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for scenes as far surpassing those that we have hitherto seen, as the beauty of the present world excels the dreary and desolate aspect of the Azoic ages. Science and Scripture concur in saying that *Man does not belong to the past, but to the future*. To that future they bid him look, and for that future they tell him to prepare.

The CHAIRMAN.—In asking you to return your thanks to the author of this Paper and also to Mr. Walter Brodie for reading it, I may observe that Dr. Gladstone's Paper, which is to follow, is of such a cognate character, that, unless any one wishes now to make some observations upon the Paper just read, I think it will be more convenient to take the discussions on both papers together. (Hear, hear.)

The following Paper was then read :—

ON THE MUTUAL HELPFULNESS OF THEOLOGY
AND NATURAL SCIENCE. By JOHN HALL GLADSTONE,
ESQ., PH. D., F.R.S., *Mem. Vict. Inst.*

MAN, God's child, is put to school in this world, and among the books which he has to study is the varied volume of Nature. There he finds endless pictures to arouse his infant wonder; and there, if he read thoughtfully, he may learn much, not only of the mysteries of the universe, but also about the wisdom, power, and goodness of its Architect, and his Father. But this child is a rebellious one, and in order to restore him to the position which he has forfeited, and to reveal more fully the Father's will, message after message has been sent him from on high. In the book of Nature he finds a multitude of facts which he combines as he best can, and the result is Natural Science: in the volume of grace he finds a number of facts and statements, from which he builds up Theology. The lessons in either department, as God gives them, can scarcely be conceived as otherwise than absolutely true; but as apprehended by man, they are necessarily subject to human error; and thus his systems of Theology and Natural Science must always admit of correction and enlargement.

In this essay I propose to confine my attention to these two parts of man's curriculum—the knowledge of Nature and the knowledge of God; and I shall endeavour to show in what way they are mutually helpful.

The great difference between the two books is in the subject treated of; the resemblance is in their indications of the character and mind of their Author.

They tell of different things. The book of Nature appeals to the bodily senses, and the whole of its teaching relates to the physical universe, and to this life. It knows nothing of the spirit, and its destinies. The Bible, on the other hand, never professes to teach Natural Science. Its words, of course, are coined from natural objects and actions, and it makes large use of Nature in the way of illustration; but its subject matter is the moral law of God, the way of salvation, and eternal life. It is not in this direction, therefore, that we need look for much mutual confirmation, nor need we fear much disagreement.

The two books, however, as was just stated, resemble each other in their indications of the character and mind of their Author. Nature leads us up to the conviction of a Supreme Intelligence; the Bible assumes His existence from the beginning. The unity of design that runs through the universe bespeaks the oneness of its Maker; in the Bible we read, "Hear, O Israel, the Lord our God is one Lord." Nature shows us the superabundant evidence of power; the Holy Scriptures call God "Almighty." Our proudest achievements in natural knowledge are but the disclosing of a higher wisdom; the sacred writers stand amazed at "the depth of the riches both of the wisdom and knowledge of God." The philosopher and the inspired apostle agree that "in Him we live and move and have our being," and alike recognize His constant sustaining energy. In our study of the universe we come to a profound conviction of the uniformity of law; Jehovah declares, "I change not;" and even miracles appear in the Bible as part of the working out of a foredetermined plan. The terribleness of the Most High is seen alike in the world and on the page of inspiration. His justice and His goodness may be gathered, though somewhat uncertainly, from the book of Nature; but they are clearly revealed in His word. It is only when our accusing conscience forces the question of His mercy, and makes us doubt the possibility of His favour, that Nature is silent, and we turn to those better oracles which unfold to us the scheme of redemption, and assure us that "God is love."

There is also another kind of resemblance between the two books of Nature and Revelation, which springs from their having the same Author, and which I may, perhaps, be allowed to term the analogy of style. In both we find facts given abundantly, but no scientific systems; in both there is a wonderful unity of plan in diversity of operation; in both there is a frequent recurrence of types—that is, of the same Divine idea repeated, perhaps many times, but modified to suit the

altered circumstances. In both, too, we find a gradual development in time, the later additions being not mere additions, but also evolutions of that which preceded, and ever tending to what is more comprehensive and better. It would take me too long to work out and illustrate these points of analogy; indeed each might be the subject of an essay. I mention them because they have a direct bearing upon part of my future argument.

If there be truth in the statements hitherto made, we shall be fully prepared to find that the study of Nature and of the Sacred Scriptures are mutually helpful. I propose considering the subject under the three heads of Natural Theology, Evidences of Christianity, and Methods of Interpretation.

I. NATURAL THEOLOGY.—It is needless to say much on this head, for this is a department of Divinity which depends wholly, as its name imports, on the study of Nature. The pious in all ages have loved to trace the hand of God in the visible creation, and in doing so they have only followed the example of the inspired Psalmist, or have learned of Him who “answered Job out of the whirlwind”—of Him who on the Galilean mount drew lessons from “the birds of the air,” and “the lilies of the field.”

This habit of noticing the indications of the Supreme Intelligence may be of service also to the philosopher in his scientific pursuits. Thus, to take an illustration, a physiologist examining an eye will see its exquisite adaptation to the properties of light and the purposes of vision; but he may come across some muscle the use of which is not evident, or such an organ as the *tapetum lucidum* of the cat, and the conviction that this also has some “final cause” will probably lead him to discover the part it plays in perfecting the mechanism of sight.

Under this head of Natural Theology, may be mentioned another important service which the fuller study of Nature renders to true religion,—it clears away much rubbish; for science is the foe to superstition. The unknown or ill-understood forces of Nature beget a vague fear in the minds of the ignorant; the movements in the world around them appear the actions of spiritual beings; a roaring waterfall, a black damp cavern, a tree waving its branches in the moonlight, the sun beaming forth heat and splendour—each is inhabited by some mysterious agent, and the character of this spirit takes its hue from the character of the mind that imagines it. If the untaught man be gentle and comparatively innocent, the spirit will be a nymph or a fairy; if he be mischievous, a satyr or an elf; and if he be wicked, the mysterious being will be a demon as

licentious or as malignant as himself. I need not remind you of the multitude and variety of false religions which have these fancies for their basis. All such ghosts vanish at the sunrise of scientific truth. No man taught in modern science can any longer believe the statement of the Hindoo scriptures, that "heavenly cows hurl the destructive thunderbolt"; nor, as the lightning flashes around him, will his fear embody itself in the picture of Thor wielding his mighty hammer, or Jupiter Tonans grasping a handful of lightnings. In the mighty electric discharge he sees only one manifestation of a force which pervades all Nature, and is convertible into other forces, the varied exponents of that one Supreme Will whose wisdom ordained and whose power sustains the whole.

II. EVIDENCES OF CHRISTIANITY.—Natural Theology is not Christianity: its deductions may be perfectly true, and yet the Jewish and Christian Scriptures may be false. It seems to me, however, that the study of Nature has something also to say to this question, and that in more ways than one.

The accordance of the character of God, as we find it described in the Bible, with that deduced from Nature, is itself an argument in favour of the truth of Revelation.

The fact that the same difficulties which meet us in Revelation have their analogues in the world of sense, as shown by Bishop Butler and others, not merely serves to stop the mouths of objectors, but is of some value in establishing a common origin.

But there is a more important issue. Science sweeps away the rubbish of superstition;—is what we deem sacred truth likewise doomed to disappear? Facts seem against such a supposition. The present century, which has seen so wondrous an extension of physical science, is marked by an increase of religious earnestness; and it seems to me that, notwithstanding some great and peculiar perils, our age has the healthy sign of a more intelligent and painstaking desire to arrive at the true meaning of the Word of God than characterized any earlier period of the Church's history. If, moreover, we turn from the effect of Natural Philosophy on an age to its effect on individuals, do we really find that the pursuit of science overthrows the belief in the Divine origin of what is recorded in the sacred writings of the Jews and Christians? By no means. A singularly large proportion of the highest men of science of this and preceding times have been devout believers, or, at least, have acknowledged the truth of the Scriptures; while, if we descend to men of the second or third ranks, we find—at least in my experience—about the same proportion of Christians as in most other professions. It is true there are scientific men

who are infidels, and at the close of last century we saw on the Continent of Europe the sad spectacle of French Encyclopædists, and other learned men, labouring to extinguish the little faith that was then to be found in the world; but it remains to be inquired whether these men were not infidels before they were philosophers; and subsequent events have shown that they raised their pæan before they had won their victory; for the Bible is read now far more than it was then, and Christ has His disciples in the halls of Continental as well as British science.

And it has not been for want of will on the part of infidels that our Sacred Writings have remained the firm foundation of the faith of Christendom. As science after science has risen into notice, they have ransacked its storehouse in search of something which they could forge into a new weapon against the old book; and even the guardians of the faith have sometimes been the first to brand some new scientific doctrine as unscriptural, or to decry the whole investigation as irreligious. As time has gone on, it has occasionally happened that the scientific doctrine proved to be a crude and erroneous conclusion; or the suspicious theory being established, it has been found that what it opposed was merely the view of some Jewish commentator or Christian poet.

