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province of our Society, and we are all bound to do what we can to support it. Our Council have a very difficult and delicate position to fill, because it is the object of the Society to protest, not against science truly so called, but against the unfair manipulation of the facts of science, and it is the province of this Society to set that clearly before the world,—it has succeeded wonderfully well for nine years. (Cheers.)

The resolution was then agreed to.

Mr. C. Brooke, F.R.S.—My lords, ladies, and gentlemen, as the important business of the evening is still to come, I think it is fitting that I should use the fewest possible words in acknowledging the sense which the Council have of your appreciation of their humble services. I would only add one remark, and that is to point out to you how much the Council owe, in the duties which they have to the best of their ability performed, to one officer —our honorary secretary. (Cheers.) I think it right to say this on behalf of the Council, on account of the large amount of work which has been accomplished for the benefit of the Institute by him alone. To him this duty is truly a labour of love, and I can only assure you that from his indefatigable exertions much additional strength has accrued to the society, and also from his obtaining men of eminence in science or in literature to bring valuable papers before us. (Cheers.) I will say no more than this in returning the thanks of the Council.

Captain F. Petrie.—My lords, ladies, and gentlemen, I am sorry to say that our honorary treasurer's absence prevents him from returning you thanks on behalf of the honorary officers of the Institute. I am sure that the resolution moved by Mr. Fowler and seconded by the Rev. Dr. Hessey, who, it is now no breach of confidence to mention, has this day been named Archdeacon of Middlesex (cheers), must afford the honorary officers much gratification. I can only say that what the honorary officers have most at heart is the Institute's progress. (Cheers.)

The Rev. Professor Main then read the following address :—

ANNUAL ADDRESS.

My Lord Shaftesbury and Gentlemen,

It is not with unmixed feelings that I have accepted the invitation of the Council of this Society to deliver the Annual Address to-day. On the one side, I feel painfully that the constant heavy occupation of my time and energies, by the laborious work of the Radcliffe Observatory, has not left me in general sufficient leisure to engage deeply in the studies which are necessary for taking part in the conflicts between

religion and science; but, on the other, I feel also that a crisis is come which imposes a weighty obligation on every believer engaged in science, at the least to accept such an invitation as that which is now offered to myself, for the declaration of his own faith, and, according to his ability, to endeavour to strengthen that of others. I will not further occupy the time of the meeting with any personal remarks, excepting the assurance that I have, since accepting the invitation, endeavoured to get an adequate knowledge of the most prominent subjects connected with scientific theological speculations, which you would naturally expect to see referred to, and especially with such as have attracted attention during the past year.

And first let me offer my congratulations to the Society on its present position and prospects, and on the increasing consideration and respect with which its operations are regarded by men capable of judging. It has attracted to itself representatives in the various departments of science, well capable of defending the faith from the attacks of scientific scepticism, and standing so high in their several departments of science or literature, that their opinions *must* be received with attention and respect. No one also could, I conceive, deny that the philosophical character of the Society has been most severely maintained in all its papers and discussions, and that every theory opposed to the belief of the ordinary Christian philosopher, has been treated with the most scrupulous fairness and respect. Personalities have been altogether avoided, and an example has been set of the proper way of conducting such controversies, which will, we may presume, have considerable influence for the avoiding of bitterness and unfairness for the future.

During the past year several excellent papers have been read and discussed before the Society, and of these I will mention only two, which appear to me to be of great importance at the present crisis. I mean that of Professor Nicholson, on the General Doctrine of Evolution, and that of Canon Birks on the Indestructibility of Force. My reasons for particularly mentioning these will be seen in the sequel.

I would however, in this portion of the Address, take occasion to advert to one or two circumstances which influence my choice of these two essays for particular mention. There are some peculiarities of the present age, which frequently render opinions held by men of eloquence and genius, influential to a greater degree than the value of their opinions, when calmly and philosophically tested, would warrant. If they have had for a long time the ear of the public, which is on the whole ill

instructed or uninstructed with regard to the truth or the real value of their subjects of discussion, the weight of their authority will be out of all proportion to the justness or the truth of their theories; and, by the additional agency of a daily press, which is naturally eager and anxious to get possession of, for publication, every novelty in science, art, or literature, and is supplied with paid skilful writers, quite prepared to advocate or attack, as the case may be, the views in question, very inaccurate theories may for a time gain acceptance. It is impossible that by such means the truth or falsehood of a new and specious theory can be arrived at, and the unlearned public are quite at the mercy of a brilliant lecturer, who may choose to advocate anything respecting religion, however old or exploded.

A paradoxical novelty will attract more than sober truth under such circumstances, and a great deal of mischief may be done before the mistake is discovered, or the idol displaced from his pedestal.

Undoubtedly there is another bar before which every such work will be brought,—namely that of dispassionate and learned critics, who have the knowledge requisite for disentangling the truth and error which are generally mixed up together in such performances; but, for one person who will take the trouble to read the replies, there are twenty who will be content to take upon trust the essay or lecture which has dazzled their imagination, and a new favourite will in all probability soon have withdrawn their attention altogether from the subject.

I am far from complaining of this state of things;—an excited, eager, and intelligent public, together with the complicated means which exist in the present day for gratifying its curiosity on every possible subject, belongs naturally to our advanced civilization:—we must take the advantages and the disadvantages together, and by prudential measures endeavour to make all work together for good.

And it is under this point of view that the advantages of such an association as the Victoria Institute appear most evident and indisputable. It exactly meets the evil which I have endeavoured to describe, as resulting from the joint effects of popularity and the daily press. Its members are men who have become so from the conviction that such an organization is necessary, and who are willing to devote their time and their learning to the distasteful task of stripping error of its delusions, and of assisting the claims of true religion.

At the present moment the duty is far from being a pleasant

one, and the subjects which I shall have to discuss or to advert to, are, to the Christian philosopher, most repulsive.

The great subject of the year indeed, in the conflict between religion and science, is (I say it without disguise) atheism,—material atheism. Some are offended at the word, who do not reject the doctrine implied by it; but, to coin a euphemism to veil or hide it, would be to exercise courtesy at the expense of truth. We have had the *thing* brought prominently forward before our eyes, and we need not dispute or wrangle about the word.

God, in our sense of the word, is the personal and intelligent Ruler and Governor as well as the Creator of the world or cosmos, a being of infinite power, wisdom, and goodness, constantly superintending and providing for the welfare of His creatures. He is as present now presiding over every part of His creation, as He was, in the immeasurably remote ages, when He, by His will and infinite power, brought it into being; and, by His Providence, He guides, adjusts, and preserves all that He has made. The assumptions of this definition are all absolutely necessary for the idea of the Supreme God who is the object of our adoration; and nothing less will satisfy the requirements of religious faith, or the natural desires of the immortal soul.

All the discussions, both ancient and modern, respecting the Supreme Intelligence seem to show that Natural Religion is unequal to the task of arriving at the correct knowledge of a Personal God, and it is only in proportion as we feel our helplessness in this particular that the blessings of Revelation will be fully felt and acknowledged.

This definition will exclude the *anima mundi*, or Pantheistic idea of God, which confounds the Creator with His creation; and also the Epicurean idea of a personal God, who did indeed create the universe at an infinite distance of time, but has left it to evolve itself without farther care or superintendence.

I do not believe that the human mind can obtain a clear conception of either of these ideas of the Godhead, and I am sure that neither the one nor the other idea has been favoured by some of the greatest modern physical inquirers.

As also the origin of sentient or animated beings will necessarily occupy some portion of this discourse, it is well to lay down some definitions with regard to it, or rather with regard to the origin of man. I shall assume that no theory is to be regarded as of any value which does not satisfy all the conditions of the problem with regard to man's nature, that is, which does not afford some satisfactory explanation of his moral and

intellectual as well as of his physical nature. It must also (and that not by mere guesses or unsupported assertions, or by the introduction of a few proofs from existing nature and natural phenomena out of the countless varieties of phenomena to which the nature of man is intimately related) give an adequate account of the means by which he has been placed in harmony with his surroundings. For example, it must show, not in a few isolated instances, but in all, how it comes to pass that the earth and the air which surround it (man's dwelling-place in fact), are adapted to his bodily organs, so as to produce the sensations on which his comfort, pleasure, and well-being depend; and that too in such a way as to satisfy his higher intellectual capacity of receiving pleasure or a sense of enjoyment from his perceptions of beauty, grace, and harmony. Truth as such should be predominant over every other consideration; but it has been the habit in some of the philosophy of the present day to identify a clever hypothesis, supported on some exhibition of facts, with the truth of the hypothesis, however great the antecedent improbabilities of its correctness may be.

