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ORDINARY MEETING, MAY 17, 1869.

THE REV. W. MITCHELL, M.A., VICE-PRESIDENT, IN THE
CHAIR.

The Minutes of the last Meeting were read and confirmed.

The Rev. Mr. GARBETT read the following paper:—

*THE RESPECTIVE PROVINCES OF THE OBSERVER
AND THE REASONER IN SCIENTIFIC INVESTI-
GATION.*—By the Rev. EDWARD GARBETT, M.A., *Mem.
Vict. Inst.*

I SUGGEST the subject of my paper this evening as a trifling contribution towards the third object stated in the programme of the Victoria Institute, "To consider the mutual bearings of the various scientific conclusions arrived at in the several distinct branches into which science is now divided, in order to get rid of contradictions and conflicting hypotheses." A slight extension of the meaning of these words will include the object I propose to myself to-day. For, strictly speaking, scientific conclusions, to whatever branch of inquiry they may belong, can never contradict themselves or each other, or stand in need of mutual adjustment. It is only when from conclusions we pass to hypotheses, that we find contradiction and conflict. The diversity is with science; for just so far as diversity exists, error exists somewhat. In science, properly so called, there can be no error, but it is in the various opinions held on the subjects of science, and yet more among different sections of men of science, especially in regard to the bearing of their particular branch of inquiry upon the province of religion. In proportion as science does its work, the diversity must diminish, and could we suppose the work ever to be completed, it would entirely disappear.

The parties to these disputes may be divided into three classes. At one end stand men of science who respect the Bible and its teaching, and who hold the results of science to be totally inconsistent alike with its historical credibility and

its revelations of doctrine. Next comes the class of scientific men, who maintain, side by side with their love of science, their belief in the divine origin of Christianity, and the authority of the Bible—men as devoted to the pursuit of knowledge and as eminent in the ranks of investigators, as diligent, as laborious, as able, as any which the annals of science can boast. But beyond these comes a third class, who have no claim to be men of science in the ordinary sense of the word; who are interested in it just as they are interested in every other branch of human knowledge; who carefully watch its results, but who in their special sphere are moralists, not philosophers,—theologians, and not men of science. In the first class we have science without religion, in the second we have religion and science combined, and in the third we have religion without science. In each class there will be considerable varieties of light and shade. In the first there may be wide differences as to the degree of scepticism to which men have been led, and to the intensity of it, from positive infidelity up to negative indifference. In the second there will be found no entire accordance as to the relation between the Bible and science, or as to the mode of which their apparent and superficial contradiction may be necessitated. In the third the feelings with which physical investigation are regarded may vary, and the degree of intelligent conviction with which science is distinguished from some men of science, may admit of indefinite shades. But still the general division holds good, and the lines of distinction are sufficiently clear for my purpose, whether the man of science who is not religious, and the men of religion who are not scientific, and the class which stands beside, of men who are both scientific and religious. It must also be remembered that the two last may very often coincide; and the list of names belonging to the Victoria Institute presents eminent examples of the coincidence; the theologian and the man of science may be one and the same: but for my present purpose it will be well to consider them as distinct.

My object is to adjust if I can the relation of these three classes towards each other and reconcile their claims. At present, when the theologian ventures to express an opinion on a point of science, or to denounce the scepticism of men of science, he is regarded as an interloper into a sphere where he has no right to enter, as a fanatic who feels, not thinks, and as arrogantly pronouncing on matters on which he has no competence to form an opinion. No doubt equally strong sentiments are expressed on the other side, on the part of the theologian toward the scientific inquirer,

and are open to the same rebuke. But I am here this evening, not as a man of science, but as a clergyman, and I must speak, therefore, from a clerical point of view. I do it the more, because personally I entertain no fear of science, nor have I the least wish to draw too strong and broad a line between science and religion. It is not science I fear, but the mistakes current under the name of science. I am told that science has disproved the Bible. I reply with a simple denial that I see no contradiction between the conclusions of science and the authority of the Word of God. I am told that I am not competent to judge, because I am not a man of science. I maintain that I am competent, and that competence I wish to defend this evening. For this purpose I wish to review the processes of scientific investigation, mark out the point at which the man of science and the theologian begin to part from each other, and assert the right of the theologian to interfere at this point of the process and to maintain an opinion of his own. In other words, I wish to mark out the respective provinces of the observer and the reasoner in scientific investigation.

It may be well to observe in passing, that both classes employ the same instrument, the reason, and that according to the same laws of the mind and the same principles of reasoning. The special influences of the Holy Spirit in removing obstacles in the way of conviction, in giving vital force to truth, and a realization of unseen things, which is almost a sight of the invisible, I now leave out of the question. I am able to do so, because the work of the Holy Ghost is no violent and abrupt disturbance to the order of our nature, but is wrought in strict accordance with the principles of its constitution. The Great ordoes not shatter His own work when He gives it higher life; He only keeps the entire machine in healthy motion, through its ordinary modes of conviction, affection, character, conduct. The theologian exercises the same instrument of the intellect in his province of inquiry, as the physical philosopher does in his. Faith without grounds on which it rested, would not be faith but superstition; the theologian no more ignores reason on his side than the man of science is able to do without faith on his.

Not only so, but there is a very strong resemblance, if not an exact identity, to the mental processes employed by the two classes, however different may be the materials with which they deal. They both use the same instrument of induction which has been the great key of all modern discovery. I do not enter into the nice questions which have been raised relative to induction and deduction, but use the

word to express what Mr. Lewes calls experimental reasoning, in contrast to that which is speculative and hypothetical. For instance, both parties begin with facts. In physical inquiry these facts are the outward phenomena of the visible world; in religion they are the evidences, external and internal, historical in the one case, moral in the other, on which Christianity is believed to be a revelation from God. Both need to take care that they know all the facts bearing on the point under examination, or else all their subsequent conclusions will be vitiated. Having got their facts, both proceed to generalize from them, a law of nature being the result in one case, a revelation from nature's God the result in the other. In passing on from one stage to another, both embody their conclusions in technical propositions for the sake of convenience, and in turn embody these propositions in single words; as when the man of science talks of gravity or electricity or chemical affinity, and the theologian talks of the Trinity, of faith, of justification, and so on. Thus both form a terminology of their own, each word of which is linked back by a connected chain with the original facts constituting the starting point of the inquiry, and which in both cases are equally liable to be corrected by fresh facts, if fresh facts are to be found, or by more accurate conclusions from old facts, if there should be reason to modify the conclusions of the past. And lastly, the facts are equally worthy of confidence in both cases, when they have been once proved to be facts. The process of proof may be more difficult in one case than another; although I see no reason to suppose the verification of a fact in history to be more difficult or to be surrounded with greater elements of error, than of a phenomenon in nature. But at all events, the facts once proved are as certain in the one case as in the other, and the conclusions to which they justly and necessarily lead, are as worthy of implicit acceptance.