The history of astronomy is instructive in this respect. When it was contended that the earth, instead of being a flat plain was a round ball, with people walking on the other side of it, the idea was denounced as unscriptural and preposterous. After this was generally received, the Copernican theory of the solar system was promulgated, and then monks preached against the new heresy, and the authorities of the Church passed these two resolutions:—"1st. The proposition that the sun is the centre of the world, and immovable from its place, is absurd, philosophically false, and formally heretical; because it is expressly contrary to Holy Scripture. 2nd. The proposition that the earth is not the centre of the world, nor immovable, but that it moves, and also with a diurnal motion, is absurd, philosophically false, and theologically considered at least erroneous in faith." When, however, these propositions were universally taught, even at the Roman observatory, the immense magnitudes and distances of the stars were looked upon with suspicion as reducing our globe to a mere speck in the universe, although it is the theatre of man's probation, and of the Son of God's great sacrifice. But no educated man doubts these conclusions now, and in many a sermon, as in Dr. Chalmers's

Astronomical Discourses, they serve as an additional proof that "the heavens declare the glory of God, and the firmament showeth His handywork." Yet astronomy may still have its theological battles to fight: the nebular theory of the formation of worlds seems to be offensive to some religious minds, and if it be ever established, it will be in the teeth of opposition.

I think that without presumption I may suggest an idea as to the purpose for which Providence has permitted this difficulty to stand in the way of the reception of many scientific truths. It thus becomes clear there is no collusion between the teachers of physical and theological science; it is not a sacred priesthood, as in ancient Egypt, that holds the key of the mysteries of nature; and thus the ultimate concord can scarcely be suspected of being at the expense of truth. No doubt foolish attempts have sometimes been made to twist the facts of science and the statements of the Bible into harmony, as for instance, by some of the advocates in the great case of Genesis *versus* Geology; but usually the physical philosopher has calmly or boldly pursued his own line of investigation, and the theologian has inquired whether the apparent discrepancy has not arisen from a human gloss, or from a misunderstanding of the true province of revelation. And what is the result? There has been the din of battle, and the shrieks of the timid have been heard amid the shouts of the warriors: earthworks which the defenders of the faith have pushed forward have been repeatedly carried by the assailants, but the citadel of the word of God remains untaken, and its venerable walls are the more redoubtable on account of the sieges which it has withstood.

III. METHODS OF INTERPRETATION.—If two books were products of the same mind, and, especially, if they are written somewhat in the same style, we should expect that the study of the one would make us better fitted for understanding the other.

In treating of the analogies between the two branches of study here referred to, I may allude to the necessity of the mind being adapted to the reception of the particular kind of truth. This is mentioned first to obviate an objection that has probably presented itself already to the minds of some hearers, and which has, perhaps, clothed itself in the emphatic words of Paul: "The natural man receiveth not the things of the Spirit of God; neither can he know them, for they are spiritually discerned: but he that is spiritual discerneth all things." Indeed, ordinary reason is sufficient to teach us that if a man would apprehend the word of God, his mind must be

previously brought into unison with that of God; while experience proves abundantly that an intellectual worldling is often blind where an unlearned believer sees intuitively. And just so is it with physical science; the man who has not a loving interest in it, can never understand its doctrines, or weigh its conclusions.

Yet neither Scripture, nor logic, nor experience teaches that the spiritual mind is all that is needed on the one side, or the scientific mind all that is needed on the other side, in order to arrive at the fulness of the truth in either department of study.

Assuming then that each student is possessed of the proper receptive faculty, and a true interest in the subject, I proceed to notice several points of analogy in the temper of mind, or the intellectual processes required. The sketch will be a very rough one, and nothing more than a sketch; for the full illustration of the subject must be left till either I, or some one with greater leisure, may take up the subject in a separate treatise.

The first requisite for a successful prosecution of any inquiry into the ways of God either in Nature or Revelation, is a *reverent spirit*,—a desire to arrive at the truth—a remembrance that what we are studying is incomparably greater and nobler than our first impressions of it. This is surely self-evident. Flippancy is fatal to success. And here the student of each department may often learn a lesson from his brother; for, unhappily, there are theologians who think they can overthrow the careful deductions of scientific men by a few dashing remarks; while there are philosophers who anxiously inquire into the mysteries and apparent contradictions of nature, yet fling aside the Bible at the first seeming discrepancy either in its statements or (more foolish still) in the statements of its interpreters.

A proper reverence will evince itself, by the care taken to arrive at whatever is the truth, by the adoption of the best methods, and by a readiness to reconsider our views, whenever any new facts or fresh arguments appear to throw any reasonable doubt on their correctness.

Passing from this moral requirement to intellectual ones, we may remark that the first step in any process of investigation, is to *ascertain the facts* on which our conclusion is to be based. Now this is a most difficult thing, though, unfortunately, people often think it so easy. Thus, turning first to Nature, let any ordinary observer try to describe such a common phenomenon as the rainbow. What a string of errors his account will probably be as to its apparent height and size, its distance,

the order of the colours, their brightness, &c. Aristotle, who investigated the subject, says that the circle is of smaller diameter at sunrise and sunset than at any other period, whereas it is in reality always 82°. The history of science is full of such mistakes of eminent men, including Herodotus's lioness, which never has more than one cub; the consequence of which of course would be that the leonine race must rapidly become extinct, by its numbers being at least halved in each generation. And the popular beliefs, how strange they often are! There is, for instance, that of the influence of a change of the moon on the weather. How many of our weatherwise friends have noticed it a hundred times! And yet the highest meteorological authorities, after a series of observations continued through many years, have come to the conclusion that no influence of any sort can be traced.

Turning from natural to divine science, we find that the facts which we must collect are the statements of Revelation; but how difficult is it to quote the Bible correctly! Passing by the errors introduced by bad translations, there is the scarcely honest practice of cutting down a text, so as to produce such unqualified statements as "Hear the church," or "All things work together for good." There is the thoughtless practice of laying hold of anything within the covers of the Bible, and using it as authoritative truth, though it should be the words of the Father of lies,* the statements of wicked and designing men,† the mistaken opinions of good men,‡ ironical remarks,§ or sayings introduced by inspired writers only to be refuted.|| There is the ignorant practice of associating modern ideas with the ancient story; as the noteworthy reference of the Mormon apostle to Paul's sailing by the mariner's compass.¶ And there is the foolish practice of wrenching a text from its connection, and making it carry any meaning which the words seem susceptible of. Some of these, indeed, have become the popular meaning of the texts; as "one star differeth from another star in glory," which generally does duty to prove the different degrees of blessedness in the heavenly state, instead of the difference between celestial and terrestrial bodies, as the context at once would show.

Passing from the facts of Nature or Revelation to the language in which we clothe our impressions of them, it may be remarked that *the terms employed should be definite and appropriate.* Some words have necessarily a more complex signification

* As Job ii. 4.
 † As Isa. xxxviii. 18.
 ‡ As Col. ii. 21.

† As Luke xi. 15.
 § As Eccles. vii. 16.
 ¶ Acts xxviii. 13.

than others; and generic terms—such as metal, or minister—have a certain vagueness which does not attach to specific terms, such as iron or Levite. In the history of science, this ambiguity of terms has been a constant source of error. The Greek philosophy was rendered almost fruitless by it; and from that time to the present, some words, such as fermentation, have been used to express two or more different modes of action. Sometimes even now a word has a different signification among the votaries of one science to that which it bears among those attached to another: thus, if a geologist hammer out of a rock a bone or shell, which, in process of ages, has been reduced simply to phosphate and carbonate of lime, he places the relic among his “organic remains,” while a chemist examining the specimen, will pronounce it to be wholly “inorganic.” Other words, as Catalysis or Epipolism, seem to have been woven as a cover for our ignorance. And as to the appropriateness of terms—in inventing a name, a discoverer is tempted to make it express his own theory of the matter; the name thus becomes bright with significance, a spark capable of kindling a similar thought in those minds on which it falls. But, while there is a present gain in this, there may be a future loss; and it may be fairly questioned, whether a simple unmeaning name is not often preferable. The disadvantage is this: as knowledge increases the theory alters, and the word becomes inappropriate; and since it is very difficult to disturb a name which has acquired general acceptance, the facts continue to be presented to the mind under the old heraldic device, on which is conspicuous the bar sinister of an original mistake. Thus, when Priestley isolated a certain gas eminently capable of supporting combustion, he called it “Dephlogisticated air,” thus giving it a name that involved a theory then under discussion, and which shortly ceased to exist; and when Lavoisier renamed this gas, believing it to be the acidifying principle, he termed it “Oxygen,” the Acid-producer, and “oxygen” it has ever since been called, though chemists know that some of the strongest acids contain none of this substance. I would just remind those acquainted with the subject, how “chemical affinity” has come to mean almost the opposite of what the words naturally imply; and how what is called the “north pole” of a magnet is really its “south pole,” with reference to the north magnetic pole of the earth.

Turning from natural to theological science, we find the same dangers attending a bad choice or employment of words. While, however, theological terms are very often ambiguous, I believe they are more appropriate than those of most other sciences:

for the sacred writers themselves furnish the words—sometimes words of their own invention—and the duty of the interpreter is not so much to put the facts of revelation into appropriate language, as to discover the meaning of the words of Scripture, and thus penetrate into the revealed mysteries. This demands scholarship, no doubt; but what is far more essential, is a certain logical power of seeing through the significance of words in relation to their context. Sometimes a popular misapprehension of a term will greatly mislead; and it should be borne in mind that words are always shifting in meaning, and have to be brought back again to their true bearings by the public teacher, or they will go hopelessly adrift. For instance, how many hearing the verse “Now abideth faith, hope, charity, these three; but the greatest of these is charity,” have a confused idea that this pre-eminent virtue is little else than either almsgiving, or a disposition to condone the faults and errors of others!