As I shall not have occasion to refer in the sequel to Darwin's *Origin of Species* and the *Descent of Man*, I may give these as an illustration. With regard to the former work, of which I desire to speak with the utmost respect and to separate by a long interval from the latter, Professor Nicholson's conclusions, which seem to have been formed from a very careful consideration of the subject in some of its branches, seem to show that Darwin's theories are of very limited application, and that they scarcely need any consideration whatever in a religious discussion. With regard to the latter, the *Descent of Man*, undoubtedly many valuable facts have been collected relating to the continuity of structure of the mammals, and to the habits and instincts of the inferior animals as compared with man; but with regard to its conclusions, which derive man's descent from the ascidian, and more recently from the ape, I, for my part, consider them as an example of the imperfect kind of use of the inductive philosophy, which is so frequent in the present day. The student of natural philosophy is, in my opinion, quite justified, on philosophical grounds, in declining to accept the ancestry here offered to him, and to rejoice still in the assurance that he was made after the moral image of his Creator, who breathed into his nostrils the breath of life.

I am of opinion that it was a bad day for science (not for science properly so called, but for the popular development of

it) when Professor Tyndall composed during a summer holiday, and subsequently delivered at the meeting of the British Association at Liverpool in 1870, his celebrated discourse on the "Use of the Imagination in Science." I heard that eloquent discourse, and I considered at the time that many of the instances adduced from the mathematical sciences were legitimate deductions from established premisses, and implied no use of the imagination properly so called. There has, however, been abundant use made of it since that time, both by the lecturer himself and by others, and I think a note of warning on this head is not out of place.

As this almost concludes the introductory portion of the Address, I will make a passing allusion to Canon Birks' paper on the errors and confusion which have been made in dynamical science, partly by new nomenclature, and partly by a misunderstanding, by some scientists of high pretensions, of the ordinary principles of mechanical science. Change of nomenclature is generally attended with some inconvenience, though in some of the instances produced by Professor Birks the change has been made by two of the most accomplished mathematicians and physicists of the day, namely by Sir William Thomson and Professor Tait, in their excellent treatise on Natural Philosophy. An old mathematician like myself finds some little repugnance to part with his friend *vis viva*, and to find it again under the designation *kinetic energy*; but new nomenclature would be a trifling matter if it had not introduced confusion into the ideas of some distinguished men of science. It must be borne in mind that, with regard to the science of pure dynamics, no new mechanical principle whatever has been discovered, and that the laws of conservation and dissipation of energy (even when applied to the universe or cosmos) must be applied in the same way as they would have been forty years ago, though with greater analytical resources, presuming that we have data enough to solve any particular problem presented to us. With regard however to the conversion of energy of one kind into energy of another, as occurs in the notable instance of heat into motion, or the effects of motion into heat, so that not a particle of either matter or force is wasted throughout the universe; this is a most important discovery of the present epoch, though I do not know that religion is immediately concerned with it.

With these preliminary remarks I will proceed to introduce the several topics which I intend to form the principal subject-matter of this Address.

In the first place I will advert briefly to a few of the most important physical discoveries, chiefly astronomical, which have been made during the last few years, being careful to avoid details, and to consider them only with relation to their bearing on religion.

I will then make a passing allusion to two books recently published, which exhibit perhaps the lowest stage of religious belief which has been given in this century as the result of the final and sober conclusions of two very deep thinkers, devoted the one to the study of philosophy, and the other to that of biblical criticism; and I hope that a few minutes will not be wasted in considering what is meant with regard to our religious and social prospects by the sad conclusions arrived at in both these works.

Finally, I will devote the remainder of the Address to the consideration of the Atomic Philosophy, with reference, of course, but not exclusive reference, to the Belfast Address. And, in this assembly, I am neither ashamed nor afraid to beg from our Almighty God and Father, in whom we all believe, a blessing on the results of our present inquiries.

Astronomical discoveries have been chiefly made in the descriptive and physical branches of the science; they have been very brilliant, and have attracted the attention of large numbers of people. It is therefore very desirable that clear notions of the extent and nature of these discoveries should be gained by all who wish to understand how they affect religion. It will be convenient to consider separately those discoveries which have been made, chiefly by means of the spectroscope, with regard to the solar system; and secondly, with regard to the fixed stars and nebulæ.

Let us take the sun first, about which the amount of discovery is, thanks to the unwearied researches of Mr. Lockyer, Monsieur Janssen, and others, very great indeed; and, first, with regard to his parallax or distance from us, the researches for the determination of this element will show, perhaps better than anything else, the activity of science in the present age. It had been suspected for some time that the solar parallax, as deduced by the famed astronomer Encke from the transit of Venus of 1769, was considerably too small, and observations made of the planet Mars in the northern and southern hemispheres in the year 1862, gave a result which it is believed differs from the truth by a very small quantity indeed. At about the same time experiments made to determine independently the velocity of light in connection with

the assumed value of the constant of the aberration of light gave another quite independent result, agreeing very closely with the preceding; and, finally Leverrier found by researches on the disturbances of the orbits of two of the planets, Mercury and Mars, a result consistent with the others. It is believed that by the observations of the recent transit of Venus a result will be obtained which will certainly differ not more than a hundredth of a second from the truth. This will give us what we have never had before,—a correctly measured base-line for the solar system, as well as for cosmical measures beyond its limits.

But for our present purpose the discoveries made by means of spectroscopy are far more important as showing the unity of structure in the members of the solar system. I need not on this occasion show you the way in which the various elements existing in the incandescent atmosphere of the sun are analyzed by the spectroscope; it is sufficient to state that at least twenty of the sixty-four chemical elements which exist in the earth are found in a state of incandescent vapour in the sun's atmosphere. The fact that the greater number of our chemical elements (including the precious metals) are not found, is not conclusive with regard to their existence or non-existence in the sun. It may be that their greater density does not allow of their vaporization. But the only fact which concerns us at present is the similarity of the structure and of the constituent elements of the sun and the earth, and this is abundantly proved.

Other facts deduced recently from the study of the sun, though of great scientific interest and importance, do not concern us much from the religious point of view. Thus the periodicity of frequency of the solar spots, which goes through its cycle in about eleven years, is practically of great importance, and opens a great field for speculation and research. It has, undoubtedly, an effect on climate, and I have myself traced its effect in producing a well-marked change of direction of the wind having the same cycle. The solar prominences likewise which are now observed as regularly and with as much care as any other phenomena, thanks to the discoveries of Mr. Lockyer and M. Janssen, indicate disturbances in the solar atmosphere of enormous magnitude, and may be of great practical importance, but they offer no occasion for further remark. The same may be said of the corona or broad ring of light seen during solar eclipses, which is proved to belong to the sun, and gives some indication of dense nebulous matter in his immediate vicinity.

Thus far all the facts which I have mentioned depend on observations of unquestionable accuracy and admit of no dispute, while, at the same time, they offer no materials for speculation on the origin or the probable duration of the solar system. But, in connection with the doctrine of the conservation and dissipation of energy, speculations of a very bold and interesting character have been made by Sir William Thomson, which may profitably detain us for a moment.

Several years ago his attention was called to the fact that the sun is constantly radiating heat into space in enormous quantities; and, to avoid the self-evident conclusion, that this vast globe must inevitably be cooling down, and that thus, at some time or other, however distant, the heat-energy of the solar system would be expended, he proposed the theory that a constant amount of heat was probably kept up by the falling on his surface of nebulous masses, comets, &c., either drawn within the sphere of his attraction from remote regions of space, or gradually brought to that condition by the resistance to motion in the densely nebulous neighbourhood of his body.