But while all this is true, it is insufficient for my present purpose. For there are such unlimited capabilities in our nature that special mental aptitudes for this or for that may either be possessed by natural gift or be developed by constant practice into a marvellous perfection. The fact is familiar in regard to the body. I have been told by a very eminent preparer of objects for the microscope that his eye from incessant practice has become actually microscopic, and that he can now detect defects with his naked eye which at one time he could only deal with by the aid of a powerful glass. The same thing is true of the mind. It may consequently be said that the man of science has developed a

peculiar aptitude, which enables him by a peremptory instinct to draw conclusions and predicate results which other men may be incapable of seeing. I most fully admit the existence of peculiar mental aptitudes developed in every branch of connected and consecutive study, and existing within their respective spheres, in the lawyer, the theologian, the preacher, the musician, the statesman, the man of letters, as well as in the man of science. But I wish to point out that these special aptitudes exist within very strait limits. They have their definite sphere beyond which they cannot pass. There is a stage in the process of scientific investigation where they cease, and the question passes to a broader sphere, where all men have equal liberty of entrance; the moment the investigation has reached this stage, the man of science ceases to possess any special apparatus, any extensive aptitude, any peculiar instinct, any royal road to his conclusion. Not only so, but it may be questioned whether he has not special disadvantages, and whether the peculiar habitude which was of immense value to him up to this point, does not become a positive hindrance beyond it.

Let me rapidly sketch the mental processes involved in scientific investigation. First comes the observation of the facts; and for this high and peculiar mental gifts are needed. To teach how to observe, and how to observe accurately, is one of the prime objects of modern education. The one fact must be separated from the thousand other facts among which it is embedded. Both incessant practice and a wide reach of knowledge, that is of accurate acquaintance with other facts previously known, are necessary for this. I have known a person accustomed to walk through the country without the slightest consciousness of any difference between the foliage of one tree or of another, yet that person would have detected a false note in music which a less cultivated ear would never have noticed. I have often found myself incapable of distinguishing between two ferns of somewhat similar appearance, because I have not been familiar with the names and exact structure of any one—the difference of one stratum from another, or the recognition of anything peculiar in the relative position of strata; the distinction between one bone and another of a fossil of an extinct species from another fossil of an existing species—are common and familiar instances where a trained habit of observation immediately and confidently perceives what is wholly hid from an eye untrained. Some men perhaps would scarcely know what is meant by the fact of flint implements being found in drift; that a certain heap of flints have really been fashioned, however rudely, by

the hand of intelligence, and have not got their shape from natural causes, is a conclusion which a trained geologist alone would be competent to form. In some cases the recognition of a fact may require the highest skill and knowledge. It is not in the power of any one to use a microscope—the blundering hand of a neophyte may scarcely be able to present to the eye the commonest object with an instrument which in other hands may suffice to reveal the deepest secrets of that mysterious organism which has hitherto been found to pervade all matter. It is not the magnitude of the telescope, but the skill of the user of it, which brings the secrets of the heavens within human reach. The aberration which caught the notice of the astronomer Adams, and led to the discovery of new planets, was no fresh fact, yet none had discovered it till then. The observation of facts tasks, therefore, mental powers of high character, and can only be effectually done when a natural gift is developed by incessant practice into an exquisite mental sensibility. There is needed in addition the genius which can grasp the value of the fact, and by a rapid intuition seize its meaning. The steam of the kettle which led to the discovery of the steam-engine, the fall of the apple which suggested the law of gravitation, had been watched by countless thousands of eyes before those of Newton and Watt. Then, moreover, a fresh process of rigid examination is needed to eliminate possible causes of error. Those who remember the first outbreak of the table-turning mania may find an illustration in that ridiculous epidemic. That tables turned was a fact patent enough. Faraday proved that their turning by a physical impulse was a fact likewise, but till his practised habit or experimental observation was brought to bear upon it, fear and wonder and superstition had magnified one of the simplest of facts into one of the most inexplicable of miracles. And lastly, when single facts have nearly been ascertained and valued, and possible causes of mistake eliminated, there is still needed a wide aggregation of facts before any general conclusion can be justified by them. The whole world must be ransacked, and it is hard to say at what point the search must end, or when it is possible to pronounce that no fresh and unexpected facts will suddenly turn up to destroy the conclusions founded on the old. This has taken place over and over again—so repeatedly that the experience of the past teaches the most excessive modesty and caution in the future. Little more can be said than that in the present state of our knowledge, that is, of our acquaintance with facts, such and such things are probably true.

After saying thus much I shall not be suspected of under-

rating the gifts required for an accurate observation of nature or of depreciating the lifelong labours of the eminent men who have become distinguished in the annals of science. And yet, after all, this knowledge of facts is not the first stage of the process. It is but the collection of the materials, not the putting together the data out of which the fabric of ascertained scientific truth is to be constructed. Two processes still remain of the utmost delicacy and difficulty, and full of the possibilities of error.

In the first place, the facts have to be generalized in the common truth represented by them, a truth equivalent to the facts; and neither falling short of them on one side, or exceeding them on the other. Thousands have failed in both ways, either drawing conclusions not justified by the facts, or failing to see the conclusion which is justified by them. The truth may be itself a fact, as, for instance, if it could be proved that the human race had existed on the earth for a period indefinitely longer than the Hebrew chronology. Or, it may be, what we call a law, that is, some uniform mode of the great Creator's working. But, in any case, directly we pass from the facts to the conclusion to be founded on them, we pass from the province of the observer to the province of the reasoner. They are two separate powers, and may exist together or may not.

But there is still one more process to be gone through before the investigation is complete, and this likewise belongs to the reasoner, not to the observer. The conclusion at which I suppose ourselves to have arrived in one branch of inquiry, has to be compared with conclusions arrived at in other branches, and to be adjusted into its proper place in the whole harmonious fabric of truth. First it has to be compared with the fixed conclusions arrived at in other branches of inquiry, for the purpose of ascertaining whether it is harmonious with them or not. For instance, suppose the conclusion which the scientific inquirer has arrived at to be the remote antiquity of man, his presence on the earth at past periods indefinitely distant. We must ascertain whether this conclusion can be held consistently with other conclusions in other branches. For as the Cosmos is but one, and all its parts so intimately related that they can be distinguished but cannot be separated, so intimate is their action and reaction, so close and complicated the threads that hold all created things together, so true knowledge can only be one. It must be consistent throughout. It is inconceivable that one and the same thing should be true in one branch of inquiry and untrue in another. No conclusion can

therefore be admitted into the fabric of our fixed and ascertained knowledge, till its consistency or inconsistency with other parts has been ascertained. Other witnesses must be examined besides itself. It cannot be accepted on its own testimonial of character. Its final adoption must, therefore, depend on the presence or absence of conflicting principles gathered from other domains of inquiry. It must be reconciled with other parts of our knowledge before it can take its recognized place in the fabric of science.

