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1910.

505TH ORDINARY GENERAL MEETING.

MONDAY, MARCH 21ST, 1910, 4.30 P.M.

HEYWOOD SMITH, ESQ., M.A., M.D., IN THE CHAIR.

The Minutes of the previous Meeting were read and confirmed.

The following elections were announced :—

As Member, T. B. Bishop, Esq.,

As Associate, The Rev. S. H. Wilkinson, F.R.G.S.,

As Missionary Associate, The Rev. E. A. L. Moore.

In the regrettable absence of the author the following paper was then read by his son, P. A. Irving, Esq., B.A. :—

LIGHT, LUMINARIES AND LIFE; IN CONNECTION WITH THE GENESIS ACCOUNT OF CREATION,
By Rev. A. IRVING, D.Sc., B.A.

(Illustrated by lantern slides.)

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I. INTRODUCTION.

THIS paper being intended to be supplementary to my former paper,* on "Evolutionary Law in the Creation Story of Genesis," a few references to that paper are called for by what has passed since in public controversy, more especially that which appeared in the *Guardian* newspaper in the autumn of 1907.† Professor E. Hull was also good enough to bring that paper into prominence in the columns of the *Church Family*

* See *Trans. Vict. Inst.*, vol. xxxviii (1906).

† See the *Guardian*, Oct., Nov., Dec., 1907.

Newspaper in an article in defence of the thesis—"The Genesis Account of the Creation not inconsistent with the Geological Record."*

I am glad to know that my previous paper has been found both interesting and useful to many students (*pace* Professor Driver, of Oxford, and the feeble "Vaticanism" of Professor Sollas in the *Guardian*). In addition to what has appeared in print, I have a collection of private letters, some from entire strangers, expressing their appreciation of the line which I had taken and of the arguments of my paper,† which were partly repeated in controversy.

Among matters which, since my paper was read, have come under my notice, I feel bound to express my warmest appreciation of the paper read before the Church Congress by the Rev. G. T. Manley.‡ It was what might be expected from a man of Mr. Manley's academical and intellectual antecedents, who had so completely riddled the so-called philosophy of Huxley and Spencer several years before.§ Especially valuable are the remarks in his paper on the value and importance of giving closer attention to "apparent discrepancies." As he truly remarks,—"An attitude of inquiry is far different from the undesirable frame of mind, which looks upon the reconciliation of science with the Bible as a Chinese puzzle, and twists and forces them into agreement by some ingenious process . . . Current Science is only the teacher of its own generation, the Bible is the teacher of all the ages."|| A fitting rebuke that to the rather flippant sneers of the Oxford Professor of Geology about "reconcilers."¶ Professor Sollas (the recent President of the Geological Society) should know that quibbling does not

* See *C.F. Newspaper*, Oct. 2nd, 1908.

† These include such men as the Dean of Lincoln, the Headmaster of Eton, F. Hugh Capron (author of *The Conflict of Truth*), Rev. Arthur Carr, the Headmaster of Wellington, along with others, entire strangers to me; one long letter to that effect reaching me from a missionary in far distant Matabeleland, whose mind seemed relieved on finding the strong negations of the late Bishop Hicks (scientist as he was) combated in the pages of the *Guardian*. To one writer, Rev. A. J. S. Downer, I am much indebted.

‡ *Guardian*, Oct. 9th, 1907. Mr. Manley, as a Senior Wrangler and Fellow of his College, shows a more capable grasp of the scientific aspect of the "Genesis" question than does the learned and distinguished Hebraist of Oxford, to whom I shall have to refer in the sequel.

§ See *Christian Apologetics*, London (John Murray), 1903.

|| *Guardian*, loc. cit.

