the impressions, then the so-called causal relation goes beyond our immediate impressions that we derive through the senses and memory. Hence, if all our knowledge is sense-given, then we do not perceive any such causal necessity in the sequence of impression. And there is, therefore, no place for necessary relation in Hume's concept of causality. Further, if we think that all our knowledge arises out of sense impressions and if our knowledge of causal relation is so sense-given, then this causal relation will have no reference to past and future. This treatment of causality on Whitehead's view is based on the false theory of perception because Hume has failed to distinguish not only the presentational immediacy and the causal efficacy but also the relation of symbolic reference between them. Whitehead says that the idea of 'Causal feeling' does not come from a long association of impressions in the Humean sense. Rather, he says that contrary is the case. One simple instance is enough to perceive the 'cause' and its direct feeling. He holds that we can very well perceive the cause relation when we, for example, blink our eyes the moment the light is given suddenly. It is obviously a fact that here we have the experience of the flash of light and also the clear feeling that it causes the blinking of our eyes. Whitehead thinks that this single cause is enough for us to be sure that the flash of light is prior to the blinking of our eyes as well as the cause of it. This case illustrates well the fact that there is a causal determination in the succession of (two) events which we experience and our feeling of the causal compulsion can not be at all reduced to the habit of expectation. Whitehead conceives that 'Causal determinism' is rather a characteristic of a whole occurrence which extends over a period of time but it is not at all true about a specific sensation. We are directly, aware of this universal relation in causation and this relation is applicable to unknown similar cases in future also. It is a natural

fact because we perceive that a flower always turns towards light, that of flash of light is the cause of blinking our eyes, and so on. But a particular sensation has always a limited applicability, and hence, it cannot extend over a period of time. So, he rejects Hume's doctrine by saying that "Hume's doctrine inverts this relationship by making causal efficacy, as an experience, dependent upon presentational immediacy. This doctrine, whatever be its merits, is not based upon any appeal to experience."[19] Besides, Hume has assumed here that time is pure succession. But what is obviously true is that time is the succession of our acts of experience, and hence, time is not pure succession but our experience, Whitehead says, "Time in the concrete is the conformation of state to state the later to the earlier, and the pure succession is an abstraction from the irreversible relationship of settled part to derivative present."[20] The notion of pure succession can be explained more clearly with reference to the notion of colour. In the later case, it is said that there is no colour as such but only a particular colour like blue etc. In the same way, it can be said against Hume that there is no pure succession of time as such, but we get it through the relation of events in succession, According to Whitehead, this succession of events is not a mere sequence of sense but a well connected experience, and hence we can not accept the Humean view that causality is a peculiar mode of our mind rather than a perceived fact in nature.

Further, Whitehead completely disagrees with Kant to the point that causality is a category of thought. In so far as the Kantian position is concerned, it appears to be the reverse of the Humean tradition. According to Hume, the succession of events is merely a defacto regularity, and hence, there is no strict law of necessity. Secondly, the idea of necessary connection is merely a matter of subjective expectation. But Kant is of the opinion that neither the origin of the concept of causality lies in the repetition of facts nor this necessary relation is a matter of

19. Whitehead : *Process and Reality*, p.204.

20. Whitehead : *Symbolism, Its Meaning and Effort*, p.35.

subjective expectation. On the contrary, it is a category of our understanding. The succession of events are invariably and necessarily connected with each other by the pure intuition of time. The events always happen from the preceding time to the succeeding time but never in the reverse direction. The event which happens in a given time and what follows from this preceding to the succeding time is a necessary evidence. Here Kant is interested in proving that the events which happen in time successively are thus chained in a necessary succession. Further, we understand the succession by the transcendental synthesis performed by the category of causality. Thus the causal relation is imposed on the succession of events in the actual world. Though we start from the empirical facts, our understanding has the capacity to go beyond the these facts and can establish the universal and necessary relation of cause and effect. According to Kant, the category of causality is necessary for our understanding any event. Ewing holds, "Without assuming causality, no cognition or judgement about anything in time would be possible, therefore causality is universally valid of events in time."[21] But Whitehead disagrees with this Kantian position and argues that Kant like Hume has taken the empirical data to stand for 'simple occurrence', and there is nothing in our perception which simply occurs. So far Kant is mistaken because he has considered the notion of time as only 'pure succession'. But there is, according to Whitehead, no pure succession of time; we always get it through the relation of events in succession. We have already noticed in the foregoing discussion of his theory of causality that every happening is universally related with each other such that every particular event has the obligation to be conformed to the past, present and future. We have also seen Whitehead saying that we can discover this universal relation in our experience of particular event, that is, we can directly apprehend the causal efficacy and its application in our perception. In other words, we can apprehend the relevance of the immediate past to the

---

21. Ewing : *Kant's Treatment of Causality*, p.100.

present and from the present to the future. Whitehead claims that this is also a distinct fact even in the lower grade organism. A dog expects the conformation of the immediate future with the same degree of certainty as the human beings do. The common people also think in the line of Whitehead that the causal relation is certain and so it cannot be equated with a mere defacto regularity but, rather, there is a uniformity which we experience in the succession of events in nature, i.e., this uniformity of events in nature which we experience year after year without any exception has positively a logical status. It is also a fact that we are not able to analyse this sort of logical status demonstratively but it is obviously an undeniable fact that planets, human beings and animals have been behaving in the same manner from the time immemorial. This causal relation is not an apriori category but a relation which is thus derived from experiences, and our mind forms such causal laws. We think that there are some strict causal laws which are operating behind all the events of this world. Science cannot carry on its investigation without the presupposition of this concept of causality, and hence, it is the fundamental presupposition of every scientific procedure. However, it is obvious that Whitehead has tried his best to solve the problem of causation with the help of his own theory of perception. But its analysis leads him ultimately to the interesting standpoint that our knowledge of causation is a perceptual fact just like our ordinary perception of anything before us. This is also a conclusion that Whitehead himself is compelled to admit . Then, it seems doubtful to us as to whether the so called universal and necessary causal connection is at all available with expected certainty on the basis of such ordinary perception. Though the preceding events and the succeeding events are observable facts, yet the relation itself is not observable in this sense because we know that it is not any physical entity; what we perceive is only the sequence. Thus, the Humean tradition is still reappearing in Whitehead's treatment of the concept of causality. Loclere in explaining the causal view of Whitehead in *The Relevance of*

Whitehead (p.327) says that objects have tendency and purpose to move towards a certain direction. This tendency or habit or disposition is not observed but we can understand it by the result of the activities of the objects even if the link is never found. Following Venn's statement in his *The Principles of Empirical or Inductive Logic* (pp. 131-132), we may, therefore, point out that there are certainly some limits to the exercise of the understanding itself, and hence it can not help us to go very far to know this universal connection in question.