Now it is by no means an easy process to ascertain this consistency or inconsistency. It demands not only a wide survey of truth, but very accurate habits of reasoning. How readily a mistake may be made here may be seen from the proposition to which I have already alluded more than once as a good typical instance of all this class of questions,—the alleged antiquity of man upon the earth. At first sight, the instinct of ninety-nine persons perhaps out of a hundred would conclude that such a fact is wholly irreconcilable with the truth of the Christian Scriptures. But more careful thought modifies such a conclusion,—there is, I believe, not the slightest contradiction between the statements of Scripture and the remote antiquity of man, should it ever be scientifically proved, so long as it is not shown that there is lineal descent between the men of past epochs and the men of the present epoch. The Bible simply contains the history of one particular race, lineally descended from one man and woman, and nothing else. Whether there may have been, or may not have been, other races of similar structure and constitution, is a further question of which the Bible says nothing one way or another. The matter will not be thought so improbable, if there be truth in the belief of some men that angelic beings have bodies in some sort similar to our own, only incomparably more ethereal. At all events, the antiquity of man would involve nothing on the face of it contradictory to the literal truth of the word of God. No doubt it would modify many popular notions, but this is a very different thing. To modify groundless interpretations of the word, is an office to which science may very properly aspire. It has done so already in some very familiar instances, and may do so again in many more, perhaps more than we have at present any idea of.

But suppose this process completed, and the matter determined, that this particular conclusion of science is irreconcilable with the conclusions formed on other branches of inquiry. For instance, suppose the antiquity of man upon the earth to disprove the credibility of the Christian Bible,

what then?—is the matter wholly settled? By no means; we have a case of conflicting conclusions—one branch of inquiry has led to the conclusion that the Bible is untrue. But it is not to be forgotten, that another branch of inquiry has led equally decisively to the conclusion that it is true—the man of science and the theologian both starting from facts—facts widely different in their material, but equally cogent in their proofs; both using the same common instrument of the reason; both using it according to the same processes; both testing their conclusions by experiment, flatly contradict one another in their conclusions. How is it to be settled? The man of science demands that the theologian should give way, and applies to him some hard words if he refuses, and bases his demand on the specific ground that his own process is a process of science, and that science cannot be wrong. But in the first place he omits to notice that he may be right in his observations, and yet wrong in his reasoning from them, and that errors in reasoning, whatever their exact character, are not scientific, but eminently unscientific. These mistakes are not the mistakes of science, but the mistakes of an unscientific mode of pursuing science. Moreover, in the highest and strictest sense of the word, all processes of inquiry, if they are properly and accurately conducted, are scientific. Science is only a body of organized knowledge, whose phenomena are arranged so as to exhibit the reasons and causes by which they are influenced in their legitimate connection and interdependence. Abstract science possesses as true an inheritance of the common name as natural and physical science. There are ultimate principles and causes at the basis of all the forms of mind, as well as of all the forms of matter. To claim special privileges or a peculiar infallibility for physical inquiry over mental or metaphysical inquiry, is not a fallacy of popular ignorance, but another illustration of the very fact I am seeking to establish, the dependence, namely, of the observer upon the reasoner. But if this be true, and if an induction from historical facts be just as scientific as an induction from physical facts, and depends on exactly the same conditions, there can be no imaginable reason why the conclusion of the theologian should be submitted to the conclusion of the geologist, more than the conclusion of the geologist to the conclusion of the theologian. The theologian may rather claim the higher degree of certainty than the lower, inasmuch as his conclusion is ratified by the experience of moral and spiritual instincts and events, of which the conclusions of natural science are necessarily devoid.

What then is to be done with this conflict? Why, in the first place, the processes on both sides must be re-examined and worked out over and over again, to discover, if possible, where the human mistake lies. And finally, if this cannot be discovered, we can only conclude that the reason of the apparent contradiction lies in our imperfect data, our incomplete knowledge of facts, and that, in proportion as this want is supplied, the conflict will diminish and finally disappear.

Thus it appears that the processes of scientific investigation are about equally divided between the observer and the reasoner. All the collection of the materials of reason, of the data on which the premises rest, depends upon the observer. Into this sphere the untrained mind has no right to enter, and it would be presumptuous for any but a man of science to pronounce an opinion. Within this sphere we must trust to Christian men of science to check and test by every rigid method the observations of the sceptical man of science. But the province of the observer, and consequently the sphere of his peculiar technical aptitude, close with the collection of the materials. Here the province of the reasoner begins, and here the scientific explorer has no advantage whatever, and has no right to claim any. The minute concentration of mind upon details must rather tend to contract, and thus to weaken, the thinking powers, and destroy that breadth of view, and that patient testing of an argument, link by link and premiss by premiss, which constitutes the strength of the reasoner. To say the least, there is no special advantage, and to assume the authority of science for all the conclusions formed in matters of science, is folly. There may be as much bigotry and fanaticism in the geologist, the chemist, or the astronomer, as in the theologian; yet it must be evident, in a process when observation and reasoning constitute two connected, independent, yet closely affiliated processes, that a mistake in one half of the processes is as fatal to the conclusion as a mistake in the other. No weight of authority can make a bad argument into a good one, or can convert an assumption into a proof. Into the proper province of the observer it would be presumption for a stranger to tread. To take, for instance, Mr. Darwin's book on the origin of species, I should not dare to pronounce an opinion on his statement and classification of facts, but when he begins to reason I hold myself as competent to judge whether his facts support his conclusion, and whether his conclusion be consistent or not with our ascertained knowledge in other provinces of inquiry, as he is himself.

Thus it appears that the claim for a peculiar certainty advanced by the votaries of physical science, is to a great degree imaginary. The certainty of the data does not involve the certainty of the conclusions. These stand on open ground, where every candid reasoner has a right to think and judge for himself. It has been observed with wise caution, and with these words I conclude,—“The great majority of what are called sciences—that is, all those branches of knowledge in which discovery is possible—hardly deserve the name, being only a bundle of theories or facts, bound together with more or less exactness, and which a fresh discovery may any day untie.”

The CHAIRMAN.—I need hardly ask you to join with me in returning thanks to Mr. Garbett for his valuable paper. I only hope that it may elicit some discussion, and with that view I now call upon any gentleman who has any observations to make.