If care had been generally taken to arrive at the true understanding of what is symbolized by the terms of Scripture, how many differences among Christian speakers and writers would be saved! Thus, faith is considered by some as totally independent of, if not opposed to reason, while others view it as the highest development of reason; again, some speak of faith as the same mental act, though exercised on different objects; while others draw distinctions between historic, saving, practical, miraculous, and other kinds of faith; and there is a popular use of the word which actually confounds it with superstition.

Would that theologians were content to employ scriptural terms, and that in their scriptural significations! We should then be saved from many an unseemly controversy.

* * * * *

In any investigation, beside the definiteness of the words employed, *the ideas themselves must be definite*. As instances of the contrary, may I not take almost at random, “A visitation of Providence;” “Nature abhors a vacuum” (at least up to 33 feet); and “Miracles are impossible.”

To think clearly in one department of knowledge is good training for thinking clearly in another.

Leaving many tempting points of analogy, I pass on to consider the most important of all—the formation of our larger generalizations,—what Bacon calls “*the raising of doctrines.*” For natural science is not a mere collection of facts, or even a classified arrangement of them; and theology

is more than a string of texts, even though they be selected to bear on one point.

In treating this subject, I must be permitted to glance back at past history, and in a few sentences to recall to your minds some of the broader features of the progress of thought.

We know little of the science of the Chaldeans, Egyptians, or Chinese, before the Christian era; but the works of many Greek philosophers have been handed down to us, so that we can form a good opinion of the way of thinking of the master-minds of that nation. While we stand awestruck before these mighty intellects, we are still amazed (perhaps amused) to see what a prodigious edifice of theory they could build on a small and often shaky foundation of fact, and how it was mental conceptions and not natural phenomena that formed the materials of their arguments. In the mean time the Jewish prophets, though generally exhibiting a loving admiration of nature, scarcely attempted to trace secondary causes. Afterwards there arose in that nation a series of commentators, who spun out a wondrous web of divinity and ethics, by as faulty a system of deduction from narrow premises as ever spoilt the philosophy of a Grecian sage. The fathers of the Christian Church were not much affected by these Rabbinical fancies, but Greek speculation had a more potent influence; and it is little to be wondered at that such mighty spirits as Plato and Aristotle cast a spell over the minds alike of the theologian and natural philosopher; and presently we find all parties bowing implicitly before the authority of the Stagirite.

* * * * *

But from the gloom of the middle ages a better philosophy began to dawn, and reformers arose both in the schools and the Church: they began to recognize a higher authority, and to allow "the ideas of the Divine Mind," whether in Nature or Revelation, to overthrow "the idols of the human mind." At length Bacon, with his "new engine," demolished the structures of the Aristotelians; and on a more careful inductive basis the temple of modern science has been erected.

* * * * *

Thus, while the mediæval natural philosophy is only known by its fossil remains, the huge saurians, the pterodactyls, or the mammoths of former theological epochs still walk the earth; or, to return to the old figure, I am sure that each of my hearers, whatever his own religious views may be, will readily **acknowledge** that while the rubbish of astrologers and alche-

mists has been cleared away, he is surrounded by faulty theological systems, some in ruins, some tottering, but others still erect, though doomed to fall.

The true method of interpreting either Nature or Revelation so as to build up a scientific system, is, *first to collect all the known facts of the case, and then to form a theory, which, without going beyond them, shall include them all in its explanation.*

Though this principle is well known, and has been often recognized both theoretically and practically in each of these departments of knowledge, and in others which we are not now considering, it may not be superfluous to illustrate it step by step.

First, as to collecting all the known facts bearing on a particular subject,—in the world of sense this is generally a very arduous undertaking, or rather, the wider we push our inquiry the greater becomes our knowledge of the facts,—in matters of revelation it is not so very arduous, for the Bible is a limited book, and the additional facts of Christian experience are gathered without great difficulty. The natural tendency of the human mind to select involuntarily one particular class of facts, and to found its conclusion on them, is a fruitful source of error and controversy. The history of geology and mineralogy furnishes us with a remarkable instance in the fierce and acrimonious discussions of the Vulcanists and Neptunists at the close of the last century. The one party, fixing their attention on the basalts, traps, and granites, held that the configuration of the surface of the earth was due to the agency of fire; while the other party, finding everywhere hardened sand and mud filled with organic remains, contended that the whole of the land was a deposit from water; and each one insisted that the opinion of his party was the only orthodox one, till a better school arose, and pointed out that in the production of the multifarious rocks and strata of our globe both agencies must be recognized. Just so in theology, there are those who think of “the man Christ Jesus,” as He wandered about Galilee or Judæa, often hungry and weary, thwarted in His wishes, imperfect in His knowledge, and saying such words as “My Father is greater than I,” till they adopt Arian or Socinian views; while there have been others, who seeing in Christ the authoritative worker of miracles, the divine Logos, the Creator of the worlds, and hearing Him utter such language as “I and my Father are one,” have sublimed away His humanity, and formed for themselves views like those of the ancient Docetæ. But each of these doctrines is erroneous, in

as far as it ignores or denies the opposite truth, and they must both be combined in a true theory of the God-man.

* * * * *

The theory must not go beyond the facts. But how hard it is for imagination to bear the harness and the bridle! We see a piece of rubbed amber giving rise to certain phenomena of attraction and repulsion, and we spring to the supposition of an "electric fluid." We count seven colours in the solar spectrum, and we at once associate it with the gamut of music; or we read, "Render unto Cæsar the things that are Cæsar's," and we conclude the divine right of kings. Of course it is when we have a strong preconceived notion, that we are sure to see proofs of it everywhere. A man is easily supported on a one-legged stool if his own two feet are firmly fixed on the ground.

* * * * *

Oh for that intellectual temperance which would prevent our seeing in Nature the products of our own brain, or drawing out of a Scripture statement what we have ourselves put into it beforehand!

A good theory must include all the facts in its explanation. That advance towards a true conception of Nature which should mark the progress of every physical science, is only to be obtained by the gradual replacement of the first hypotheses by such as are founded on a larger generalization. Thus the idea that heat was some imponderable form of matter, which could be transferred from one substance to another, and could remain latent among its particles, was once deemed competent to explain the various phenomena; but now its incompetence is fully recognized, and we are led to regard heat as one of the ever-shifting forms of force, so that our measure of it now is expressed in terms of foot-pounds, that is, of the amount of force required to lift a pound weight through a space of twelve inches. Similarly, we should expect that in the progress of Divine science our doctrines should become fuller and truer, as we sound more thoroughly the depths of the Divine word and the dealings of Providence. I must, as before, select an instance. Suppose we are investigating the benefits which flow to mankind from Christ's death, we must enter into the meaning of those typical sacrifices under the old dispensations by which atonement was made; we must listen to the utterances of the prophets; we must catch the allusions of Christ to that future scene of suffering which appears to have been constantly present in His mind; we must study the simple narratives of the

crucifixion; and we must try to discover what is involved in the Apostles' preaching of the cross, and in such words as propitiation and ransom, reconciliation and eternal redemption. Then we shall scarcely be satisfied with the opinions of Anselm, or Abélard, or Bernard of Clairvaux, but we shall endeavour to include the whole of the Scriptural statements in our great conception of the Saviour's sacrifice.

I have thus endeavoured to illustrate some of the points of analogy between the methods of interpreting Nature and Revelation; and it is on this account that the present lecture has been written, for I want to plead for the larger introduction of the study of Natural Science into our schools of Theology. The power and usefulness of the Christian ministry in the future will depend little on their ability to make verses in dead languages, or on their knowledge of the differential calculus, but it will depend greatly on their being abreast of their fellow-thinkers in their appreciation of those processes by which truth is arrived at. Every parish priest, and every teacher of religion, must be more or less an expounder of the word of God, and it is surely desirable that he should enjoy, as far as possible, the advantage which may be derived from a knowledge of those methods of investigation which have proved so fruitful in a kindred region of thought,—a region where calmness is more easy, for human passions and human interests are less involved in the issue,—a region, too, where the conclusions are more readily brought to the test of direct experiment than they generally can be in the domain of Theology. I do not forget the greater importance of those studies which bear directly on the duties of the sacred office, but I plead for the study of Natural Philosophy because I believe in its peculiar adaptation as a trainer of the mind in the pursuit of truth.

There will be also minor advantages. A better acquaintance with physical science will remove distrust, and enable the sacred teacher to feel as well as to repeat, "The word of the Lord is right, and all His works are done in truth." And then again it will furnish the preacher with an abundant store of illustrations, such as adorn Moses's Song of the Rock,* or Paul's argument about the resurrection of the body.†

I feel that my train of reasoning has led me to speak of the services rendered by natural science to theology rather than those rendered by theology to natural science. The advantage of their mutual intercourse would seem to be on the side of theology. Perhaps it is so, and perhaps it is right that it should be so. Theology is the queen of sciences: it is befitting that

* Deut. xxxii. 1—43.

† 1 Cor. xv. 35—44.

those of lower rank should wait upon her. Yet, if I had spoken not of theology, but of the Christian religion, I know not but that the obligation would have been on the other side. Human philosophy has done little to make men better Christians; but had Christ never become man and suffered, or had the Holy Spirit never been poured out, it may be a question whether the race of man would not have sunk lower and lower in their degradation, and whether there could have been that state of civilization which allows of the calm pursuit of intellectual studies, or that mutual confidence which is necessary for such great undertakings as the establishment of museums, the perfection of large and costly machinery, or the laying of submarine telegraphic cables. But I care not to compute too nicely the gain on either side, but rather to remember that every honest student may be the servant of Him, who has given to us the command, "By love serve one another."