This theory, however, was shortly given up, and the conclusion at present held by himself and many other physicists, is that the cooling process is really going on, though we are not sure that any effect whatever has been observed during the term of man's occupation of the earth. If this be so, it is quite certain that a time will come, measured perhaps by a large multiple of millions of years, when the solar system will be a complete wreck, the sun himself a dark inert mass, and the attendant planets, like the moon, unfit habitations for organized and sentient beings.

The earth too, even if the sun were to retain its heat, gives evidence that it was not intended for an eternal existence in its present state. It has been surmised, and the guess assumes something like verification from the accurate mathematical calculations of Delaunay, Airy, and others, that the friction of the tides contrary to the direction of diurnal motion is sufficient to produce a small but calculable increase in the time of the diurnal rotation. No one doubted that the tides would produce *some* effect of this kind, and calculation seems to prove, on certain assumptions, that the effect is sensible, and that it will some time or other bring the earth to rest.

These are grand speculations, and they appear to be based on data which are unquestionable. By analogies drawn from the fixed stars we are also brought to nearly the same conclusion. Many of these are variable, and some, from a high degree of brightness or magnitude, fade away at regular

intervals, which are accurately known, till they become very faint, if not almost invisible, and then in a period of equal length resume their brilliancy; others have been known to blaze out suddenly, with a brightness denoting a conflagration on a scale which we can scarcely imagine; and many of my hearers will remember the star near ε Coronæ which suddenly burst out in this manner in the year 1860, and was estimated as of the 2nd magnitude. The spectroscope immediately showed Dr. Huggins that this wonderful change in the star was due to a great evolution of hydrogen and other gases occasioned by some internal convulsion. All persons will remember a similar instance which occurred in the time of Tycho Brahe. Thus all tends to prove that the state of things which we see around us is not, and is not intended to be, constant and changeless; and he, in my opinion, philosophizes most safely who looks up with adoration when he has come to the limit of his knowledge to the Almighty framer and preserver of these countless and wonderful systems.

But discovery has gone on at an equal pace in other directions. Of these I can only mention some of the most important instances. Our knowledge of the nature and physical composition of comets is very much increased since the year 1866, when the large swarm of November meteors attracted so much attention, and the labours of Professors Newton, Schiaparelli, Adams, and others, were the means of identifying the orbit which they described round the sun, with that of the comet discovered by Tempel in 1866, or Comet I of 1866. In the same way the orbit described by the Perseids was identified with the third or bright comet of 1862, which has a period of revolution of about 124 years. Other remarkable coincidences between comets and meteor-swarms have been confirmed or suspected, especially in that which occurred on the evening of November 27th, 1872, the orbit of the meteors being found to be the same with that of Biela's comet. In this instance it is believed that the comet itself, in its passage, either touched or passed across the earth. Comets then apparently are nothing but aggregations of matter of very small density and consisting of very small discrete particles, which have been most probably thrown off from the sun, or from other more remote systems, and have come within the sphere of the sun's attraction. Between fifty and sixty (probably more at this time) of such systems are known to exist, though the most remarkable are those which I have mentioned. In this particular, then, we have more correct notions of the solar system than our forefathers had; but there is nothing in our additional knowledge

which tempts us to throw off our allegiance to our Heavenly Father, but rather to increase our religious awe and admiration. These portentous and mysterious bodies, as our ancestors esteemed them, coming suddenly, and with fearful velocity from the depths of space, and heralding, as they in their superstition believed, war, or pestilence, or famine, are now proved to be harmless.

We do not even fear a collision with them, and their constituent particles, many of which it is believed do not exceed one-third of an ounce in weight, flash across the sky when ignited by our atmosphere, and are only subjects for our curiosity. In this *we* believers may find cause to thank God for His mercies, and for His providence in keeping evil from our dwelling-place.

Discoveries in stellar astronomy have kept pace with those in other branches of Astronomical science.

The spectroscope, with its wonderful power of analysis, has been applied by Dr. Huggins and Padre Secchi to the stars, with as much success as by Mr. Lockyer to the sun. Both Huggins and Secchi have examined with minuteness a great many of the brighter stars, and the results show that the uniformity of structure which was observed in the solar system, is extended to the stars. The most remarkable of the published results of Dr. Huggins, are those arising from the examination of the two stars Aldebaran and α Orionis. In the spectra of both a great number of absorption-lines were found, of which it was possible to compare several with terrestrial substances, as in the case of the sun. In the case of Aldebaran at least nine chemical elements were identified,—hydrogen, iron, magnesium, antimony, and quicksilver being among them; in the case of α Orionis six substances were identified; amongst which were magnesium, calcium, and iron, hydrogen being absolutely wanting. Secchi's researches were of a still more elaborate nature. He was enabled, in the comparatively clear atmosphere of Rome, to examine about 500 stars, and to divide them into four typical classes, distinguished by the nature of their absorption-bands.

The first class contained stars of a white colour, like α Lyræ; the second contained yellow stars, in which the bands bore a close resemblance to those of our sun; the third included reddish stars like α Herculis, β Pegasi, and α Orionis; and in the fourth were included stars of a lower magnitude (never above the sixth), with the interesting peculiarity that the spectrum consisted of bright bands, separated by dark intervals.

How wonderful is all this variety, and at the same time how

distinctly is there marked the impress of the same creating hand that made our sun and our earth, and the other attending planets. How impossible also it seems for the most unimpassioned philosopher to avoid exclaiming with the Psalmist, "Such knowledge is too excellent for me: I cannot attain unto it. Whither shall I go then from thy presence? If I climb up into heaven, thou are there; if I go down to hell, thou art there also. If I take the wings of the morning, and remain in the uttermost parts of the sea, even there also shall thy hand lead me, and thy right hand shall hold me."

There is only one other stellar discovery (also due to the spectroscope), which I feel it necessary to mention, namely that relating to the velocity of the motion of the stars, as compared with that of the earth's velocity in its orbit.

I need scarcely explain that the sense of colour depends on the number of vibrations made on the eye in a given time, or on the length of the wave corresponding to that colour.

If then the velocity of a star be not insensible when compared with the velocity of light, the number of vibrations reaching the eye in a given time for a particular colour in the spectrum, or for a particular absorption-band, will not be the same for a star in motion and for one at rest, and the effect will be a slight displacement of any absorption-band, as compared with the chemical substance which is its terrestrial analogue.

This displacement will therefore be a measure of the velocity of the star with regard to the earth, and the latter can be calculated without much difficulty.

Dr. Huggins has bestowed great attention on this difficult class of observations, and has been very successful in measuring within narrow limits of error, the velocities of several of the brightest stars.

For instance in the case of Sirius he found that the relative motion, with regard to the earth in motion, was about 41·4 miles per second, and, as the earth's motion of recess in the direction of a line drawn to the star, was about 12 miles, there remain 29·4 miles per second, as the actual velocity of Sirius away from the earth.

This I consider to be a result which can be relied upon as being derived from observations, difficult indeed, but of which the probable errors can be rigorously determined.

Such considerations enlarge our views of the immense scale on which the operations of nature in the Cosmos, or, as I should prefer to say, the operations of the Almighty architect of the earth and the heavens, are carried on. There is a unity

of plan and structure, which points evidently to the assumption of one guiding and controlling mind, and, even at the distance of Arcturus, we are familiar with the phenomena presented; in fact we seem to be at home.

With one still more extended survey of the realms of unlimited space, I will conclude this brief and imperfect review of the recent teachings of Astronomical science.

Our speculations and our knowledge about the stars excite our imaginations, and inspire us sufficiently with awe and wonder, though the astronomer has little need for guesses, and is guided in his legitimate deductions by the severe rules of the inductive philosophy.

But we have still to deal with another class of objects which give us a still nearer insight into the constitution of the universe, namely the nebulæ and star-clusters.