Mr. REDDIE.—Before the discussion commences I should like to ask the author of the paper what element he refers to as being common throughout the whole creation. I do not know whether he refers to the new thing called “protoplasm.”

Mr. GARBETT.—I do not think I used that phrase at all. If you will find it in the paper I shall be obliged.

Rev. C. A. Row.—I feel a considerable difficulty in entering upon this subject, from the fact that I have not yet seen the paper in print; and a paper of this kind I should be sorry to attempt to discuss, unless I had had the advantage of reading it carefully beforehand, as I am certain that I could not do justice to it. There are one or two small matters, however, in the paper, which I will just mention with these few words of preface; because I feel that I have no right to discuss a paper of this kind unless I have previously given it a careful looking through, as I should be in great danger of making mistakes. I think I agree generally with the purport of the paper; but it strikes me that Mr. Garbett must admit this much: He has laid it down, and I fully concur with him, that there is a great importance in skill in every department of human thought. But I think he must also admit that though the physical philosopher may be the exclusive judge of facts because of his skill in investigation, we must extend that principle into the reasoning faculties as well. No doubt there are many persons who are really incompetent to judge of the processes of reasoning. The paper is rather loose there, because Mr. Garbett seems to lay down that most of mankind have an equal power in judging of reasoning and its conclusions. Here I think there is an unquestionable looseness, because it does not always fall to the observer of facts as facts to be able to reason accurately from them. Many people would have us believe that because they are clever at one thing they are also clever at another,—a conclusion which, in many cases, I altogether dispute. On certain points which I have studied deeply I am entitled to give an opinion;

but there are certain others on which my opinion is worth nothing. In the same manner I apprehend that the power of the mind in judging of the evidence of facts, and in reasoning from those facts, form two distinctive branches of skill. This is rather obscure in Mr. Garbett's paper, and I hope he will explain it more fully. He seems to me to have used the term theology in a very general sense, but I understand him to apply it to the evidence on which revelation rests. Is that your view or not ?

Mr. GARBETT.—I did not mean to limit the term to that application, but simply to show that that evidence is the first step.

Mr. Row.—Of course there is no doubt that in theology as in nature there are facts on which alone theological science can be based, and if we do not base theological science upon them we are nowhere. I quite agree that the utmost which science can do, will be to explode a number of theological theories which are not really theological at all, and which do not belong to the Bible, and the sooner they are got rid of the better. But where I see a great difficulty is in this: theological science is so extensive, and it deals with so many phases of the human mind of a high character—metaphysical, for instance,—and many other things, that we have a greater difficulty in ascertaining the ultimate facts of the mind than in ascertaining the facts of nature. Take such facts of nature for instance as time and space. They are clearly determined as conceptions; but in theology and morals we have to make a very careful analysis of the mental processes by which we arrive at them and at the general truths contained in them; and it is that, I apprehend, which makes theological science a matter of much greater difficulty than simple physical science. Theology consists of a number of sciences of a kindred character: it is of no use to speak of it as one science. It includes metaphysics, deductive logic, and the ascertaining of facts as conveyed to us by revelation, by instituting an exegesis suitable to find out the precise meaning of the Biblical language. This is one of the great defects of the paper, and I should be glad if Mr. Garbett, in his answer, would explain more fully the theory which he has in his mind. I do not know if I have clearly expressed what I meant, but I should be glad if in his written answer he would elaborate this point. I think the paper would then be much more clear—

Mr. GARBETT.—I did not mean to put all men's reasoning powers on the same level; but I wished to separate them into two classes—the scientific observers, and the reasoners who were not scientific.

Mr. Row.—There I certainly agree with you. I quite admit that reasoning is entirely distinct from the observation of facts, and that a close attention to the observation of facts does not qualify the mind for reasoning; but then at the same time there are diverse classes of reasoning. I do not think, that, on the whole, mathematical reasoning qualifies the mind for reasoning well on moral subjects; and I do not think that men who confine themselves to pure mathematical subjects are found, as a rule, to be good or correct reasoners on moral subjects. Mathematics contain evidence of a highly demonstrative character, but they do not require us to enter into the minute

considerations which form so large a portion of all observations founded upon moral subjects.

Rev. J. H. TITCOMB.—I would not offer a word of criticism upon this valuable paper on this or that particular point ; but I must say that I was extremely pleased with the able way in which Mr. Garbett stated that true science could contain no error. I think we cannot possibly overstate that fact. You see the truths of science come from God, and the truths of revelation alike come from God. God must be the author of both, and if the one be infallible the other must be infallible too. For instance, I would not mind saying, even in the pulpit itself, if the occasion demanded it, that such a fact in mathematical science as that the squares described on two sides of a right-angled triangle are equal to the square described on the hypotenuse is no less infallibly true than that there is only one God. The two facts are equally true. This adjustment between revelation and science is necessary, because they come from the same author, and have a common origin and a common fulness. That thought struck me while the paper was being read. I was also very much struck with the value and force of what Mr. Garbett stated with regard to the importance of accumulating facts for the better ordering and subserving of truth in all the processes of experimental science. I think the history of geology shows that the gathering of a few facts and generalizing upon them may lead to much error in so-called science, or at all events to the adoption of an unscientific manner ; and the addition of other facts afterwards may lead to other deductions, which may totally upset the previously formed views on the subject. Fossil remains have been found in a stratum which was thought at one time to contain no such remains ; and things which a few years ago were pronounced to be unscientific are now possibly quite scientific—

The CHAIRMAN.—Or are supposed to be correct ?

Mr. TITCOMB.—Yes. The accumulation of facts becomes more and more the handmaid to discovery ; but for that we should go into the line of thought suggested by Mr. Garbett, concerning the great advantage of skilled or talented observation. I was very much interested with Mr. Garbett's observations regarding the microscopic power of the eye. If Mr. Darwin were here, we might call upon him to elaborate his theory of the origin of species, and to explain the power which he attributes to a body, of assimilating and developing certain organs and functions to a degree which did not naturally belong to them ; and he would no doubt tell us whether the change remains permanent and continues from generation to generation or not—

The CHAIRMAN.—Certainly long sight and short sight are not hereditary.