The CHAIRMAN.—I am sure you all feel very much indebted to Dr. Gladstone for his paper; and I may say that both Dr. Gladstone's paper and the preceding one exemplify one of the canons which Dr. Gladstone has laid down,—namely, that the first requisite for a successful prosecution of any inquiry into the ways of God, either in nature or revelation, is a reverent spirit. I am sure you will feel that that marks both the papers we have heard this evening; and I now call upon any gentleman who wishes to make remarks on these papers, to do so.

Capt. FISHBOURNE.—There was another canon that Dr. Gladstone gave us, which is a very excellent one, and which, I observe in the paper, is marked in Italics,—*That we should first ascertain all the facts upon which our conclusions are based.* Now I observed that in the first paper all the facts are assumed, and I must protest against this—against taking for granted that all the conclusions advocated by geologists are true. It appears to me they are all rather in question; and the whole argument falls to the ground, if that be so. Mr. Brodie argues as if the current system of deposition and of the stratification of the earth were quite true; but in the paper read at our last meeting, we were told that Professor Ramsay had alluded to strata in extent equal to an English county, that had all been turned upside down. In Mr. Brodie's paper the question is begged, while we want proof; and until we have that we cannot admit the order of stratification. Again, in the paper it is assumed that the earth was once a great many degrees hotter than now—that the world was at one time a globe of fire, and gradually cooled down;—and that this accounted for the tropical plants, and evidence of tropical signs in this country and in Spitzbergen. On the contrary, however, it appears that will not answer the case at all. You may have a hotter climate the result of internal heat, but that will not give the tropical rays of the sun or the plants of the tropics. In this view is wanting

that characteristic adaptation which is found all over the world at the present moment:—it does not account for the tropical plants requiring the sun's rays and the showers of a tropical climate ; for mere heat below would not give these. I need say no more about Mr. Brodie's remarks, because I think they fail, from not being founded upon established facts.—Dr. Gladstone's paper was on the subject of the mutual helpfulness of Science and Scripture ; but, as he tells us, he went rather on the one side ; and I strongly feel this, that it is in this way that science is doing one of the greatest injuries to Scripture that is possible at the present moment. There is a passage in his paper which shows what I allude to ; and I am sure, that if he had thought of it, he is really of the same mind as myself. I allude to the passage where he quotes from St. Paul, that “the natural man receiveth not the things of the Spirit of God.” The meaning of this is, that as respects Scripture, it is indispensable we should have a power—the teaching of the Holy Spirit—to enable us to understand it ; but Dr. Gladstone draws a parallel between Philosophy and Scripture in that respect ; whereas there is this characteristic difference between the two. I say that elevating the requirements of philosophy, into the position of a strict parallel with the requirements for the interpretation of Scripture, has just this effect, that men fancy that by mere force of intellect they can understand all Scripture. Now, I say, that this is most fatal ; and that as long as any idea of that kind arises in the mind,—while it ignores, either directly or indirectly, that indispensable power for the understanding of Scripture,—it is not helpful, but exceedingly injurious, and I think that view is a main defect in Dr. Gladstone's paper. I am sure we are one in sentiment ; but in the paper he has overlooked the point, perhaps from writing it hastily.

Mr. WARINGTON.—I confess on looking through Mr. Brodie's paper as Captain Fishbourne was speaking, I failed to see there any assertion on the part of the writer that the earth was at one time hotter in consequence of internal heat. I find it there stated that “a larger proportion of the carboniferous element was diffused through the atmosphere, and that there is reason to conclude that the average temperature of the globe was much higher than that which now prevails ;” but I did not see any assertion as to how it came to be higher, nor did I see any assertion of our globe being originally a molten mass—

Capt. FISHBOURNE.—I said it was assumed ; I did not say it was asserted.

Mr. WARINGTON.—I am not disputing that it is possible the writer of this paper may have had that theory in his mind ; but I do not think he has so expressed himself as to be open to the charge of having bound up the lessons which geology teaches, with particular theories which may be erroneous. No theory of geology will ignore this, that the earth has existed a long time and gone through many changes, and that man is about the last being that has been created on the earth ; and as these are the whole foundations of the lessons which Mr. Brodie draws, I think it is hardly fair to say, because there may be a particular detail questionable here and there, that his whole paper is at fault. Surely we are too much disposed, in looking at these questions, to

forget that all our knowledge rests on probability. That was the great thing Bishop Butler insisted on in his *Analogy*, that probability is a fair foundation for practical conclusions. I think, then, that in these matters of science, we are not to say, because a certain thing is not mathematically demonstrated, therefore we are not to take it as a basis of argument. If so, we should have no arguments at all. Our chairman has told us that in the purest of all sciences, mathematics, there are propositions taken as bases of argument which cannot be demonstrated in mathematical fashion—they are assumed ; so that even in that science we have to take probability into account. Hence I take it, that all we can fairly demand in taking any conclusion of science as a basis for argument, is that it should be a probable conclusion. To pass to the second paper ; it struck me that the objection which Captain Fishbourne raised against it, arose from a misunderstanding of what the author of the paper intended to convey. As I heard it and read it, it did not seem to me that Dr. Gladstone meant that it was the same quality, the same faculty of mind, which rendered man able to interpret the facts of nature scientifically, that would enable him to interpret Scripture scientifically ; but rather that there was in each a true and proper faculty, and that so far the two cases were analogous ; because just in the same way as the scientific faculty of the mind was required for the investigation of the facts of nature, so the spiritual faculty of the mind was required for the investigation of the facts of Scripture. It struck me that the position Dr. Gladstone took up was one of great importance with a view to tracing out the analogies which exist between nature and Scripture in this way. It gives a useful answer to objections which are raised at the present day, something in the same fashion as the great work of Bishop Butler on *Analogy* did, to objections in his day. For there are certain prominent fallacies put forward by some thinkers now, which can be met most effectively by this analogy between science and Scripture. I will take two, which are hinted at, though not worked out, in Dr. Gladstone's paper. In the first place, we are constantly hearing men say that there is but one standard in theology, and that is conscience ; and of course if we reason on *à priori* principles, we must admit that the standard of ultimate appeal is man's conscience. There may be others, but we must come at last to the practical one, the ultimate one, and that is conscience. The conclusion drawn is, that, consequently, whatever a man's conscience thinks right, is right. Now, to turn to science ;—the ultimate standard of appeal, by which every scientific conclusion has to be judged, is reason. And this not merely reason generally, but by each man's faculty of reason. But would it therefore be fair to jump to the conclusion that what every man's reason decides is science ? Certainly not. We see that although reason is the true faculty to which appeal must be made, yet that faculty has to be educated, and must have before it a proper estimate of the facts of the case on which the conclusion is to be based ; and unless these are kept steadily in mind, it is extremely probable that reason will come to a wrong conclusion ; and thus though the right standard may be

referred to, that standard will give a wrong verdict. So, if conscience is not educated to discern right and wrong, and you have not considered the full estimate of the facts of the case, you are liable to make similar mistakes in religion; and therefore, just as you say to a man in regard to science, your individual reason is not sufficient ground for adopting a conclusion; so also you may say to a man in regard to religion, your individual conscience is not a sufficient ground for adopting any conclusion. To take another parallel case, we hear it constantly said by persons who uphold conscience as opposed to authority: We are to search out everything for ourselves, and believe nothing on trust. Now, if we look at this matter on *à priori* principles, it is right that we should search out everything for ourselves, just as in matters of science, the scientific student is supposed *à priori* to search out everything for himself. But what is he obliged to do practically? If he wants to learn astronomy, for instance, he does not immediately begin investigating the minutest principles of his science, and go through every step. No; he takes a manual of astronomy and learns first of all the conclusions to which others have come in the science he proposes to learn. Then when he has mastered these conclusions, if he thinks a point defective, he tests it, and puts the whole into practical use; and if it passes this greatest test of all, the test of practice, he does not quarrel with the conclusions of others, but accepts certain things, contrary to the theory of science, on trust. And so it is precisely in theology; the student does not begin by questioning the fundamental positions of theology, but learns of his teacher or theological manuals; then he puts their conclusions to the test of practice, or tries any particular point which seems defective, and decides whether it is true or not. It struck me that in this kind of way the false positions taken up by theological sceptics at the present day may be advantageously met, by showing that precisely the same thing is done in the matter of science; especially as it is on the scientific method that our sceptics profess to deal with Scripture. We should say to them, then, Deal with your conscience in religion in the same way as with reason in science. Deal with authority as to theological conclusions arrived at in days gone by, in the same way as you do as regards scientific conclusions come to by investigation in days gone by; and you will find your objections touching conscience and authority fall to the ground. In this way, I say, science may very notably be the helper of theology.

REV. DR. IRONS.—What has fallen from the preceding speakers has failed, I confess, to reconcile me altogether to the thesis which Dr. Gladstone has attempted to demonstrate this evening. I am reluctant to admit the expression that science is helpful to Revelation, or Revelation helpful to science. I think that Revelation being most distinctly the impartation of truth from God to us, does not as such need help from science or man at all. Of course there is a sense in which every external instrumentality may be said to be helpful to it. Language may be said to be helpful to the promotion of the cause of religion, and so may all social institutions; and in that sense I, of course, cannot deny that science may do a little in helping the education of the human mind. It certainly has done but little as yet, though it may do more in time to come.