These, in the telescope, cloud-like looking objects were first observed and described in great numbers by Sir W. Herschel, and to him science owes a very great debt of gratitude, for his wonderful labours in this department of astronomy. The two classes, nebulæ and star-clusters, are with ordinary telescopes in general undistinguishable, but Sir William by using high powers on his gigantic reflector succeeded in resolving in a great many instances the nebulous mass into its constituent elements of stars. Lord Rosse with his immense reflecting telescope resolved a great number of others which had not yielded to the inferior optical resources of Sir William. Then came an important question on which depended in a great measure the truth or falsehood of La Place's theory of the constitution of the universe out of nebulous matter; namely, whether there were any nebulæ actually irresolvable, or consisting of really nebulous matter, and not of aggregations of stars too far distant to be separately visible by any existing optical power.

The spectroscope has satisfactorily answered the question, and, in the opinion of most persons competent to judge, decided that La Place's theory was essentially correct, and we may assume that the existing solar system, and all other similar systems, were formed from matter in the nebulous state. The possibility of the truth of the theory on mechanical grounds was seen at once, and the fact of the existence of such matter (proved now beyond the possibility of doubt) scattered about in the heavens in various degrees of condensation, gives immensely greater assurance of the fact that this is the way in which it has pleased the Almighty to act in the creation and formation of the visible universe.

But, grand as is this conception, deduced, as we believe, accurately from observed facts, and wonderful as are the ideas which we gain of the vastness of the works of God, how little does it tell us of the way in which a single globe like ours was in the course of successive periods of geological time prepared for its inhabitants, or of those nice adjustments of temperature, fluidity, rigidity, &c., which were necessarily made before it was possible that life could be sustained at all; and still less of those Fatherly providential adaptations to the intellectual and moral nature of man which are ours to enjoy and to thank the Giver for. We can still, after acknowledging and using all the discoveries of modern science, and making them the basis of future research, only adore the wisdom of the Creator, and confess that we are still only on the threshold of His temple.

There is still something more to be said in connection with this subject, of great interest and importance.*

Mr. Lockyer had been led to the conclusion, in the course of his observations and experiments on the effect of pressure on the gases which form the atmosphere and chromosphere of the sun, that, owing to the great height of the atmosphere, the effect of gravity is to produce an arrangement of the different elements in layers similar to our geological strata. Thus, in the coronal atmosphere exists the cooler hydrogen; in the chromosphere incandescent hydrogen, magnesium, and calcium; and in the reversing layer, sodium, chromium, manganese, iron, &c. He is also of opinion that the metalloids (sulphur, carbon, silicon, &c.) lie outside the metallic atmosphere, and gives reasons for the faintness of their record amongst the metallic lines. He then attempts to answer these two questions: 1st. Assuming the earth to have once been in the same condition as the sun now is, what would be the chemical constitution of its crust? 2nd. Assuming the solar nebulæ to have once existed as a nebulous star at a temperature of complete dissociation, what would be the chemical constitution of the planets thrown off as the nebulosity contracted?

Mr. Lockyer suggests that, with regard to the earth, the arrangement of the earths and minerals consequent on the supposition given above, would be that which we find to be actually existing; and, with regard to the planets thrown off, the exterior planets approaching in their constitution to that of the sun's outer atmosphere, and the nearer ones being more

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* See Professor Prestwich's Inaugural Lecture.

metallic in proportion as they are nearer to the central portions of the nebulæ.

This is found to be the case in fact, the densities of the exterior planets (Jupiter and Saturn for example) being relatively small, and their atmospheres very large and highly absorbing, as if containing a larger proportion of metalloid substances.

The above may be taken as an interesting case of legitimate speculation requiring and giving motive for further experiments and research.

I ought now in the natural order, after this brief and necessarily imperfect survey of the chief of the recent astronomical discoveries which have more or less bearing on the subject of religion, to take up the subject of recent discoveries in the atomic theory. But as we shall, in this instance, be brought face to face with material atheism, I think it best, before this, to make a few brief remarks on Mill's *Three Essays on Religion*, and Strauss's *Old and New Faith*, that the whole of this disagreeable part of my duty may be discussed at once.

Many among you have, I doubt not, thought it necessary to read the three essays of Mill, and to those who have not, it may be useful to bring before you a few of the results—probably the final results—of the philosophical system of this really great and profound thinker, of whom it was said (in some instances boastfully) that he lived a long life absolutely without any consideration of God and religion.

These Essays are a melancholy termination to the labours of a lifetime of philosophical research, but they have at least dispelled that illusion. He did not, and we may be permitted to doubt whether any man ever did, live absolutely without God in the world; and the Essays show that he has even thought and, I believe, has been sincerely anxious about those deep questions (which vitally affect every person born into the world), life, death, the immortality of the soul, God, and future judgment. They are all bound up with our nature, and form, as it were, part of ourselves. We must ask at times of ourselves, Whence came I? and whither am I going?; we must all feel (at least I doubt whether any living man capable of thinking has ever avoided the necessity of feeling) that there is something besides ourselves and the visible creation, and that that something is God, whether it be assumed to be the Pantheistic God almost identified with creation itself, or the God omnipotent and eternal of the Christian. Then again man cannot, if he will (even after a life of evenly maintained philosophical scepticism), avoid the occasional-or frequent intrusion of the thought

of that which awaits him beyond the grave. Death *must* come, and in the thought of it there is suggested their alternative of annihilation or a future judgment. If the soul is immortal, an immortal and all-powerful God exists, and the idea of responsibility comes in. If it perish with the body, the prospect is not one to be accepted willingly except in the dark hours to which the author of the Belfast Address feelingly alludes in his preface.

And it is plain that Mr. Mill had thought deeply of all these things, and has drawn conclusions from his thoughts which are, in my opinion, amongst the most melancholy perversions of truth which exist on record.

With respect to the supernatural in general, he concludes that the rational attitude of a thinking mind is that of scepticism, as distinguished from belief on the one hand and from atheism on the other.

But from the consideration of the eye, he is led to the conclusion that it has its origin in an intelligent will, and rejects the solution which might be effected by the theory of the *Survival of the Fittest;* and, "on the whole, it must be allowed," he says, "that in the present state of our knowledge the adaptation of nature affords a balance of probability in favour of creation by intelligence."

This admission is important as coming from him, but it will soon appear that we have no great cause for thankfulness. "Every indication of design in the Kosmos," he says, "is an evidence against the Omnipotence of the Designer." This may be a new and strange argument to some, but he means that an omnipotent architect would have accomplished his work without successive steps indicating design. And now comes a quotation which makes us shudder, and which follows the attempted proof, that the intelligent Creator cannot be and is not omnipotent.

"If man had not the power," he says, "by the exercise of his own energies for the improvement both of himself and of his outward circumstances, to do for himself and other creatures vastly more than God had in the first instance done, the Being who called him into existence would deserve something very different from thanks at his hands."

The blasphemy of this passage, from our point of view, is only equalled by the shallowness of its philosophy.*

* There is nothing new or original in this idea of a God of limited power, though it has been proved on *à priori* grounds to be metaphysically impossible. See Dr. S. Clarke's *Being and Attributes of God*, prop. x.; Cudworth's *Intellectual System*, chap. ii. art. xvi., where the arguments of Lucretius are discussed; and Lactantius, *De Irâ Dei*, cap. xiii.

But let us proceed: "If we look for justice" (that is from God) "we find a total blank."

Now let us have his final summing up.

"These are the net results of Natural Theology on the question of the divine attributes. A being of great but limited powers . . . of great, and perhaps unlimited intelligence . . . who desires and pays some regard to the happiness of his creatures, but who seems to have other motives of action which he cares more for, and who can hardly be supposed to have created the universe for that purpose alone. Such is the Deity whom Natural Religion points to, and any idea of God more captivating than this comes only from human wishes, or from the teachings of either real or imaginary revelation."

He now proceeds to discuss the probability of a revelation, and allows, in the first place, "that it has some stand-point from the indications of a Creator which have been proved."

This reasoning is evidently quite correct, and it would have been well if the German writers had always borne it in mind. "The sender of the alleged message," he continues, "is not a sheer invention; there are grounds independent of the message itself for belief in its reality; grounds which, though insufficient for proof, are sufficient to take away all antecedent improbability from the supposition that a message may really have been received from him."

This is also an important admission, and might be used with very great effect on Mill's disciples, who look upon him as the great champion of unbelief.