¶ *Guardian*, Nov. 6th, 1907.

advance the cause of *truth*; and he ought to recollect, that each new attempt in that direction should be judged on its own merits, and not looked at through the haze which may have been created by earlier attempts made in a less advanced state of our knowledge. On several occasions I have felt it necessary, before this Institute and in the columns of the *Guardian*, to point out the fallacy of assigning to the utterances of even the highest authorities in science a *finality*, which they would be the last to claim for what seems to them the resultant outcome of the latest scientific advance. It was therefore satisfactory to find this contention of mine strongly supported two years ago by a member of the staff of Greenwich Observatory, who writes to me :—

“I was very glad that you laid emphasis at the Meeting on Wednesday* on the fact that there is no *finality* in Science. I think that that fact must always be kept in view as of first importance, when we are discussing the relation between Revelation and Science.”†

I have been taken to task in several quarters for suggesting that the ancients, and in particular the writer of the Genesis Narrative, may have been possessed of more knowledge of nature by direct observation than we generally accredit them with. I dealt with that point as it turned up in controversy;‡ and it may suffice to remark here that the more one learns of the indications of such knowledge as possessed by prehistoric men, and of the ancient science of the Chinese,§ the more value one is compelled to attach to such references as are made in the prehistoric chapters (i to xi) of the Book of Genesis,|| to such knowledge of practical application of nature to the wants of man, as was possessed by the men of at least the Bronze and the Iron Ages, if not even by the Neolithic men. It is from people who touch science from the outside that such criticisms

* The Annual Meeting of the Victoria Institute.

† Letter to the present writer, dated Aug. 21st, 1908, by Mr. E. W. Maunder.

‡ *Guardian*, Nov. 20th, 1907.

§ See Yu Tung Kwai, on the “Ancient Knowledge of Chemistry,” in the *Times*, June 3rd, 1909, and the *Standard* of June 2nd.

|| E.g., the building of cities and the use of bronze (?copper) and iron by the impure race of Cain’s descendants.

Sir Robert S. Ball, F.R.S., the Cambridge astronomer, remarks: “The discovery of Mercury was a brilliant achievement of prehistoric times. The early astronomer who accomplished that feat . . . merits our hearty admiration for his untutored acuteness and penetration” (*Story of the Heavens*, p. 290).

come, and it seems to have taken away the breath of a Cambridge Professor of Divinity, who writes to me:—"I am confident that the doctrine of a 'pre-Adamite man' is not the doctrine of the Bible." If by that is meant that the early chapters of the Bible are primarily concerned with the development of the race of Adam, centering itself at the Call of Abraham upon the chosen people and its history, to whom the special revelation was given, we may I think agree. But while we recognise that as "the doctrine" of the Bible, we may surely at the same time look for agreement between the glimpses given to us of earlier races, in those parenthetical verses (iv, 16-24) and what anthropological science has revealed to us of prehistoric man. It is therefore somewhat startling to find Professor Driver* writing, "Who could there have been to slay Cain? According to the existing Book of Genesis there could have been no one"! Yet the Book tells us that he found a people, among whom he took a wife, at a distance from his paternal home, in the land of the Nâdu, "the wanderers," the nomads, as the Stone Men undoubtedly were. This fact is blinked, and then the inference† is suggested that "Cain" is "a figure which belonged to a much later stage in the history of mankind." The speculations on this subject given in Dr. Driver's learned work are not very conclusive. He points to an "inconsistency, of which the narrator is evidently unconscious"; on which it is fair to ask why he should have been conscious of the "inconsistency," which is read into his narrative by the critics, who refuse to recognise (as he does) the existence of a pre-Adamic race? With this may be compared the preface to the story of Noah and the Flood contained in Genesis vi, 1-8, on which some interesting remarks by Mr. Henry Proctor‡ are very suggestive, although some adverse criticisms of Mr. Proctor's "Hebrew" have reached me from Cambridge.

At the time when my previous paper was read I was further taken to task by two of my critics, neither of whom is very prominent in the world of letters, for speaking of the Genesis account as a "poem,"§ as if they had never heard of "poems in prose." Yet so distinguished a scholar as the Dean of Lincoln did not hesitate to write to me at the time: "The

* *The Book of Genesis* (5th ed., 1906), p. 67.