But as to its being helpful in any higher sense, I confess Dr. Gladstone has failed to convince me. If he will excuse my saying so, I think there did prevail throughout his essay a kind of patronage of theology, a kind of treatment which I think, as theologians, we do not desire. I do not, as a theologian myself, wish to be patronized. Believing that Divine Revelation is actually true, I ask no favour to be shown to it whatever. Let it confront the world in its own way, and I am quite sure it will answer for itself. If it be not capable of doing so, it is not of God. Then the tone which was adopted in some parts of this well-meant paper, seemed to me to be otherwise scarcely respectful to our side—the theological side—of the subject brought before us. Indeed, Dr. Gladstone admitted that he had paid rather more attention to the other side, and in some degree in one passage he apparently apologizes for it; yet I thought the apology a somewhat awkward one. It is that sort of apology which we make to a lady when we tell her, in some very complimentary way, that we defer to her judgment, that she is our queen! And “queen” was the title assigned to our science,—not by Dr. Gladstone in the first instance, I grant, but in his paper to-night, in a somewhat new sense,—a sense which seemed to me to be about as respectful as that which I have just indicated. But there were graver things that arose in my mind many times as the paper proceeded. One or two points seem to me to show that Dr. Gladstone has not given that close attention to theology that he undoubtedly has given to science. He may probably retort that on me; and I cannot help it. But I think in his case, it would have been well if he had not classed Anselm on the doctrine of atonement with Abélard and Bernard of Clairvaux, as though there were anything in accordance between them—

DR. GLADSTONE.—I referred to them as holding totally different views!

DR. IRONS.—I only mention that as an instance of a kind of treatment of theological science which, I think, would scarcely have been thought respectful, if it had proceeded from our side towards natural science. It would have been thought to have been a mingling together of incongruous and impracticable theories, as if all were science alike. But with respect to one part of Dr. Gladstone’s paper, I have to take a much stronger line of objection. He says that the Bible is so much easier to understand than natural science. You will recollect the passage, as the paper has been so recently read. He seems to consider even the language of the ancient prophets to be so extremely intelligible that any one might make out their meaning for himself. Now I do not hesitate to say, that if he would take the prophet Isaiah, and read it through (in the Hebrew) with care, and take his pen and endeavour to put down in plain modern language side by side, in a parallel column (in language such as *The Times* newspaper, for instance) the exact sense of the prophet,—what he means in every phrase,—Dr. Gladstone would certainly not arrive at any of these conclusions concerning any single chapter of Isaiah, which have been universally taken, in the Christian Church, as being the sense of the prophet. I am persuaded there would be found in the literal language much more that is acceptable to a Jew than to a Christian. And yet, notwithstanding this, we should accept

the Christian interpretation of Isaiah, for instance (and I only give that as one example) and not be prepared to accept Dr. Gladstone's dictum, that we can ascertain its meaning for ourselves, in that off-hand way which he seems to suppose in this essay. I am perfectly sure that, apart from the hereditary faith of the Church, we should not be able to interpret truly the Old Testament prophecies. Take, for example, the prophecy concerning the Child that was to be born, whose birth we celebrate on Christmas Day. We read, that "before that Child should be able to know good or evil, the land would be abhorred of *both her kings*." All such details connected with the prophecy, literally and simply understood, would lead to a distinctly Jewish interpretation of the whole. I mention this as one warning as to the way in which the whole of Christian truth may be cut from under our feet, if we were to adopt the rule implied in this paper, of reading by our own wit the Old Testament, instead of being led by the Spirit of God to those interpretations handed down from the days of Christ. It was not my intention this evening to address you at all. I have been, though interested in the subject, so engrossed by other matters, up to the moment of my coming here, that I have been unable to do justice to the subject, in any observations I might have wished to make; and you must forgive me for speaking in this desultory way. I do feel that this is an important Institution, and that every subject here discussed ought to be watched with care. I should be sorry indeed if any paper read in the Victoria Institute should give currency to the idea that we are going to "help Revelation" in any way. Let us remember that we must be helped by Revelation, rather than that we can assist it. The passage which I referred to before, my eye now falls upon—"Theology is the queen of sciences, it is befitting that those of lower rank should wait upon her." Wait upon her! With reverence, surely; in a lowly and distant spirit of homage, if you will; but not wait upon her in the spirit thus intimated; for here she is set before us, as not only having an equal, but perhaps an equal of a somewhat domineering character, in this natural science! No, I must entirely dispute, either that science receives help from us, or that we receive help from science. I have not yet glanced, indeed, at the other side of the alternative. But I quite admit that it is not our business, as theologians, to import into science any of our dogmas. The two subjects should be pursued with independence of thought, and with fearlessness as to all conclusions. Reverence, indeed, in both should be predominant, for if there be not a reverent mind, I cannot conceive that any one would be either a truly scientific man or a good theological student; but the two things must stand on their own merits. Science must be pursued for its own sake, humbly, fearlessly, truthfully; and so also Revelation; but that must further be aided externally by the gift of God directly, and internally by the Spirit of God applying His truth to the soul of man. I have no further observations to address to you on this paper, and I thank Dr. Gladstone for his patience in listening to these few remarks.

Mr. REDDIE.—I should wish to notice first the remarks of Captain Fish-

bourne with reference to Mr. Brodie's paper. While I quite agree with Captain Fishbourne, that some of the assumed facts in the paper may not be regarded as facts by many of us here now,—and especially after Professor Kirk's able Discourse upon the history of geology ever since geology became part of the science of the world,—yet I think Mr. Brodie puts it very modestly in his paper, that he is only assuming certain conclusions in the meantime, without stating that they are ascertained facts:—his words are, “without stopping to inquire whether the facts on which geologists raise their hypotheses, have been ascertained with accuracy;”—and I think the paper is valuable in this respect, that assuming all those long epochs, and assuming even the now extinct “Azoic ages,” we find that a reverent spirit can still extract grounds to support his belief in a Supreme Being of Almighty power and wisdom, and yet perceive that man occupies that position in the world, even upon these suppositions, which he also is shown to occupy from the teaching of Scripture. Of course, it is always to be preferred that arguments should be based upon what are perfectly ascertained facts; but I think it must be in all our recollections, that most of these assumed facts in Mr. Brodie's paper, have been taught as the certain facts of geology during the last twenty or thirty years. Some men also, we know, have made use of these same “facts” to teach impious doctrines, or to oppose Revelation. And it is, therefore, of great consequence to find that a gentleman like Mr. Brodie,—himself an able geologist, who has written one of the best replies to Sir Charles Lyell's book on the Antiquity of Man,—can extract proper notions of the Deity, and of man's position in the world, from those same facts from which others have drawn very different deductions.—I come now to the more important paper of the evening. I do not quite go with Dr. Gladstone's mode of treating the subject of his paper, especially when we view it with regard to its title,—“The Mutual Helpfulness of Theology and Natural Science.”—I however consider this a fair subject for philosophical consideration, and I cannot agree with Dr. Irons in saying that the one cannot derive any benefit from the other. Still, it strikes me that Dr. Gladstone (as he in fact himself states in his paper) has not treated the subject of their mutual helpfulness, but rather the respective modes of interpreting the two sciences, Theology and Natural Science, and drawn analogies between them. Now, of course, there are analogies, or ought to be, between all kinds of right reasoning; and if you have not a fact to deal with, you cannot very well reason soundly, or at least, to any good purpose. You may assume a hypothesis, and say that such and such follows; but this too often results in idle speculation.—I must now notice some incidental remarks in the paper, although I consider that there is this mistake throughout, that it does not quite fulfil its promise; for I do not know in what respect it has shown us that science helps theology or theology helps science. In the opening of Dr. Gladstone's paper, the first thing I find to which I should venture to demur, is the almost hopeless view he seems to take of the whole subject. He says that our “systems of theology and natural science must *always* admit of correction and enlargement.” Now to me that sounds too like Pilate's

question, "What is truth?" I have greater hopes of both than that; and trust that science, as well as theology, is on a sounder basis, and that we are not destined to be ever learning, and yet "never able to come to a knowledge of truth." Then he says, "The book of nature appeals to the bodily senses, and the whole of its teaching relates to the physical universe, and to this life." I must also demur to that. I do not know what Dr. Gladstone means to include in natural science; but I consider that some of the heathen in their "natural science" taught more as regards another life than almost our own Christian theologians. For instance, the immortality of the soul has been almost demonstrated by Plato and the Greek philosophers, while it is a question scarcely argued in the Christian church. It has been assumed no doubt, and many other arguments have been added, in connection with the resurrection of the body; but I fancy no Christian theologian would like to throw aside the teachings of pure natural science, or human philosophy, on that subject. Then I find St. Paul himself making use of natural science to aid theology (I say this in all deference to Dr. Irons's opinion); and he does so, no doubt, because theology has for its basis, belief in God; and St. Paul appeals to things visible as proving the existence of the invisible Deity; thus also showing us that even natural science does properly deal with something besides this life and mere material things.—(Dr. Gladstone here made an observation to the Chairman.)

THE CHAIRMAN.—I think Mr. Reddie means this, that he considers natural science in a wider sense than Dr. Gladstone has done, and would include in natural science, mental philosophy, and I suppose what the Scotch term "the humanities."

MR. REDDIE.—I include all human philosophy, and that is why I think this Society has such a wholesome range in its scope. We are not a mere "scientific Society" in the narrow modern sense, but truly a philosophical Society—

THE CHAIRMAN.—I think Dr. Gladstone's paper was directed to the one branch of science, which I should term "Natural Philosophy," rather than as including the whole range of philosophy.