Mr. TITCOMB.—As to Adams's discoveries, I understood Mr. Garbett to attribute them to the observation of other discoverers. I understand that Adams's discovery was arrived at from abstract reading ; Leverrier's from actual observation—

The CHAIRMAN.—The real facts of the case have not been given by Mr. Garbett. Mr. Garbett assumes that Adams and Leverrier were both astronomical observers. Now, at the time Adams made his discovery, I

doubt whether he had ever used a telescope for observation. The fact was that Adams was writing his planetary theory, previous to his offering the hint to look after the perturbations of Uranus ; the aberrations of which from the supposed known law of gravitation had been observed by observers, and could not be accounted for by the effect of any of the then known planets. The next question was, Suppose you start the hypothesis of an additional planet, will that account for it ? And he was supposed to tell Challis where to look for it, and Challis looked. The same process was carried out by Leverrier, with a hint of Adams's plan from Airy, who had the plan which Leverrier carried out ; for he was more fortunate in his observation, and found the planet. But Mr. Reddie was the first to draw our attention here to the fact which was established, that the planet was not discovered where it was supposed to be ; that the place where the planet was supposed to be and the observed facts were most discordant, taking the calculations of either Adams or Leverrier ; and that there was not that scientific agreement between the observations of the two distinct observers which was supposed to exist.

Mr. TRICOMB.—As I see some young friends here, I think it important to make a few observations on the intense pleasure and profit which we gain through intelligence and reading. There are numbers of persons who toil painfully through the British Museum or the Kensington Museum for want of an intelligent acquaintance with the facts of the case before them, and the nature of the topics suggested to them by what they see. I never feel my own ignorance so much as when I go through certain departments of those vast magazines of science and learning ; but in certain departments I feel at home, and I have an intelligent enjoyment of them, because I can observe minutely, and see things which I otherwise should not be able to see. I never feel the importance of having thoroughly studied one department of knowledge so much as on such an occasion, nor the miserable consequence of not having had time to study the others. It is utterly impossible to study all, however ; and it is better to have a thorough acquaintance with one than a little knowledge of all. It is one of the advantages of a paper like this that we may learn to feel more and more that we never can know too much ; and that therefore we should try to take advantage of what we read on practical occasions, such as when we visit museums, in order to reduce our reading to practice, and gain fresh intelligence and enjoyment.

Mr. Row.—This is a strong illustration of the point maintained in the paper as to the difference between the observer of fact and the reasoner :—I do not see by what argument the physical philosopher is to infer that design does not exist because he is an observer, any more than I am to infer that it does. That is a point where observers get wrong, and go a step beyond their own province. It is a plain matter of pure reasoning whether design exists or not. To quote a person like Darwin—supposing that he denies it—is no authority that design does not exist in creation. He and other men of the same stamp are no doubt authorities in their own department, but when they go beyond that, and infer as part of their science that there is no such thing as design in creation, they get out of their province altogether. I

think the paper which we have had read to us is very valuable for the purpose of concentrating our strict attention on this fact. It does not follow that because a man is eminent in one branch that he should be taken for a guide beyond that ; and I maintain most strongly that it is not the faculty of observation which enables a man to say whether there is design in creation or not.

Rev. A. DE LA MARE.—I quite agree with what Mr. Row has said this evening, that Mr. Garbett's paper is a most valuable one, and full of the most valuable material for our own thought when we shall have it printed and in our hands. But there is one point for which I especially thank Mr. Garbett, because I think he has clearly brought out what has led to so much misunderstanding in the relative position of theologians and scientific men. Mr. Garbett has stated distinctly that the theologian has as much right to faith on his side, as the scientific man has to demand to have evidence received from him ; or, in other words, that the scientific man can no more do without faith in carrying out his processes than we can do without reason. I only draw attention to that lest it should escape notice, because it answers an imputation which is often thrown out against theologians, that their processes are almost superstitious, resting on nothing but faith, and totally removed therefore from a scientific character. I thought Mr. Garbett's observation was very valuable, and I desired to mention the point lest it should not be noticed.

Mr. REDDIE.—I am sorry that Mr. Garbett has left us, because I am afraid that I shall have to criticise his paper adversely on some points. With regard to the general scope of the paper, as an illustration of the object which this Society has in view, I think there will be a general agreement among us ; but when I now proceed to make some observations, not quite in accordance with Mr. Garbett's views, I may state that that is not fighting him in an unfair way, as he will be allowed, if he wishes, to reply to what is reported of our remarks. He commenced his paper by saying he would give a few instances to illustrate his general reasoning, but he was peculiarly unfortunate in those instances. We have already heard that the actual place of Neptune and the calculations of Leverrier and Adams did not agree in the least together. All the calculations have been published by Messrs. Walker and Pierce, of the principal observatory in the United States. The astronomers here, however, did not take these revelations very well, because there is an inclination among them to profess to be perfectly accurate in their science—

The CHAIRMAN.—Certainly one has heard very little of the great discovery since, as an example of astronomical accuracy. (Laughter.)

Mr. REDDIE.—Without going into the history of that, however, I think it is easy to show, that there is considerable inconvenience from the observer and the reasoner being separately employed upon the same work, for I do not go with Mr. Garbett on that point. It is unfortunate that those who give us the mathematical laws of astronomy are seldom astronomers at all, while the astronomers who observe are often but indifferent mathematicians

and seldom physicists. To the mathematician it is all the same whether the sun or the earth is in the centre—the calculations would be just the same in either case. I believe, *qua* mathematics, that is so; but if you place the earth in the centre, you have no longer to place the sun at so very great a distance; and the physical law which would serve to whirl the earth round the sun is a very different law to that which would be required to guide the sun round the earth. Of course I speak of this as not being an astronomer myself. The story of Newton's apple I believe is a complete myth. Ten years before Newton put out anything about the theory of gravitation—and I speak from papers to be found in the Transactions of the Royal Society which I have already quoted in this Institute*—ten or twelve years before Newton wrote his *Principia*, papers were read upon the theory by both Halley and Hook; and the story of the apple is even quite given up by Whewell in his *History of the Inductive Sciences*. It is in fact nothing more than an old nursery tale. As to the story of the steam of the tea-kettle being the origin of Watt's steam-engine, I doubt that very much—

The CHAIRMAN.—I always understood that what Watt discovered was the use of the safety-valve. He saw the lid of the kettle moved up and down by the force of the steam, and found a way of applying it to the steam boiler which was then in use.

Mr. REDDIE.—But these are minor points. The other illustration which Mr. Garbett gives is as to the antiquity of man being reconcilable with the Scriptures; and here I must again say that I think it was unfortunate that he should put forward these opinions, considering that the subject has been amply discussed here already. I think the best of the argument rests with those who deny that antiquity. If we admit that Adam was not the ancestor of the whole human race, we interfere very naturally with the Bible—

Mr. TIRCOMB.—I must vindicate Mr. Garbett on this point. He only said that antecedent to Adam there may have been other races, and not that all the members of the existing human race have not descended from Adam.