† *Op. cit.*, p. 72.

‡ See *Trans. of Vict. Inst.*, vol. xl, pp. 74, 75. Discussion of Professor G. F. Wright's paper on "The Influence of the Glacial Epoch upon the Early History of Mankind."

§ See *Trans. Vict. Inst.*, vol. xxxviii.

criticism of your use of the term ‘poem’ is absurd. Longinus puts the ‘Let there be light, etc.’ by the side of the first passage of Homer, as types of ‘the sublime’ in style. You can have prose poems.” Again, a very able contributor to the subsequent correspondence in the *Guardian** writes to me—“The objection that it has not poetical form seems to me a quibble, and a rather poor one. Some of the finest poems in existence are in prose; e.g., De Quincey’s ‘Levana, or our Lady of Sorrows.’” I was impelled to speak of it as a poem from the balanced proportion and the rhythmic swing of its thoughts, which seem to me to give it the stamp of poetic genius. Perhaps we all need to “think orientally” a little more than we are accustomed to do, in order rightly to appreciate it, or the Bible generally.

What I find in briefest outline in the poem may perhaps be put thus:—

From the first it was God (*Elohim*, a word of obscure derivation according to Dr. Driver)† who *was creating* the heaven and the earth; bringing into being the “waste and void” matter of the universe, with its marvellous properties imparted to it by the Creative Spirit, the primary result being *luminosity* (v. 3), as this “waste and void” matter (this matter in an ultra-gaseous state) became integrated by the energy of chemical affinity; *directing* the powers of inorganic nature (supplemented later on by the introduction of life); so that the inspired writer was able to reach the climax in ii, 3, summing it all up in the double category of the work “which God had *created* and *made*,” all culminating in man, a being endowed with spiritual faculties and powers.

This will be found to agree with the last paragraph of my previous paper, which does not clash very much with the *credo*, to which Dr. Driver‡ confessed in the last stage of the controversy, except on the question of the sequence of the phenomena, which are associated with the third and fourth “days.” That question is dealt with at length in the present paper. It has long been a puzzle to me, as to why the writer, if he meant a literal “day,” should have gone out of his way in each case to define it by “an evening and a morning,” instead of phrasing it in accordance with the natural sequence of things.

* Rev. A. J. S. Downer (*ibid.*, Dec. 18th, 1907).

† *Genesis*, 6th ed., p. 402.

‡ *Guardian*, Dec. 11th, 1907. See also my reply to that (*ibid.*, Dec. 18th, 1907).

One more point may, I hope, be permitted here. The more one compares the Genesis poem with the 90th Psalm, the more one finds of community of thought in the two. The latter has been described as "perhaps the most sublime of human compositions."^{*}

If we want to get behind the narrative of Genesis at the thoughts of God floating in the mind of the author of it, it is to this 90th Psalm that we may, I think, fairly look. An impartial perusal of Bishop Perowne's introduction to this psalm will enable anyone to see how feeble is the case that has been made out by the critics against the traditional heading, "A Prayer of Moses, the man of God"; and we may fairly claim that the same lofty conception of the Divine Immanence with the Divine Transcendence behind it all, which characterises the psalm, may be found in the Genesis poem.

The case against the Mosaic authorship of the psalm may be said to be "not proven"; and a close comparison of the internal evidence found in the community of the ideas, which run through the two documents, ought in common fairness to be taken into account by those who would assign a later—even an Exilic date—to the Genesis document.[†]

The dogmatic style which characterises the assertion of the "higher critics," must be taken for what it is worth; more especially after the collapse of the contentions of that school in the matter of the historicity of the *Acts of the Apostles*.[‡]

II. SOME GENERAL POINTS FURTHER CONSIDERED.

(A) *The Geocentric Conception of the Universe.*

In the controversy, to which reference has been made Professor Driver[§] had the hardihood to say that the Genesis account of creation is *geocentric*, and therefore "false." How on earth could it be otherwise than geocentric? That however does not make it *false*, unless it can be shown that those observations of the heavenly bodies which were fitted into that conception were false. *Empirical* it certainly is; but empiricism is a matter of degree; and we might equally say of such a dogma as the Lyellian uniformitarian doctrine, which long dominated

* See Perowne, *The Psalms*, vol. ii, p. 157.