MR. REDDIE.—I would scarcely like thus to dissociate the various branches of human philosophy or natural science—for instance, natural philosophy from natural theology. But I shall endeavour to bring out my views, and also to show what is found in Scripture, in their justification. I would agree with Dr. Irons that "science," in our modern sense, is not made use of in Scripture; but if by science you mean a true knowledge of certain things in nature, without any pretence of going into the depths of nature and beyond what we do know of the laws affecting these things, then I consider that Scripture makes very great use of science in this sense. It does not profess to propound the particular laws that regulate the movements of the heavenly bodies, but it recognizes most distinctly that they are regulated by law, as in the phrase, "He hath given them a law which shall not be broken." Again, we have the verse, "The Heavens declare the glory of God;" teaching us, therefore, that the contemplation of the material heavens ought to lead the

mind of man beyond the visible to the invisible. Now, that is the essence of what we properly call "Natural Theology;" it is, I might say, the constant burden of the teaching of the prophets in the Old Testament as against idolaters; and it is just what St. Paul argues to the Romans. The allusions to the facts of natural science in Scripture are often incidental, and yet I venture to say they are always characterized by extreme accuracy, although necessarily appeals to the actual knowledge, or science, of those addressed. When Dr. Gladstone tells us that the notion of the earth not being a level plain was opposed as being unscriptural, I can only say that whoever made that objection must have known very little of the Scriptures. What is the fact? In the Book of *Job*—and I believe that is the oldest book in the world in which the idea occurs—the earth is distinctly spoken of as hung upon nothing, or as we should say, suspended in free space, in the beautiful passage, "He stretcheth out the north over the empty place, and hangeth the earth upon nothing." There is there no notion of a flat plain with a solid arch over it; but, on the contrary, as correct an allusion to the earth as we now understand it, as a globe suspended in space, as we ourselves could indite. Then in *Job*, besides, look at the allusions to the sweet influences of the Pleiades, and to some other of the constellations. I believe it is also the first book in which the extraordinary far-sight of the eagle is noticed. This fact in natural history you will find in modern books, like Bishop Stanley's *History of Birds*; but many such facts are now spoken of always as if only we moderns had discovered them; and we take credit for this, though you may find them in the Scriptures. The theory of the circuits of the wind and what we now call "the law of storms," was suggested by the language of Scripture, as has been frankly acknowledged by Captain Maury. There are many other allusions to the facts of nature in Scripture which are very important; and I must say I think Dr. Irons has overlooked them, and will acknowledge this, because some of them have an important bearing upon those teachings of Christianity which relate to the mysteries of grace. For instance, there is St. Paul's argument from the engrafting of the wild olive.* Now, it is a very curious fact, that we have nothing in science, so far as I am aware, to explain to us what constitutes the difference thus produced between the wild and cultivated fruits. We are all acquainted with the fact, and with the mode of engrafting upon the wild tree; but we cannot convert the latter into a cultivated tree without this mysterious engrafting. We must all recollect how St. Paul makes use of this, as an analogy between nature and the operation of grace in man. I recollect, at the meeting of the British Association at Cambridge, in 1862, hearing Dr. Gray, of the British Museum, speak, if I may so say, an admirable "paper" to a number of gentlemen around him out of doors, in the course of which he declared there was no cultivated plant and no tame animal that had not always been cultivated or tame from time immemorial. And he then challenged Colonel Sykes and

* This method of reasoning is, moreover, strictly "theological;" for instance, in the Athanasian Creed we have the argument, "For, as the reasonable soul and flesh is one man; so God and man is one Christ."

other travellers and naturalists who were present, to adduce a single instance of a tame animal that had originally been wild, or of a cultivated plant that had originally been a wild one. Among many others, which he showed to be groundless, (such as the potato and domestic fowl and turkey,) the case of the horse in the Pampas was brought forward ; but Dr. Gray was prepared to prove that the Pampas horse was descended from the tame animal, which had been imported into South America from Europe and allowed to become temporarily wild. Besides, the Pampas horse is not, properly speaking, "wild," for the moment you put a bridle upon him he submits, and his tame nature shows itself. But you cannot do that with really wild animals, like the zebra, or the wild ass, the untameable character of which, also, is recognized in *Job*. Now, if we consider the use which St. Paul made of his knowledge of the process and effect of engrafting, to teach the mysterious power of grace ; and also of the sowing of seed or grain, from which we raise the crop of grass or wheat that grows afterwards, to illustrate the doctrine of the resurrection ; I think we must admit that there are apt analogies in nature, which may most fitly be made use of, to help us to understand theology and certain parts of religion. So, our Lord, in His teaching in the Sermon on the Mount, tells us to "consider the lilies of the field, how they grow ;" and He alludes to the feeding of the ravens by God ; thus showing us that we ought to derive sentiments of natural religion (which will so far concur and agree with revealed religion) from the study of the objects in nature. That being the case, I should be sorry to think there should ever be such a total dissociation between theology and natural science as some in the present day contend for. There is this further thing I would venture to say,—though we ought to be most cautious and not presume to found arguments for religion upon mere imagined knowledge of the laws of nature,—and it is this :—that there can be no harm in taking any of those scientific discoveries, about the truth of which there can be no question, and arguing from them to something higher. I will now, therefore, instance a case in which we may thus make use of our more advanced scientific knowledge as an aid to faith. I do not believe it was possible for the ancients, with the knowledge of physics they had attained, to have such a perfect appreciation of the reasonableness of some of the doctrines laid down in Scripture, (as, for instance, the doctrine of the Holy Trinity, and what is also said of "the seven spirits of God," who is yet "the One Eternal Spirit,") as we can now have, knowing as we do that white or colourless light is actually composed of the three primary colours, with their seven brilliant prismatic shades. I think, therefore, our science of light is a help in that respect to us. I also think that all true natural science may well play its part thus, and "wait upon 'the Queen of Sciences,'" without assuming in the least an improper position. Lord Bacon well said that "natural philosophy is the handmaid of religion ;" but in saying this he never meant that science was to intrude upon things supernatural, which can be only known to us by Revelation. Nor should the perversion of true science by others frighten us from its legitimate and rational use. We must recollect that the foundation of all religion is a true belief in Deity, and in God's

benevolence and wisdom, as well as in His power and eternity. And it is surely by tracing the signs of design in nature, and understanding the various uses of the organs of the body and the marvellous laws of adaptation and compensation throughout nature, that we may best arrive at a higher appreciation of God's wisdom and goodness;—better than we ever could attain if in a state of ignorance of nature. On the other hand, religion, in its turn, has especially benefited our natural science, and above all “the science of man,” by throwing light upon what was felt by the earnest heathen philosophers to be dark as regards the origin of evil, and difficult as regards man's nature and future destiny. It has taught us God's mercy in a way that no mere natural science could have ever reached, and thus has enabled us to understand how the evil in the world, “that mars the fair face of creation,” is to be redressed by the Creator.—But I must pass on to another part of Dr. Gladstone's paper,—that in which he pleads for a “larger introduction of the study of natural science into our schools of theology.” I am afraid we ought to be warned to be cautious as to this, from actual experience of what might be the result. Cambridge, I believe, turned out Dr. Colenso somewhat better taught in the science of the day than in theology. It would depend upon *how* science is to be taught. I am afraid that we might have an enormous amount of bigotry (I can only use that term) introduced into the teaching of our theological colleges, were all that passes for science to take a higher and more positive place than it does at present. Only remember what scientific varieties our students would have been taught in geology, had there been a “Natural Science Tripos” at Oxford during the last twenty or thirty years; because they could only be taught science in one particular way at a time, or they would be “plucked.” With Mr. Mitchell in the chair, I may venture, perhaps, to speak even a little plainer, and ask him, whether there is not a good deal too much of irrational “cramming” at Cambridge already, in the matter of mathematics? Men are expected to get up certain transcendental propositions and repeat them, whether they understand them or not; and I appeal to our chairman, as an eminent Cambridge mathematician, to say whether this is not a fact that may be stated in the face of the world? What could have been the advantage of teaching theological students to accept as scientific truth the doctrines of “latent heat,”* of the Azoic ages, or the Nebular theory? And what might not be taught next as “science”—the theory of “continuity,” perhaps, or Darwinism, or the eternity of matter! In this Society, happily, these things are intended to be questioned and in-

* I was glad to hear from Dr. Gladstone that the “incompetence” of the theory of latent heat is now “fully recognized.” I was taught to believe it as “science,” (with what is in fact co-relative to it, that cold is a mere “negation,”) but ventured to oppose it in *Vis Inertiae Victa, or Fallacies affecting Science* (§ 33), several years ago; but I am really not aware in what textbook on Chemistry or Natural Philosophy it is *not* even yet taught, just as it was in our chemical classes thirty years ago. It will be found, for instance, in the last edition of Bird and Brook's *Elements of Natural Philosophy*, §§ 1223.—1230, etc.