But all that follows shocks our religious sense by its apparent profaneness, though I am far from saying that he meant to treat the subject with intentional disrespect or levity. He allows primarily the correctness of Butler's main argument in the *Analogy*, but qualifies it in this strange way. The sum and substance of the argument, he says, is this: "The belief of Christians is neither more absurd nor more immoral than the belief of deists who acknowledge an omnipotent creator: let us, therefore, in spite of the absurdity and immorality, believe both."

One or two more specimens of Mr. Mill's reasonings, and I will leave him.

Of miracles he says: "No miracle-worker seems ever to have made a *practice* of raising the dead; that and the other most signal of the miraculous operations are reported to have been performed only in one or two isolated cases, which may have been either cunningly selected cases or accidental coincidences."

Every one will see how weak and inapplicable this is to the miracles of Christ, including His own resurrection.

Still he sees no absolute improbability in miracles.

"Admit God, and you may admit miracles," he says; and from this severely logical thinker this admission should be remembered.

Again, "The conclusion I draw is that miracles have no claim whatever to the character of historical facts, and are useless as evidences of any revelation."

Surely, in connection with the preceding admission, we may well ask why the miracles which are included in the historical narration, and cannot be extracted without tearing the whole to pieces and destroying the historical value of the whole, should not be received as historical facts?

One more extract about the Gospel of St. John and I have done with Mr. Mill. "What *could* be added and interpolated by a disciple we may see in the mystical part of the Gospel of St. John, matter imported from Philo and the Alexandrian Platonists, and put into the mouth of the Saviour in long speeches about himself, such as the other gospels contain not the slightest vestige of, though pretended to have been delivered on occasions of the deepest interest and when His principal followers were all present; most prominently in the last supper. The East was full of men who could have stolen any quantity of this poor stuff, as the multitudinous Oriental sects of Gnostics afterwards did."

The only remark I will make on this ill-written and offensive sentence is that it seems to assume the authenticity of St. John's Gospel. Renan made the same admission in his *Life of Jesus*, and the German critics found this a fatal obstacle to the reception of his views.

I have already, I fear, wearied you with Mill, but I must, for the purpose of giving you a sufficiently correct picture of the degradation of religious belief in circles called philosophical, read a few extracts also from Strauss's recently published work entitled, *The Old and the New Faith*.

I have selected a few extracts for the purpose of exhibiting, in as few words as possible, the absolute repudiation by this writer of all religious belief whatever in the latter years of his life. Thus, "An object of religious adoration must be a Divinity, and thinking men have long since ceased to regard the founder of Christianity as such."

Again, "My conviction is that, if we would not evade difficulties, or put forced constructions upon them; in short, if we would speak as honest, upright men, we must acknowledge we are no longer Christians."

Again, "It is only an ancient Christian-Hebrew prejudice to consider monotheism in itself, as contrasted with polytheism, the higher form of religion."

The absurdity in the author's case of discussing the relative merits of monotheism and polytheism will be evident from the following passage, in which he rejects altogether the existence of a personal God.

"If we endeavour to conceive of a creator of the cosmos, as an absolute personality, we may be sufficiently instructed by the foregoing that we are merely dealing with an idle phantasy."

In connection with the immortality of the soul, he has the following needlessly offensive passage:—

"Even the apostle Paul . . . . believed, or fancied that he believed,—for I deem him better than his speech,—that if the dead rose not, then he and men like him must be fools, if they would not rather eat and drink instead of endangering themselves for the sake of their conviction."

One more instance, and I have done with Strauss.

"If the preceding consideration has conducted us to the conclusion that we can no longer either hold the idea of a personal God, or of life after death, then it would seem that the question with which we have prefaced this section—if we still have a religion—must be answered in the negative."

I have given pain, I doubt not, gentlemen, to you as well as to myself, by dwelling even for so short a time on such miserable sophistry as is contained in Mill's half-admissions and lamentable rejection of divine truth, and in Strauss's absolute rejection of any religion whatever.

The books from which I have quoted are freely circulated amongst our youth,—the one in its original shape as edited by the step-daughter of Mr. Mill, and the other in a translation (which has arrived at a second edition, corresponding to the sixth German edition) by Mathilde Blind.

I do not know whether there is anything significant in the fact that a woman is the editor of each; but, to my own mind, the circumstance adds a deeper shadow to the religious darkness of the age.

And the danger arising from such publications is not to be measured by the effect they have on men who are capable by their learning of detecting the sophistries and falsehoods that are contained in them, and who know that there is scarcely a quibble or a rational objection put forward which was not quite as well known to the ancient philosophers, and in many cases much better discussed. But it is to young educated persons

of high intelligence and imperfect learning that the danger is greatest. Every novelty has its charm, and error clothed in attractive language and armed with the authority of a man of acknowledged genius and learning, is not easily detected by the ardent student of the new philosophies. And here is the proper place for showing you that this danger is not visionary but real and increasing. The Bishop of Oxford, in his recent Charge, wherein his words are necessarily guarded, has exhibited a state of things as existing in the great University of Oxford, of a very alarming character; and, as far as I know, his statement has met with no public contradiction.

"To speak the simple truth," he says, "a considerable number of graduates who hold office in the University, or fellowships in the Colleges, have ceased to be Christians in anything but name;—in some cases even the name is repudiated, when arguments based upon its retention are pressed. It is not only that text-books in some branches of study are recognized, which assume a disbelief of Christian doctrine, and that some lecturers hint, or express, their own rejection of it;—there is something like an understanding that Christian teachers shall abstain from insisting on the truths they believe. Thirty years ago the ablest and most highly esteemed of Oxford tutors took it for granted, in their ethical teaching, that Christianity furnished the only certain standard in morals, and were accustomed to correct the shortcomings of other systems by its rule: Christians are expected to forget the existence of such an authority, when they cross the threshold of their lecture-rooms now. The historical facts of Christianity fare no better than its precepts; deference to scientific criticism (whatever that may mean) forbids them to be taken for true. . . . .

"With self-complacency, which would be amusing if the subject were less serious, they dispose of religion, natural or revealed, with the airy phrases they have borrowed from the latest sceptical review, ignorant of the Scriptures they reject, but, glad to be rid of the restraint which the Divine precepts impose, they wander this way or that, as materialism on one side, or some new phase of philosophy on the other, seems to offer an escape. The practical result of this education is a selfishness of character, far from attractive. Learners in the school of unbelief have been taught it is folly to disturb themselves for the sake of others, they have lost all motive for serious action: self-restraint and self-sacrifice are discovered to be 'mere moral babble'; it is, at the best, an amiable weakness to do good. Human life is but the interval, longer or shorter, which condemned mortals have to pass before they die. 'Our

one chance,' it is said, 'is in expanding that interval, in getting as many pulsations as possible into the given time..... Not the fruit of experience, but experience itself is the end.... The theory, or idea, or system, which requires of us the sacrifice of any part of this experience, in consideration of some interest, into which we cannot enter, or some abstract morality we have not identified with ourselves, or that is only conventional, has no real claim upon us.' So sceptics teach: can you wonder that some who played an honourable part in Oxford life a generation since, refuse to let their sons imbibe lessons so alien from the lore they learned? Can you wonder that to young men who have imbibed this teaching the cross is an offence and the notion of a vocation to preach it an unintelligible craze."

Our only remaining consideration now is that of the atomic theory in its connection with theories of religion. If the subject, in its purely physical aspect, were not so interesting, we might complain of being obliged, on account of recent circumstances, to dig up as it were from its grave of oblivion that old exploded form of atomic atheism, and to go through again the arguments for its refutation. A wearying and unprofitable task surely, but one which the extreme unbelief of some of the philosophical systems of the present day renders necessary. It will be a little relief, and will probably conduce to clearness, if I take the parts of the subject in reverse order and explain first in as few words as possible what is the modern theory as founded on adequate observations and experiments.