Mr. REDDIE.—That is a new idea. We have had many curious ideas with regard to the antiquity of man put forward, and this is another idea. I am always glad to hear these conflicting theories put forward, for they are utterly irreconcilable with each other; and while the theorists are fighting with one another about them, we need not bring the Scriptures to bear on the subject until they agree with one another, which will not happen for a long time to come. An instance of extremely fallacious reasoning on *quasi* facts took place with regard to the fossil man of St. Denise, discovered in some *débris* connected with the Auvergne mountain cones which were supposed to have been erupted long before the time of Noah's flood. But in our *Journal of*

* Vide *Journ. of Trans. of Vict. Inst.*, vol. i. p. 413, *et seq.*

Transactions it will be found that those theories have been refuted, and that the eruption of these mountains took place in the fifth century of the Christian era. Then there was the Neanderthal skull, supposed scarcely to be that of a man at all, but almost of the "missing link" between man and monkeys. There is something very analogous to the shape of that head in the Nova Scotian giantess who was exhibited in Piccadilly not long ago. But it was found by a careful observer, Dr. Barnard Davis, that that skull was merely an abnormal skull, and that disease had been at work upon it and had caused the peculiar frontal development which it exhibited. Nobody now believes that it was either a very ancient skull, or that there was anything Simian in its character; and, in fact, there never was any proof that the clay in which it was found was old clay. Mr. Garbett has told us that facts when ascertained should always be accepted. If they are facts, no doubt that is true enough, but the question most often is, whether so-called facts are facts or not. Many things which at first have been taken to be facts have been found not always to be relied on. Another thing which Mr. Garbett has said is, that the facts of history are not more difficult to be ascertained than are the facts of physical phenomena. Now I think it is most difficult to get at the true history even of one day's transactions. We know the wide divergence there was between the Federal and Confederate accounts of events in the American war; and we know also how completely we were, and are, at sea with regard to many of the events which took place in the Crimean war. And that being so, how we are to tell what took place in the histories of other nations before "our own correspondent" became an institution, I really do not know. As to natural phenomena, whatever is a fact once is always a fact, unless you deal with exceptional matter or miracles; and here is the great advantage of entering upon the study of natural science, for it should make us more accurate and careful, and we should never accept its facts without having them verified over and over again. Whatever was true to Copernicus, to Kepler, to Newton, to Darwin, or to any one, is the same always. You have the same elements that they had, the same natural world, and the same investigations may go on over and over again to eliminate the errors of previous philosophers. What is the history of science but a record of discoveries and the setting right of errors and mistakes, it being constantly found that what were put forward as facts at one time were really no facts at all? There seems a strange disposition on the part of Mr. Garbett, and on the part of others, to an unscientific mode of viewing these things; there is an inclination to separate the reasoner and the observer too completely from one another. Now I must say, that without reasoning a man would be but a very poor observer, and an observer would be a sorry man of science if he did not reason——

Mr. Row.—You must not confound two processes of reason together.

Mr. REDDIE.—I think that all processes of reasoning are analogous——

Mr. Row.—There is inductive and deductive reasoning.

Mr. REDDIE.—Quite so; but deduction is only extending the process of induction. There is no material difference in the character of the mental work.

You must have your facts as a foundation ; and you must not draw conclusions, whether deductive or merely inductive, beyond the facts which are there. There is too great a disposition on the part of men of science to cut up science into detached parts ; and, like the mathematician who deals with a bit of astronomy instead of the whole, you get them entirely overlooking many important considerations, and this prevents them finding themselves to be mistaken. This is entirely because science is cut up in this way ; for it is obvious that you cannot have two things true which contradict each other. Mr. Garbett was out of tune with the rest of his paper when he spoke of science and theology being at issue, because he began by pointing out that true science could not possibly be wrong. If there is an issue between science and revelation, it must be because that which we call science is not really science, or else we have some error in the revealed Scriptures. Now if it be proved by science that there were races of men created, according to Professor Macdonald's theory, whose descendants are still living in different parts of the world, or, according to the extraordinary and new theory of this paper, none of whose descendants are now living, I would say that equally in both cases there must be some error in the Biblical narrative. Those who have been accustomed to read of Adam as being the first man, and of all men dying in Adam and being renewed in Christ,—all Scriptural students would at least be startled if you could prove from science that there was a race of men of which the Bible seems to know nothing. But I do think that if instances are brought forward in a paper like this, they should be instances on which there is no disagreement at all ; but in this case, with regard to the theories of the antiquity of man, there is the widest disagreement. There are hardly any two theories upon the subject which are at all reconcilable with each other. You should also consider the changing condition of geology, and remember that this theory of the antiquity of man is a deduction from a now antiquated geology, based upon fossil remains now found in different strata. As Mr. Titcomb has pointed out, you may have one theory, apparently supported by good evidence, in one year ; and a year or two afterwards it may have to be entirely given up.

Admiral FISHBOURNE.—There is one point which I think has not had sufficient justice done to it, and that is the necessity for harmony existing through all branches of knowledge. God is the common author of all things, and I cannot see the necessity for any one who is studying one department of knowledge to assume, because he thinks he has got his facts arranged judiciously, that his deductions are exact, and that he is to ignore the contradictions between his facts and those of others. The last paper which we had read here is an illustration of the necessity for that harmony. The author of that paper spoke favourably of Darwin's evolution theory ; and yet he was a theologian, or rather a clergyman, though I consider his argument was directly opposed to the whole of the Biblical scheme. Geology recognizes a flood, and has it stamped upon the strata of the earth ; but how can a theologian point to the Flood or to the fall of man on the evolution principle ? Any man, whether he admits the Scriptural doctrine of the Fall or not, must

admit an imperfection in his nature. He does those things which he would not, and he does not do those things which he would, with a consciousness of imperfection and fault in his own character. But there is an utter want of harmony between the Fall and the idea of evolution, which shows that evolution cannot be true, and those who support that doctrine must go back and amend their arguments and so-called facts. But if we go back to the facts, we get back to other difficulties, which another class of philosophers take up. One says that protoplasm is one continuous principle that pervades all beings, but he forgets that the protoplasmic are as numerous and as various and distinct as the beings are; and how he imagines one is transferred into the other I cannot say. I do not see how it agrees with Darwin, who says that man was originally a monkey, and the monkey something else, till you get down to one common monad. With regard to Mr. Garbett's paper, I agree, generally speaking, with Mr. Reddie; but I understood Mr. Garbett to put forward that point which Mr. Reddie so much objects to simply as a hypothesis, subject to the possibility of its being established; and I do not think Mr. Garbett should be tied down to the assertion of a definite opinion on the subject. I believe the theory is utterly untenable, and I should not have introduced it in such a paper, though I do not take great objection to its being so. I do, however, think that the case of physical philosophers has clearly established the position of Mr. Garbett, that there is a great and manifest distinction between the observer of facts and the reasoner who has to consider these facts. My experience has shown me that a man may be a very good observer of facts and yet be utterly incompetent to reason out general principles and laws from them. And when a man has a theory in his mind he cannot be a good observer; he is looking into the book of Nature merely to find supports for his theory, rather than to take the facts as he finds them. So it is with theologians. They look for things to support their opinions in the Bible in accordance with their views, overlooking many things that they might otherwise find. As to physical facts, Mr. Reddie has told us that so-called facts, accepted as facts some time ago by philosophers, reasoners, and good believers, have turned out to be no facts at all. A distinguished philosopher has published a book in which he says that he found infusoria and algæ and other things in volcanic rocks, and he insists that they are not volcanic but a crystalline or aqueous formation from stagnant water. That is a blow struck at geology, showing those gentlemen who want theologians to accept their views—which belong to a science of yesterday, whereas theology is the science of thousands of years—that they have gone through processes which have landed them in much error, a great deal of which was accepted by the theologians of a few years ago, whose reasonings, however, are not accepted now. But the state of things remains the same. Geology is a science of only yesterday, and yet those who follow it have the presumption to ask theologians of long standing, whose science has had the advantage of thoroughly testing and sifting every fault, and obliging errors to be given up, to accept their theories. This is a further reason why the theologian should stand his ground, and why the physical philosopher should be told to go