vestigated, and we publish what is said on both sides. Now, though you have good scientific papers read in the Royal and other societies, you have also bad papers ; but the objections taken to them are too often lost sight of, not being reported. But surely the only way in which science can be properly arrived at is when it is discussed as it is here, and as it was among the ancients in their academies ;—not taught dogmatically, in what Bacon calls “ the professorial style.” There is one remark as to this, which Mr. Warington’s observations have suggested. I went with much that he said with reference to appeals to conscience and authority in religion, though even that might require a little qualification. But when he came to argue for such absolute authority in the teaching of science, it struck me that if his principles had been thoroughly at work among people who believed the earth to be a level plain, they would never have been allowed to think or prove the earth to be round ; and if taught to submit in this abject way to authority in science when men believed the earth to be stationary, we should never have had the Copernican theory put forward, and not any modification of it allowed afterwards. We have surely had too much of this authority in the world already. We are just as prejudiced and positive about our current theories as ever the ancients were about theirs, and there is, in fact, a growing *odium scientificum* among us now, apparently intended to supersede the *odium theologicum* of former days, when science was not the fashion. Now, I think neither one theory nor another in science should be taught as absolute truth ; but all regarded as matters of free inquiry ever open to investigation. We, however, boast of the great advancement we have made in science,—and Dr. Gladstone would be the last man to say that we have not truly made great strides in science,—but, how have we done so ? Not by teaching it as now proposed at the Universities ; but by science being comparatively free ; and by means of the press, and societies like this, such as the Royal Society and the Royal Institution of Great Britain, of both which Dr. Gladstone is so distinguished a member.—I shall conclude by citing from the Transactions of the Royal Society a fact little known, relating to what has been certainly taught most authoritatively in our Universities, and is the greatest boast of modern science—“ universal gravitation.” In vol. ii. of the *Philosophical Transactions* from 1672 to 1683, (Lond. 1809, pp. 126, 127 ; vol. ix. of the original edition, anno 1674,) there is an account of a book, entitled *An Attempt to prove the Motion of the Earth from observations made by Robert Hook, F.R.S., in 4to. 1674.* Hook was the well-known Secretary of the Royal Society ; and in this book we have the theory of universal gravitation (which is generally taught as having occurred to Sir Isaac Newton, by a kind of inspiration of genius, from observing the fall of an apple) actually published, and an account of it given in the Transactions of the Royal Society of London, twelve years before Newton produced his *Principia*. The *Principia* is said to have been some two years in MS. ; but that still leaves ten years’ priority to Hook. This is what appears in the *Philosophical Transactions*, and you will see it is precisely Newton’s law which Hook then put forward —

“ He [Hook] affirms to have actually made four observations ; by which, he says, it is manifest that there is a sensible parallax in the earth's orbit to the star in the dragon's head, and consequently a confirmation of the Copernican system against the Ptolemaic and Tychoinic. . . . Lastly, he promises that he will explain to the curious a system of the world, differing in many particulars from any yet known, but answering in all things to the common rules of mechanical motions ; which system he here declares to depend on three suppositions :—1. That all celestial bodies whatsoever have an attraction or gravitating power towards their own centres, whereby they attract, not only their own parts, and keep them from flying from them, as we may observe the earth to do ; but also all other celestial bodies that are within the sphere of their activity. 2. That all bodies whatsoever, that are put into a direct and simple motion, will so continue to move forward in a straight line, till they are by some other more effectual power deflected and bent into a motion that describes some curve line. 3. That these attractive powers are so much the more powerful in operating, by how much the nearer the body acted on is to their own centres.”

There was besides this another book, by Halley, published in 1676, still ten years before the *Principia*, which even gives the precise ratio of attractive force as “ increasing inversely as the square of the distance.”* Now the only book in which we have any approximation to a statement of the real facts as to this theory is in Whewell's *History of the Inductive Sciences*. He laughs at the mythical story of the apple ; but even he does not tell us the whole truth : and although it is actually to be found in print in the *Philosophical Transactions*, it seems to have been lost sight of or intentionally put aside. I think, therefore, these interesting facts are well worth being put on record in our *Journal of Transactions*. We hear many now still talk of this theory as one not to be questioned, although Mr. Grove really gave it up in his address at Nottingham last year ; and indeed every one who has learnt more than this child's story of the apple, or really understands anything about the matter, must know that whatever may be the amount of truth or error in the theory, it has the merit at least of being totally inconsistent with anything like “ the law of continuity ” applied to the heavenly bodies ; for they, according to Newton, must have been hurled into space, or projected in the direction of tangents to their orbits, by a force once given *ab extra*.

Dr. IRONS.—I would mention, in addition to the story of Newton's apple, another old story which some men are never tired of quoting—that of Galileo and his recantation—which should be revised before it is again brought forward. The Pope has really never had justice done to him on that subject ; and I think this stock story of sham scientific ought to be entirely eliminated from scientific history.

The CHAIRMAN.—I think the late Professor Whewell has conclusively shown that the whole story of Galileo's persecution has been greatly exaggerated, and that he never was thrown into the dungeons of the Inquisition. With regard to the first paper read this evening, that of Mr. Brodie, no one

* *Philosophical Transactions*, anno 1676, vol. ii. p. 326. (Lond., 1809.) The *Principia* itself was not published, or noticed in the *Philosophical Transactions*, till the year 1687. (*Ib.*, vol. iii. p. 358.)

who heard it could fail to mark the extremely reverential tone in which it is written. It may well be taken as an example of the manner in which such subjects ought to be treated by believers in revelation. Mr. Brodie's paper will be a valuable addition to our *Transactions*, as affording a fair sample of the manner in which geology was attempted to be reconciled with revelation ten or twelve years ago. Since then geology has so changed its theories that we see how needless such attempts were to reconcile an imperfect science with the Bible. Though Captain Fishbourne has been fairly answered by Mr. Warington, I believe his remarks were substantially true. I shall only quote one passage from Mr. Brodie's paper:—"A larger proportion of the carboniferous element was diffused through the atmosphere, and there is reason to conclude that the average temperature of the globe was much higher than that which now prevails." In this one sentence are two hypotheses now abandoned by the majority of geological professors. They have shared the fate of so many others which, once almost universally received, are now as completely laid aside. Dr. Gladstone has also treated his subject in a very reverential manner. I think, perhaps, that he has not drawn all the lessons he might have done, or shown fully how helpful theology is to science. Perhaps, as Dr. Irons has stated, he has shown a stronger leaning to the scientific than to the spiritual element of his theme. But of this I feel assured, that no one can more highly estimate the spiritual element than Dr. Gladstone does. And in this respect, taking into consideration the difficulty of dealing with subjects so vast and so transcending the powers of the human mind, I feel that there is very little real divergence between Dr. Irons and Dr. Gladstone. We are much indebted to Mr. Warington for a useful line of argument analogous to that pursued by Dr. Gladstone. When, however, he tells us that all our knowledge of science is based on probability, though I agree with him in the main, I might be disposed to take some exception to his illustrations. He has brought forward many useful analogies between a right method of acquiring scientific knowledge, and that of theology. I am sorry that we have not time to extend Mr. Warington's analogies still further than he has done, as they would strengthen Dr. Gladstone's subject of the Mutual Helpfulness of Theology and Natural Science. I shall only endeavour to pursue the subject with respect to one science, that of astronomy. A real knowledge of that science can only be acquired by a long training and a mental discipline very analogous to that required for a reverential study of theology. Before our reason can master the proofs on which astronomy claims to be a natural science, we must cultivate profound humility and great deference to the authority of those who have mastered the subject. Mr. Warington told us he would commence his study of astronomy by reading a manual of the science. But this, though it would give him a fair view of the theories and conclusions of astronomers, would utterly fail to enable him to follow intelligently any of the processes of reasoning by which those theories are proved or are accepted by scientific astronomers. The whole Cambridge course of mathematics in my day was subsidiary to acquiring those methods of reasoning by which Physical Astronomy was

proved to be a true science. I found it a very hard and thorny path to acquire this knowledge. Without this discipline I consider it impossible to judge the pretensions of any theory of astronomy to be a demonstrable science. If you have not gone through such a training as this, and you would ask me what you must do before you can understand the reasonings on which Physical Astronomy is based, I tell you you must acquire knowledge of the whole science of pure mathematics. But this will require an exercise of a vast amount of patience, perseverance, and docility. As Sir John Herschel once so pertinently remarked, you must enter upon this subject through the portal of humility. And in a science of pure reasoning, founded professedly on pure reasoning, you must first defer to your teachers. You must admit the humiliating confession that you cannot at first appreciate the reasoning processes of your teachers. But taking on trust their superior power of reasoning to your own, you cannot test their accuracy till familiarity with their processes has strengthened your own powers. To take Geometry alone, as an instance, what does the study of Euclid require? The admission, at its very commencement, of the most difficult metaphysical problems and paradoxes on which metaphysicians might dispute for ever. That this is no exaggeration on my part, I may mention that only a few days since I was conversing with a most distinguished mathematical professor, and he told me he was engaged in preparing a geometry which should be sound in its logic. He said that it was not till called upon to teach Euclid to others as it had been taught to himself, that he learned how very faulty and illogical that method had been. But the metaphysical difficulties of plane geometry sink into utter insignificance when compared with those of the higher algebra and mathematical analysis. (Hear, hear.) Here long familiarity with new processes and new methods of thought—continued drudgery in the mechanical combinations of symbols, by rules and methods—taken at first as true on the authority of your teachers, or that of men famous in the mathematical world: all this must be gone through before you are capable of comprehending the reasonings, or mathematical logic, by which the problems of physical astronomy are proved. There may be mathematical geniuses who may perceive almost by intuition what costs so much toil and mental labour to others. But men of the average endowment of intellect must pass through this course of mental drudgery with profound docility and humility, before they can feel competent to reason for themselves as to the truth or error of the demonstrations of physical astronomy. The task does not end here. Before his mathematical analysis can be applied to solve the motions of the heavenly bodies, “Laws of motion” must be accepted, which have been inferred, but not proved, from thousands of experiments, which can never be repeated by one man, and must be taken for granted on the faith of others. And after all, the grand problem of celestial mechanism must be solved by methods admitted by no incompetent mathematical authority (M. Comte), to be quite *illogical*, because of the insuperable difficulty of applying those that are considered strictly logical. Then, when you have interpreted the equation of the moon’s place, or that of a perturbed planet, you depend upon the