The atomic theory in chemistry, due to Dalton, has been established of course for a considerable time, by which it is known that the elementary chemical substances will combine in only definite proportions; but the physical or kinetic theory of molecules and atoms is of much more recent date, and owes its present expansion chiefly to Sir William Thomson and Professor Clerk-Maxwell in England, and to Professors Clausius and Loschmidt on the continent, the experimental researches of Dr. Graham and Dr. Joule having also contributed much to its advancement.

In the theory it is assumed that all matter is an aggregation of molecules compounded of the atoms of the fundamental chemical substances; that these atoms are small almost beyond our power of conception, and are in a constant state of rapid vibration, with velocities differing in different substances, but always absolutely the same for the same substances. It is assumed also that the pressure of gases and

fluids against the sides of the vessels containing them arises from the rapid and ceaseless motions and collisions of the atoms, which in gases are least confined, and are allowed some length of free path without collision, in liquids are more confined, and in solid matter have very little motion indeed.

These are the assumptions which, of course, must, as in the case of the law of gravitation, get their verification by experiment. The experiments which seem to have established the theory (which, however, we must consider to be yet in an infant state) are chiefly those of the rate of diffusion of gases, in connection with the laws of the assumed motions or vibrations of the molecules. And the facts which physicists of the highest reputation of the present day think they have indisputably established are very wonderful indeed, and give us a much deeper insight into the mysterious workings employed in the structure of the universe than we had before. For example, there have been found for the gases hydrogen, oxygen, carbonic oxide, and carbonic acid, and probably, by this time, for many others, the mean velocity for each molecule, and the relative mass, and with somewhat less degree of certainty the relative size, length of free path between collisions, and number of collisions in a second; while conjecturally (that is, subject to very great corrections from future observations). attempts have been made to determine the absolute masses of the molecules, and their number in a given space. To give some idea of the results, I may take the case of hydrogen, for whose atoms the mean velocity is 1,859 mètres per second, and two millions of them in a row would occupy the length of a millemètre, and a million million million million of them would weigh between 4 and 5 grammes. Finally, in a cubic centimètre, at the standard pressure and temperature, there are about nineteen million million million atoms. Is not this wonderful? Some of these results are only approximate, but they give an adequate idea of the correctness of the theory, and want only additional observations for their correction. And it must be borne in mind that the atomic theory is true for the whole universe. A molecule for example in Sirius or Arcturus executes its vibrations in precisely the same time as on the surface of our earth or our own sun.

I will conclude this account of these marvellous elements in the excellent words of Professor Clerk-Maxwell at the end of his lecture delivered at Bradford in 1873: "No theory of evolution," he says, "can be formed to account for the similarity of molecules, for evolution necessarily implies continuous change, and

the molecule is incapable of growth or decay, of generation or destruction. None of the processes of nature, since the time when nature began, have produced the slightest difference in the proportions of any molecule. We are therefore not enabled to ascribe either their existence, or the identity of their properties, to the operation of any of the causes which we call natural. On the other hand, the exact quality of each to all the others of the same kind gives it, as Sir John Herschel has well said, the essential character of a manufactured article, and precludes the idea of its being eternal and self-existent. . . . . Science is incompetent to reason upon the creation of matter itself out of nothing. We have reached the utmost limit of our thinking faculties when we have admitted that because matter cannot be eternal and self-existent, it must have been created. . . . . Though in the course of ages catastrophes have occurred, may have occurred, and may yet occur in the heavens, though ancient systems may be dissolved, and new systems evolved out of their ruins, the molecules out of which these systems are built—the foundation-stones of the material universe—remain unbroken and unworn.

"They continue this day as they were created, perfect in number, measure, and weight, and, from the ineffaceable character impressed on them we may learn that those aspirations after accuracy in measurement, truth in statement, and justice in action, which we reckon among our noblest attributes as men, are ours because they are the essential constituents of the image of Him who in the beginning created not only the heaven and the earth, but the materials of which heaven and earth consist."

I cannot refrain from adding also the concluding words of Sir William Thomson's address from the Presidential chair of the British Association at Edinburgh, in 1871, as they are of a similarly religious spirit.

"I feel," he says, "profoundly convinced that the argument of design has been greatly too much lost sight of in recent zoological researches. . . . . Overwhelmingly strong proofs of intelligent and benevolent design lie all around us, and if ever perplexities, whether metaphysical or scientific, turn us away from them for a time, they come back upon us with irresistible force, showing to us through nature the influence of a free will, and teaching us that all living beings depend on one ever-acting Creator and Ruler."

We have thus had the testimony of two great living physicists to their belief in a personal God, the maker and preserver of all things; and it will be desirable to add in this

place, that of a third who occupied the same Presidential chair in 1869, namely Professor Stokes. At the close of his address, speaking of organic structures, or of life, he says, "Let us fearlessly trace the dependence of link on link, as far as it may be given us to trace it, but let us take heed that in thus studying second causes, we forget not the First Cause, nor shut our eyes to the wonderful proofs of design which, in the study of organized beings especially, meet us at every step. . . . .

"When from the phenomena of life we pass on to those of mind, we enter a region still more profoundly mysterious. We can readily imagine that we *may* here be dealing with phenonema altogether transcending those of mere life, in some such way as those of life transcend, as I have endeavoured to infer, those of chemistry and molecular attractions, or as the laws of chemical affinity in their turn transcend those of mere mechanics; Science can be expected to do but little to aid us here, since the instrument of research is itself the object of investigation. It can but enlighten us as to the depth of our ignorance, and lead us to look to a higher aid for that which most nearly concerns our well-being."

Let us now proceed to devote a few minutes to the study of atomism as understood by the ancients, with the express purpose of offering a few criticisms on the Belfast Address. This would be scarcely necessary if that celebrated Address had been compiled from original sources; but of this I will speak afterwards.

The principle, as expounded, with a large amount of detail and illustration, in the poem of Lucretius, is taken immediately from Epicurus; but he had it, as is commonly believed, from Democritus, who enlarged and improved the doctrine which he had received from his contemporary and teacher Leucippus. It is doubted even whether Democritus did not get it, or a portion of it, from a still earlier source, namely Moschus, a Phœnician, in the course of his long travels in Asia and Egypt. This, however, is of little importance. Its ancestry, as regards essentials, is rapidly traced from Leucippus and Democritus to Epicurus, and from Epicurus to Lucretius. Democritus flourished about 450 B.C.; Epicurus 305, and Lucretius about 70; and it is useful to bear in mind that Cicero and Lucretius were contemporaries.

The works necessary for a study of the philosophy as given by Democritus, are Diogenes Laertius; several treatises of Aristotle (including his *De Generatione et Corruptione*, the *Metaphysics*, and the treatises *Physica* and *De Animâ*); to these must be added Sextus Empiricus, *Adv. Math.*, Plutarch *de*

Placitis Philosophorum, Cicero's *De Naturâ Deorum*, and some of his other works. No one also is likely to get a clear idea of the connection of the physical theory with Democritic atheism, without having made himself master of the first three chapters at least of Cudworth's great work, *The True Intellectual System of the Universe*, and probably of some other works which I have not had leisure to attend to in my own research. Of modern works Dr. F. Ueberweg's *History of Philosophy*, translated by Morris, seems to be one of the most useful.

Let us now see with what apparatus the author of the Address undertook to bring before one of the most learned bodies in Europe, and to recommend to them, this Philosophy, including in some degree at least the atheistical principles.

The chief portion of his equipment appears to have been, a recently published work of Professor Lange, entitled *Die Geschichte des Materialismus*;* a work by an American, Dr. J. C. Draper, entitled *History of the Development of Science in Europe*, of which I would wish to be understood to speak respectfully, and to separate altogether from Lucretian principles; Munro's Lucretius; and two or three other modern books. Almost at the commencement of the Address Bacon is mentioned, but it is in a quotation from Lange, and in depreciation of Aristotle and Plato as compared with Democritus.

I am mentioning bare facts, and I presume that the most devoted friend or admirer of the author of the Address, could scarcely venture to speak highly about the amount of scholarship brought to bear on this difficult point of Greek philosophy.

The historical sketch which follows is just what might have been expected: a polished and rapid style is used to give us a sketch of philosophy, chiefly in connection with the atomic

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* Since the delivery of the Belfast Address, another volume of this very learned and elaborate work has appeared, forming the second part of the second book.