back and re-examine his facts, with the intimation : "When you have gone through the fiery ordeal which we have gone through, we will listen to you."

Mr. Row.—Let me just point out one fact : I think that all are of opinion that the logic of induction and of deduction are two essentially different principles. Archbishop Whately attempted to resolve them into each other, but that was a failure. They are two essentially distinct principles—the logic of induction and the logic of deduction.

The CHAIRMAN.—I have only listened to Mr. Garbett's paper, which is of that character that it is quite impossible to discuss it fairly without reading it. I must say, therefore, that all the observations which I shall make must be taken with this limitation, that I shall not attempt to reply to the paper, but only cursorily examine what may have been the false impressions which I have received as to the nature of some of the illustrations. With the object of the paper I cordially agree ; but there is a little vagueness in the manner in which the term "science" is used throughout. This is our great difficulty, that we find ourselves sliding into five or six different definitions of science in the same discussion. If we take science in its highest and purest sense as meaning true knowledge, which I conceive to be the only real and true definition of science, then I would most cordially agree with the paper ; but I must go further, and say that I cannot distinguish between theology and science, because, in respect of all that is universally true, it will be found that theology is of all sciences the highest and purest, and when we examine it, it will give us the highest degree of proof of any science whatever. I am not afraid that the science of theology, considered strictly as a science, and considered strictly as a science arrived at by the operation of human reason, should be compared with any other science derived from human reason. Take an illustration of Mr. Titcomb's, though I will not go so far as he does. He conceives that it is absolutely demonstrable that if you have a right-angled triangle, the square on the side opposite the right angle is equal to the squares described on the other sides—

Mr. TITCOMB.—I said absolutely true. I said nothing about demonstration.

The CHAIRMAN.—Then I misunderstood him. But I would say that the truth of the existence of the Deity can be proved by a higher mode of demonstration than that arrived at mathematically. The reception of a mathematical demonstration as a scientific fact must depend upon its demonstration, and that demonstration depends on certain fundamental definitions and certain fundamental axioms and postulates. All demonstrations in geometry depend on those first principles. If your first principles are open to doubt, all the demonstrations founded upon them are equally liable to doubt ; and we find that no system of geometry has yet been conceived which has been able to proceed upon axioms which are demonstrably true, and admitted to be true as a kind of instinctive truth of the human mind. We are obliged in some form to assume some propositions which as much require proof as any of the propositions afterwards proved. Under these circumstances, I say that all geometrical conclusions founded upon geometrical reasoning and de-

monstration must take with them whatever degree of doubt may exist in the original fundamentals of the science. This, I think, is a point which should be strongly insisted upon when what are called physical and mathematical sciences are brought into collision with the highest of all sciences—pure theological science. It is a generally received opinion—but I believe it is an opinion which is founded upon ignorance—that the mathematical and the physical sciences possess an amount of demonstration which is utterly unattainable in such difficult subjects as those which occupy men's thoughts when they enter upon the science of theology. I am sure of this, that the more the subject is investigated, and the more we analyze the principles on which those so-called scientific demonstrations in mathematical and physical science are founded, the more it will be found that we have as strong a proof and demonstration of the higher science as any that can be produced in any of the other inferior sciences. If the same degree of scepticism which has been brought to bear upon theology as a science were to be applied to any of the other sciences with which we have to deal, or any of those sciences which are supposed to be demonstrative sciences, I feel convinced that there are far greater difficulties to meet with in those so-called demonstrative sciences than any which theology has to answer. Now this is a subject which should be thoroughly considered. With regard to the distinction between the observing faculties of those who are called upon, when facts are observed, to analyze them and to arrange them, and the reasoning faculties of those who are to determine what is to be derived from them, I conceive them to be two very different faculties of the mind. They are both capable of being cultivated to a very high extent, and no man can become a good observer who does not cultivate the faculty of observation ; and I agree with Mr. Reddie, that this also necessarily implies the co-existence of very considerable reasoning powers. But then I believe that it also requires a long education, and an education of a totally distinct character from that of the mere observer, for a man to attempt to deduce from the observed facts their general laws, or their bearing on the other facts of nature. I cannot help feeling, that while I agree in the main with the conclusions in this paper, I am very sorry that Mr. Garbett, as I conceive, has made use of illustrations which are rather faulty in themselves and which do not hold water. I think some of them came probably from an incorrect apprehension of some of the circumstances, as in the case of the reference to Adams and Watt. They were correct as illustrating Mr. Garbett's paper, but incorrect as not bearing on the supposed facts to which Mr. Garbett wished to refer. But it should be borne in mind that it is very difficult to become true observers of facts, and I could give an illustration which would go further than his. It is a matter of trained observation for a chemist to determine whether a fluid contains a supposed poison or not. Does this water contain arsenic, for instance ? In such a matter, no mere tyro in chemistry should be trusted where a man's life is at stake, and men's lives sometimes do depend on the chemist's accuracy in such a thing. In one case a man was accused of committing murder, and among the bottles found in his possession was one containing a clear, trans-