observations of others to interpret the constants of your equations. And, finally, the real place of the moon or planet occupying the place predicted by your mathematical analysis is your only ultimate proof that you have not been misled by the subtle methods of thought, experiment, and observation, of which you have made use. In such a course as this I think we may see a useful analogy as to the humility, long training, and serious study required by a sound pursuit of theology. I feel assured that men who will apply to theology the same training imperatively required for a sound knowledge of natural science will never be found among the impugners of revelation. Here I am reminded by an observation of Mr. Reddie how much more important is a sound philosophical education to the mere cramming and accumulation of scientific facts—and oftentimes of those doubtful hypotheses so frequently dignified by the name of science. I regret the formation of a natural science tripos at Cambridge. I think the old training was much better, which taught men rather *how* to pursue science than to acquire after all what must be little more than a mere smattering of science, or of scientific theory. Dr. Gladstone has told us that such terms as Catalysis or Epipolism seem only to have been woven as a cover for our ignorance. It may be a humiliating confession after all our boast of the advance of natural science—of our science of physical astronomy, which we have supposed advanced to the rank of an exact science, perhaps the only one fairly dignified by that epithet,—it may be a humiliating confession, but I believe the term *gravitation* to be as much a cover to cloak our ignorance as Catalysis or Epipolism. Gravitation is a name for certain phenomena observed among material bodies. Catalysis is a name for certain phenomena when one kind of matter is in contact with another whose ultimate cause is unknown. Epipolism is a term for certain phenomena of light manifested in its passage through certain fluids. But what do we know about the ultimate cause of the phenomena classed under the term gravitation? Is gravitation a property inherent in matter, or is it the result of certain forces independent of and external to matter? We can give no answer to such queries; even Newton was too modest to hazard any more than a guess inclining to the latter. When I consider how little we really do know of natural science, with all our boasted progress, I feel how little we should boast of our reasoning powers, and I cannot but thank God, who, by the influence of His Holy Spirit on the human heart, affords even the peasant a stronger ground for his faith in the truths of Divine revelation than any the philosopher can adduce for the most advanced of all natural sciences. Dr. Gladstone said, “We see a piece of rubbed amber giving rise to certain phenomena of attraction and repulsion, and we spring to the supposition of an ‘electric fluid’; we count seven colours in the solar spectrum, and we at once associate it with the gamut of music.” Dr. Gladstone, in this passage, as well as in what he said about heat, seems to follow Mr. Grove in the idea that imponderable fluids have been banished from nature. I shall not repeat what I have so recently said to you on this subject, further than to remark that some of the most eminent of modern philosophers have recently started a hypothesis which replaces the imponderable fluids or æthers of

space by an imponderable, vibrating, jelly-like substance, capable of transmitting the vibrations of light, heat, electricity, and other forces, from the sun and stars, while forming a perfectly unresisting medium to the motions of material and ponderable bodies. And with regard to the analogy between the colours of the spectrum and the diatonic scale of music, I have always considered Newton's treatment of that analogy as a prophetic anticipation of one of the most brilliant triumphs of modern analysis. There is one point which I could have wished to have seen introduced into Dr. Gladstone's paper, and that is the powerful aid the belief in the wisdom of the Creator, as displayed in His works, has given to the advance of true science. Newton, Harvey, Cuvier, and Hunter, not to mention other great discoverers of scientific truth, were led to make their discoveries by a profound sense of this wisdom. An assurance of the perfection and wisdom of God's works led them to a right interpretation of facts which to others seemed inexplicable or unmeaning.

Dr. GLADSTONE.—In rising at this late hour of the evening, I must be very brief in what I say ; and first I have to thank all those gentlemen, who have spoken upon my paper, for the kind tone in reference to myself in which they have treated it ; and I have also to thank Mr. Warrington, Mr. Reddie, and Mr. Mitchell, for the additions that they have made to my argument. I think each of these gentlemen said things that I might have put in my paper if thought of at the time ; though I do not of course endorse everything that they may have said in reference to the matter. As to the objections that have been raised to my paper, they seem to class themselves under three heads :—

1. Objections raised upon a mistaken idea of what the paper contains ;
2. Objections which I must leave simply to a difference of opinion between myself and those gentlemen ; and
3. Objections which I think it worth while to enter upon at length.

First, as to objections which arose from a mistaken idea of what my paper contains, I am sorry to say, it so happens, that all the five objections (I have put down five) of Dr. Irons originate in mistakes—I am quite sure unintentionally, for he tells us he has not read the paper before, and merely received his first impressions of it this evening. He objected, first, to the statement that revelation was helpful to science or science to revelation. I never said either the one or the other. My thesis is, that theology is helpful to natural science and natural science to theology. Then, with reference to the patronage of theology, I am sure I did not mean to speak in a patronising way of theology any more than of natural science. In reference to the particular passage where I spoke of theology being the queen of the sciences, and those of lower rank waiting upon her,—I meant simply what I said. In reference to Anselm, or Abélard, or Bernard of Clairvaux, I mentioned them as representing three extremely divergent doctrines of the atonement. Abélard, I believe, had a definite theory ; and not only that, but was one of the earliest promulgators of views relating to the atonement, which have been brought into prominence now ; and it is for this reason that I mentioned his name. Then comes the objection that I stated that the Bible is easier to

understand than natural science. Upon asking Dr. Irons for the passage, he referred me to one in which I speak merely of the collection of facts, and I am prepared to stand by what I said in that paragraph. I think it is more easy to collect the mere texts of Scripture bearing upon a particular subject than to collect the facts in nature bearing upon any particular subject there. I speak, of course, in a general way. As to the interpretation of these facts of nature or texts of Scripture, that is another subject, and instead of believing the Bible to be easier to understand than nature, I think the opposite; indeed, one of my reasons for writing the paper was, that I consider nature is a matter which we can understand and comprehend more easily, and that the various methods of interpretation which we arrive at in reference to nature may well be transferred to interpreting the Bible. I am sure that in saying these things you will understand I do not suppose that Dr. Irons in any invidious way brought forward these objections; but, in a brief paper like mine, it is not easy to find the meaning in all cases, and there are complicated lines of thought and argument, and sometimes one may get hold of a meaning which ought to be counterbalanced by what is said elsewhere. As to the second class of objections, Mr. Reddie made various remarks in reference to natural science which showed that he put a very different meaning on the words "natural science" to what I did; but I must leave this as a mere matter of definition. In reference to the question of the introduction of natural science into colleges, I mean to advocate it, and to maintain all I said in my paper; and I hope to express these opinions in other places: I have done so in one theological college, and hope to do so in others. The subject deserves the widest discussion. I am glad it has been brought forward, and that arguments have been used against the position I maintain; and I hope these discussions will extend beyond the Victoria Institute, and that the truth will prevail. Perhaps I may add this,—I repudiate altogether the taking of Colenso as a scientific man, for his objections are non-scientific. Then comes one objection which I ought in justice to myself to deal with at some little length, and it is the objection of Captain Fishbourne, that I have not dwelt sufficiently clearly upon the difference between the natural mind and the spiritual mind. It is possible that the few words I have said on that subject might not convey the whole of my meaning, and you will permit me to explain further my view of the case. In my paper I spoke of there being a receptive faculty in both cases. I think that is what is alluded to in the writings of St. Paul. But there is a different receptive faculty for each: it is the power of appreciating spiritual truth in the one case, and the power of appreciating physical truth in the other. Then the question arises,—How are we to get this faculty? Upon that subject there is not a word in my essay; but there is an important difference between the two. In respect to natural science, there are some men who have the ability born in them of loving science and of taking an interest in it and understanding it, and other men have not this faculty; but when we come to the spiritual mind, we do not find there is by nature this faculty: it has to be imparted to man by the Holy Spirit of God. The origin of these two is therefore different,

and we must bear that in mind always, and I am glad to have an opportunity of expressing my conviction of it here ; but, granted the capability of understanding the Bible, which comes from the Holy Spirit teaching the individual heart ; granted, too, the capability of understanding natural science : then we start on parallel roads, we must have the honest mind and the clear intellect, and I believe the canons of interpretation in the two cases will be found analogous. It has been objected to my essay that it is not complete, and here I fully agree with what has been said. The subject is very large. If, indeed, I have only taken up some particular lines of thought, why, I have left other lines of thought for other persons to pursue. I have dwelt more upon that analogy between the methods of interpretation, because it is one very little written upon or spoken about, and I thought it better to treat of it at greater length. I trust we shall find our efforts will be of service to natural science, and natural science helpful to theology. I believe it is so, and the arguments of others this evening convince me still more that we must enter on the study of theology in the same way in which we enter on studies of natural science, in order to arrive at full comprehension of the truth. There are other points that have been stated by some of the speakers, which, if I had time, I should like to enter upon ; but I must conclude, again thanking you for the friendly spirit in which you have considered my paper.

The Meeting was then adjourned.

NOTE.—The asterisks on pp. 397, 398, and 400, indicate that certain passages in Dr. Gladstone's original Paper were omitted at the request of the Council, as trenching upon purely theological and controversial points.