The following translated extracts would seem to show that Professor Lange's own sentiments are very different from those of the author of the Address:—

Page 149. "We are not in a condition to comprehend the atoms, and we are not able, out of the atoms and their motions, to explain even the smallest phenomena of consciousness."

Again. "One may twist and turn the idea of matter and force as one will, we stumble at length upon the incomprehensible or unknowable, if not altogether upon mere inconsistency, as in the conception of the forces which act at a distance in empty space. There remains no hope of solving the problem—the hindrance is a Transcendental."

theory from the time of Democritus. We are painfully conscious all the time that we are only listening to Lange and Dr. Draper, and are in fact frequently reminded of it by the author. We are also aware, all the time, of the one-sided character of the sketch. Indeed any sketch of a single period of history, to say nothing of so long a space of time (from Christianity and before it till the present time) which regards it from only one point of view, must of necessity be exceedingly imperfect. We are asked to go over, at railway speed, the events included in the time which has elapsed since the breaking up of the old form of society under the Roman empire up to the present day, including the various disturbing elements affecting the political relations of the various European states after the reconstruction of society; the action of Christianity upon the barbarous nations composing it; and finally the general awakening of intellectual activity in the centuries immediately preceding and following the Reformation. We are asked to look at these mighty changes only in their relation to physical science, and with such illustrations as chiefly concern the atomic philosophy.

Why is Giordano Bruno set so prominently before us, but because he revived the doctrine of atoms, though in a very confused way, and asserted pantheistic principles; and because he was a martyr to science, and thus a rare opportunity was given of showing the cruelty and obstructiveness of the Church? Why even is so much space given in so short a sketch to a much greater man, Gassendi (the sketch as usual taken from Lange), but for similar reasons?

For any purpose whatever, except in its relation to materialistic philosophy, the sketch is useless if not mischievous, and we need not be detained with it any longer.

It was my purpose to have gone into some detail with the successive steps of the ancient atomic philosophy, and I have collected a considerable quantity of material; but my time is nearly exhausted, and the subject, in connection with the modern theory, is scarcely worth the trouble.

The theory itself of the construction of the Cosmos by the fortuitous motions and collisions of atoms is so grossly erroneous as to be but a caricature of that with which we are now acquainted by means of the resources of modern science; but, at the same time, there are one or two points which cannot be passed without notice. The germ of truth was there, and the acute Greek intellect had not only speculated correctly on the nature of matter as distinguished from its qualities or accidents, and of motion as of one of its most important

fundamental properties; but the idea once gained was never lost sight of. That Democritus introduced an atheistical theory in connection with it was a backward step, as is clearly shown by Cudworth; and that this view was afterwards retained and expanded by Lucretius with much misapplied ability and in excellent verse, may perhaps be accounted for by the corruption of Roman morals and the debased state of religious belief at that time. In fact the whole subject has become at the present day rather literary than scientific; the modern doctrine is not built upon the ancient theories, nor in the slightest degree indebted to them; and the chief interest which can be felt in the study is of the same kind as that arising from any other branch of ancient philosophy.

In the time of Cicero, a Roman nobleman, C. Memmius, restored the Garden of Epicurus, and, it is said, intended to raise a public building for the advancement of Epicurism. Some celebrated men followed him, among whom was Velleius, one of the interlocutors in Cicero's *De Naturâ Deorum*. To this person (Memmius) Lucretius dedicates his book and seems to be chiefly anxious, throughout the poem, to impress upon him the necessity of imbibing perfectly the *atheistical* principles of it.

Of Lucretius himself very little is known, and that little is not to his advantage, though it appears that his family was a good one. It is supposed that he went to Athens to be educated, and that he listened to the Epicurean philosophy of Zeno and Phædrus. It is said that he was dissipated, but I do not think there is any direct testimony for this, and the fact is probably assumed from the tenor of his poem and his Epicurean tenets. According to Eusebius, he committed suicide in the forty-fourth year of his age, in consequence of the fits of madness to which he was subject from the effects of a philtre or love-potion administered to him by his mistress Lucilla.

Tradition also says, thongh I do not know any confirmation of it, that his wonderful poem was composed during the intervals of his frenzy.

This is enough to know about Lucretius, and, for his philosophy, I cannot sum it up better than in the epigrammatic sentence of a French biographer: "Ce système (d'Epicure) dans les vers du poète paraît, il faut l'avouer, très-logiquement absurde, en même temps qu'il est fondé sur la physique ls plus ignorante et la plus fausse."

Why the author of the Address should have chosen this subject and brought it in its most absurd (that is the religious)

aspect before the British Association, has been always a matter of wonder with myself and many others; and that wonder is not lessened by the explanations which he has offered in the preface to the seventh thousand.

He evidently wishes to keep, by its means, prominently before our eyes the potentiality of the fact that matter is in some way or other the origin of life without the intervention of other life. And yet, as far as the atomic theory is concerned, nothing could be farther removed from probability. Could an atom unmoved produce life? and could mere motion add to its capabilities? Would the fact that great numbers were moving and colliding with very great velocities alter the state of the case?

And yet, he says, when grasping the true idea of the atom and molecule, "By an intellectual necessity I cross the boundary of the experimental evidence, and discern in that matter which we, in our ignorance of its latent powers, and notwithstanding our professed reverence for its Creator, have hitherto covered with opprobrium, the promise and potency of all terrestrial life."

I have spoken before of the abuse of imagination as applied to science, but this is perhaps one of the most singular instances of misuse which has occurred. If ever there was anything which has put an impassable barrier in the way of imagination as well as knowledge, it is the molecule or atom. "Thus far and no farther" is the address to the human mind, as plainly as to the ocean, that on the shore within a defined range its proud waves are stayed.

It is what the mathematician would call a case of a discontinuous function. A successive set of values of the variable will give tabulated values of the function amenable to law up to a certain point, and then the formula fails to give any finite or intelligible result. And here it is so likewise—we can resolve matter into its elements up to a certain point, and then we come to substances absolutely irresolvable and unchangeable, or, as an eminent physicist has well called them, the foundation-stones of the universe. Imagination has no more place than farther experiment has at present. We can do nothing but look up and adore the *Author* of Nature.

I am unwilling to discuss farther the merits or the demerits of the Belfast Address. Its brilliant style and genuine eloquence and enthusiasm, the jealous love of its author, not only for nature and experimental research, but even for the inert matter on which the experiments are made, have induced some to look upon it with greater admiration than its philosophical

character would warrant, and others to err on the other side by too great a fear of the mischief which the tone of its teachings with regard to religion will warrant. I do not partake of either the admiration or the fears; and, after the full discussion of its bearings on religion in various journals and reviews, entered into by men far more competent for the task than I can pretend to be, I may well decline the office of pursuing the subject farther, especially in an Address which has already taxed your time and patience rather severely.

I have been obliged to take you with me through the dark and dreary places occupied by the philosophical atheism of this boasted age of intellect and light. In the last writings of Mill I have introduced you to his pretended philosophical ideas about the being of a God, and the existence of a revelation as from Him, which, in accuracy, are, in my opinion, far behind those of the Greeks and Romans a little before the Christian era. Groping as they did in the dark, and impossible as they found it altogether to sever the notion of the Creator from the matter which He has created, (for Pantheism in some shape or other pervades nearly all their systems), they were rarely guilty of the unpardonable error of speculating on the existence of a supreme God of limited power. The notion is metaphysically impossible, and we may well believe, both from Mill's admissions and his non-admissions, that in his latter days his keen, incisive, logical intellect was dulled. Assuming the fact of Omnipotence in the Deity (which he will not grant), his admissions give us, unless the whole be written with grim irony, almost all which we Christians can desire, that is, the probability of a revelation from God, which of course includes supernaturalism, and the probability also of miraculous intervention. With regard to Strauss, I consider the melancholy exhibition of some of his latest thoughts which I have read to you, as the *reductio ad absurdum* proof of almost all which we contend for. He has for many years been descending from one platform of semibelief and rationalistic doubt to one still lower, till he has lost *all* religion, and coolly discusses the question, "Are we yet Christians?" by trying to persuade us that there is neither God nor immortality. Few even of the illuminati among our men of science who are engaging themselves, each from his own point of view, in the propagandism of unbelief or the establishment of something else which they call religion, will follow Strauss to this lowest depth, and his example may, under the blessing of God, act as a warning rather than an encouragement.