parent liquid. A strong suspicion arising from other circumstances, independent of the chemist's observation, that arsenic had been used as an instrument for committing the murder, it was the chemist's business to determine whether any of the bottles contained arsenic or not. Any one will admit that Professor Taylor can be taken as a good example of the trained experimental observer; but let us see what is required in him besides mere accuracy of observation. It was the case of Smethurst, which led to a great discussion at the time. Professor Taylor examined the fluid, which he subjected to a test which was conceived at that time to be a certain test to discover the existence of arsenic, and he went, and upon his oath, as a chemist before a coroner's jury, said, "I have examined this fluid, and I find that it contains arsenic": and he gave the quantity of arsenic which should have been contained in the fluid. Now we cannot suppose that a trained observer would be careless in such a matter, or that, when asked on a question of life and death, he would consider it consistent with his duty to state lightly on oath, broadly and distinctly, that a certain fluid contained arsenic. Between the coroner's jury and the trial of the man, however, certain doubts were suggested to Professor Taylor as to whether his analysis had been altogether accurate, and as to whether the fluid did really contain arsenic or not. What was the fact? He had made use of a certain test which was considered to be infallible. It consisted in this, that if a suspected fluid containing arsenic is mixed with a certain quantity of hydrochloric acid and boiled in contact with bright copper, that bright copper receives a metallic, silvery-looking stain, and it is the chemist's business to determine whether that stain contains arsenic or not by subliming the stain by applying the heat of a spirit-lamp until the stain evaporates, and little crystals are formed, and the chemist's determination depends on the form of the crystal which is deposited. When Professor Taylor took copper to analyze this fluid he used copper-wire gauze. He found that the fluid contained something which caused the copper wire to dissolve. He kept on adding copper until the fluid no longer dissolved it, and then he submitted the solution to the further process, saying, "Now I shall see whether the fluid will give me the arsenical stain or not." It did give it, and he said, "I put in so much copper; therefore it must contain so much arsenic." A suggestion was made to him—I believe by Mr. Graham, the late Master of the Mint—who said, "Taylor, are you sure that you did not put in the arsenic yourself? Have you examined the copper you used, and are you sure that it contains no traces of arsenic?" Professor Taylor upon that dissolved a piece of the wire gauze in a solution which he knew absolutely to contain no arsenic. He got the arsenical stain from that, and then he found that there was no copper which did not contain arsenic, and that there was not a particle of arsenic in the fluid he had analyzed. And he had the boldness and the honesty, when he came to that conclusion, to confess that he had been mistaken. That is one of those things which show how, as Mr. Reddie and Admiral Fishbourne have pointed out, what are supposed to be scientific facts turn out to be no facts at all. The fact to which Professor Taylor swore on oath was that the

fluid contained so much arsenic. Now, to use Reinsch's test it was almost impossible to obtain pure copper, and when he attempted to do it by galvanic aid, even then it was difficult, for sometimes the electricity carried over from one pole to the other not only the copper, but the arsenic with it. What was it that caused Reinsch's test to supersede Marsh's test? Marsh's test was said to be the most delicate test for arsenic. But it was so delicate as to be almost useless, because it depended on your dissolving in nascent hydrogen the arsenic of your suspected fluid. You had to get your nascent hydrogen from two materials, zinc and sulphuric acid, but when Marsh's test was employed almost all the sulphuric acid of commerce contained arsenic, and so did almost all the zinc, and therefore you had to test your tests before you could proceed with your analysis. Reinsch's test was adopted because it was supposed to get over that difficulty; but now it is known that the chemist should have the same reason for suspecting that arsenic may be found in copper as well as in either sulphuric acid or zinc. This is an illustration to show that something more is required in attaining scientific facts than even the most careful and accurate power of observation. That, no doubt, is a great intellectual power, but at the same time I agree with one of Mr. Row's observations, that the men who devote themselves most assiduously to the mere observation of minute facts in nature are scarcely ever, from the habits they acquire, good general reasoners on general grounds. The eye can be readily adapted by training to the most minute observation, and may easily become more skilled and adapted to observe objects. The eye is a most wonderful instrument, from the power of adaptability which it possesses, and which enables the savages and Arabs to have long sight, while it gives to others who have to examine minute objects an almost microscopic vision. But that microscopic sight leads frequently to a microscopic structure of the mind. Most of the objections raised against Revelation come from those microscopic observers, and I think that matter was very wisely and forcibly brought before the world in what I think the most valuable of all Dr. Whewell's works, his *Bridgewater Treatise on Astronomy*, where he traced the difference between the sceptical mind of Laplace and the believing mind of Newton. Laplace's analytical powers were of the highest order; he was a trained manipulator of analytical formulæ. Laplace was a man whose mind was trained to the manipulation of mathematical formulæ and the interpretation of mathematical symbols. Whewell showed that that had contracted his mind, and prevented broad general views. His was the case of a mere inductive mind; but Newton's was a deductive mind. He was a man who put together what had been arrived at by the process of deduction, and strove to bind it up into a general truth; and Whewell showed that there was this difference between the two, that where the one mind became highly sceptical, the other became highly capable of belief. The more we investigate the matter the more we shall find that faith is an element quite as much required by the mathematician or the physicist or the philosopher, as it is required by the theologian. I agree with Mr. Reddie in thinking that the illustration of the great antiquity of man

was a faulty illustration, but I should like to carry it one step further. Let us suppose a hypothetical case. Supposing that human remains were to be found in the Silurian series; that would be a scientific fact that they were found in a certain stratum, in a certain position, underlying certain other strata. But while that would remain a fact, the conclusion that therefore those remains must be millions of years old, or at all events more than 6,000 years old—that conclusion I think is only to be arrived at by a process of reasoning which may be most essentially fallacious. I think there was a fallacy in the illustrations which Mr. Garbett brought forward. Mr. Garbett, I am afraid, like many others of our friends, has a certain lingering belief that the theories of geologists, which I believe to be mere hypotheses not founded on real facts, may some day or other be proved to be true; and this is an endeavour to hedge ourselves in such a manner that, supposing they are found to be true, we may still hold the Bible with them. But I say, first prove that these things are true, and then it will be time enough to see whether you require to accommodate your Bible to them. Suppose your Silurian men are found of a different creation: you have first to prove that they belong to a different creation, and then you have to prove their antiquity. It is very dangerous theology indeed, and cannot fail to be taken advantage of by the sceptic, when you say that the Bible is such an accommodating book altogether, that it does not matter whether these things are true or not for anything the Bible says to the contrary, and that there may have been hundreds of different races in existence. That is not my own view. It may be false, but I do not think that any man who reads his Bible honestly would say that it accords with the pre-Adamic hypothesis of the existence of former races. All sorts of efforts are made to make the Bible square with these hypotheses: this only arises from a great fear that science has proved that which it has not proved. I believe that the whole progress of geology is antagonistic to any such views; and if not, we should wait until geology has spoken a little more clearly, and leave geologists to fight their own battles among themselves. Then I believe they will come back to the six-days' creation, and believe that all races of men were derived from Adam, and that there were no pre-Adamic races at all. (Hear, hear.)

The meeting was then adjourned.