Then with regard to physical science, I think we have seen that its real advances are in favour of religious faith. This mysterious atom in which some can see "the promise and potency of all terrestrial life," has to my mind brought God nearer to us. We see now the elements out of which it has pleased Him to make the world; we see the presence of that one Supreme Intelligence as distinctly in the weed that grows or the flower that blossoms on our own planet as in the stars and nebulæ which at still unmeasured or unimagined distances reflect His glory and proclaim His unvarying laws.

The Bishop of Llandaff.—My Lord Shaftesbury, ladies, and gentlemen,—I have the honour to move: "That the best thanks of the meeting be presented to the Rev. R. Main, the Ratcliffe Observer, for the Annual Address now delivered, and also to those who have read papers during the session." It is a great gratification to know that this Address, which unites the two subjects of scientific investigation and true Christian faith, will not only have been heard with very great advantage by those present, but that, being published in our Journal, it will be circulated throughout the kingdom, and will give the same pleasure and profit to many others that it has done to ourselves. The second part of the resolution refers to those who have read papers during the session — papers which are not only extremely valuable from their contents, but also from the discussions which follow them. As I have never before this had the pleasure of being present at any of these meetings, I may take the liberty of saying how thankful I am that such a society as this exists, and that it is pursuing its course with such energy. I trust that every Anniversary meeting may prove that the Society is gaining greater hold upon the intelligence and respect of the public. We live in days of great intellectual activity, and there is no subject to which that intellectual activity has given a greater impulse, perhaps, than that of scientific inquiry and the practical results of science to our daily life. I think we may well believe that there is no desire whatever to limit the progress of scientific inquiry. Certainly we could not possibly do so. But why should we attempt it? If I understand it aright, scientific inquiry, when properly conducted, is nothing more nor less than a devout examination of the works of our Almighty Creator; and the more we become acquainted with these, and the nearer we approach to His presence, the more must every one be filled with devout adoration and a sense of His infinite majesty and glory. As the learned author of this address has pointed out in the course of his observations, that the one circumstance of the Almighty having given us faculties to enable us to pursue these investigations, must be taken *à priori* as a reason and a proof that it is quite consistent with our duty, as well as with our highest interests, that we should pursue

scientific inquiry. But we must always recollect that it has pleased our Almighty Maker to give unto us not only intellectual faculties, but also a moral nature, and something which has to live when this world has passed away. And this moral condition of man brings its own necessities, which must be supplied, and it is impossible that mere science can supply them Now, there is no necessity that there should be an antagonism between the Revelation of God in His works and in His word. There may be difficulties in Revelation—we should expect such; for how are we to understand those things which have reference to infinity? We find difficulties in nature which we cannot explain: how much more then, when we come to consider the moral and the spiritual things? There may be a difference between the kind of evidence in which we are to receive Science and Revelation; but we should always recollect that, though the truths of religion may not be the subject of demonstration, we have an amount of moral evidence collected from the facts which range over a very wide surface indeed, all converging at one point; and these give us a moral certainty that religion is true. And as reasonable men we are bound to act upon that moral certainty. And if we did what Coleridge recommended a friend to do, who was doubting about religion, namely, to try it, we should no doubt find the truth of what our Saviour has said, that if any man do the will of God he will know whether the doctrine be of God.

Rev. T. P. Boultbee, LL.D.—I rise with great pleasure to second the resolution. As an old Cambridge mathematician, I have listened with the greatest delight to Professor Main's address. He has given us certain modern scientific results, and the limits within which these results have been dealt with have been the closest in which they could possibly be laid down. Mr. Main has proved the use and necessity of this Society in two ways; he has exposed the formation of errors, and he has shown a great deal of their fallacies, and he has thrown the great weight of his own personal authority on the side which we all believe in. What we all recognize as the great cause and necessity for this Society is the peculiar tone of certain men of science, who have not limited themselves to their own subjects, but have thought proper to attack the very fundamental principles upon which, not only all religion, but all society is founded; and if it be so, inasmuch as we must live in society, these things are far more valuable to us than any mere scientific discoveries can be. We must live here together, and charity and justice, and all the fundamental virtues, are necessary to us here; but it is not necessary to us that we should know the ultimate constitution of atoms. Therefore, to say nothing of the infinitely greater things that rise up before us as Christians, we are all persuaded of the great value of this Society. This is not simply a clerical society; but in this, as in all other matters, we advance best when the clergy and the laity can advance together. I have much pleasure in seconding the resolution.

The resolution was carried unanimously, and acknowledged by the Rev. R. Main.

Mr. C. Brooke, F.R.S.—I am requested to address you a second time in consequence of the unavoidable absence at the House of Commons, of Mr. John Walter, who had charge of the following resolution :—"That our best thanks be given to our esteemed President, Lord Shaftesbury, not only for his kindness in presiding on this occasion, but for the inestimable manner in which he has devoted his whole life and energies to the maintenance of all those principles which it is the main object of this Society to support." (Cheers.)

Mr. A. W. Crickmay.—I have the honour and pleasure of seconding the resolution. The resolution was carried with applause.

The Earl of Shaftesbury, K.G.—My lords, ladies, and gentlemen,—I am sure you will readily believe that I accept with much gratitude the vote you have been pleased to pass ; but I should feel a still deeper sense of gratitude if you would excuse a speech from me, for I really shrink from all the great subjects which have been brought before us. I believe I was present at the very birth of this Society, when an address was delivered by my friend Mr. Walter Mitchell, in a small dark room. I had no conception at that time of the work which the Society would do, and of the position which it would hold, and I assure you I feel now very much like an astonished duck that finds it has hatched an ostrich's egg. (Laughter.) I had no expectation whatever of seeing the Society assume such magnificent proportions, and from the bottom of my heart I thank Almighty God that He has so prospered our efforts. (Cheers.) I did at one period give up some time to the study of science, but it is so many years since, that I have lost the little scientific knowledge I once had. Forty-four years ago I was much engaged in Sir James South's place at Kensington, and many hours and days have I spent there, but I am astonished now at the ignorance in which I was, at a time when I thought I had attained to the very heights of science. We are greatly indebted to our learned lecturer to-night for conveying to us so much important knowledge, and for conveying it in so masterly and literary a style. (Cheers.) And imbuing it also with such a noble spirit of piety, religion, and truth. (Loud cheers.) Again I say, I give God thanks that we are brought together to have it manifested before us that there are men of science who can combine the two, and see in science and religion the one God, the Creator of the world. I remember that the object with which this Society was formed was, not merely to beat down the views of others, not to be antagonistic to the progress of science, but to do all that we could do for the development of Truth ; and if I may use the phrase, to give religion "fair play" : for our opponents came down with so much heat, and such a weight of authority, and told us that no man who was not a simpleton could ever believe in science and religion together, that we said, "We will see what we can do—we will bring masterly minds and pious hearts together, and see if we cannot give a great manifestation in favour of revealed truth." What has been the result ? Has there not been a great reaction in the public mind ? (Cheers.) Do not people now, to a much larger extent, profess to believe in Revelation ? And

do not some of those believers rank among the best scientific men of the day? (Cheers.) My own desire as to science is that she should go on with enormous and uncontrolled rapidity, rather than go so slowly as she does. Our scientific men lag behind too much; they get a fact and rest upon it, and think that with it they can tear down all revealed religion; until after a time they find it no fact at all. (Cheers.) They should not pause so long, they should dive to the lowest depths, ascend to the greatest heights, and leave nothing untouched nor unexamined; but they should be sure of their "facts" before they come forward and proffer to weak and timid minds a "theory," and so establish an unbelief that may never be uprooted: for there are many who hear the statement of a case who never hear its refutation. (Cheers.)

[The Annual Meeting being concluded, the members, associates, and their friends assembled in the Museum of the Society of Arts, where refreshments were served.]