† See letter from Dr. Dukinfield Astley, *Guardian*, Nov. 6th, 1907.

‡ See Sir Wm. Ramsay's Paper, "Exploration of Asia Minor," etc., *Trans. Vict. Inst.*, vol. xxxix.

§ *Guardian*, Nov. 20th, 1907.

geological thought in this country, that it was empirical. The astronomers of the earliest civilizations known to us, and probably even Neolithic men,* had very ingenious ways of recording and classifying their observations of the apparent movements of the celestial bodies ; and, so far from being "false" were these, that they went a good way towards laying the basis of the *Kalendar*, by using the geocentric conception, upon which the *Nautical Almanack* in use to-day is constructed.†

Professor Maspero‡ tells us that "the Chaldaeans had conducted astronomical observations from remote antiquity," centuries anterior to the earliest date ever assigned to the Book of Genesis, and with such a degree of accuracy as to be able to foretell eclipses ; and though their notions of the causes were affected by their "vain imaginations," the observations were not falsified by that. One can follow Mr. E. Walter Maunder, F.R.A.S., of the Greenwich Observatory, much more readily than Professor Driver (even with Professor Bonney's endorsement),§ when, in his Address to the Victoria Institute,|| on "The Bible and Astronomy," he tells us that "The Astronomy of [Genesis i] is indeed primitive and simple in character, but it is the astronomy of observation. It concerns the observed brightness of the sun, moon, and stars. But it is not myth ; there is not the faintest deification of sun, or moon, or stars, or of spiritism. There is no confusion of ideas ; no anthropomorphic treatment of sun or moon. The astronomy of the chapter is sane and simple, and (we may truly say, to the very small extent to which it goes) scientific." So the astronomer. Is it not possible for the mind of the geologist to be too geoconcentrated ? It certainly seems that it was, for the quarter of a century or so which held the geological mind in the swaddling bands of uniformitarian empiricism, before it was forced to open its windows to the side-lights of astronomy, chemistry and physics.¶

One thing that impressed itself upon my mind in the

* *E.g.*, at Avebury and Stonehenge.

† See letter by Mr. H. W. Morley in the *Guardian*, Nov. 27th, 1907.

‡ *Dawn of Civilization* (trans. MacIure). S.P.C.K., p. 775.

§ *C.F. Newspaper*, Oct. 9th, 1908.

|| *Trans.*, vol. xl.

¶ Cf. Friday Lecture at the British Association, Bath Meeting (1888) by T. G. Bonney, F.R.S., on "the Foundation Stones of the Earth's Crust," and the Address to Section C on "Evolutionary Geology," by J. W. Sollas, F.R.S., in 1900; also *Chemical and Physical Studies*, etc., by myself (1889).

controversy in the *Guardian* of 1907, to which reference is made in the present paper, was the apparent incapacity of Professor Driver to think in terms of scientific thought. That eminent Hebraist is not serving the cause of *truth*, by including in the earlier chapters of his *Genesis* feeble attempts to give the results of later investigations of great scientific questions cast in the mould of his own mind, and then resorting to the art of dialectic "fence" to maintain them for consumption by his pupils in the Oxford lecture-room. Such a process amounts to dogmatism on matters on which he has no claim whatever (so far as I know) to speak as an expert; and involves the fallacy of assuming finality for the conclusions of scientists themselves. It would be better, I think, if Dr. Driver would substitute for his little homœopathic doses of "science" a good "bibliography" of the subject, which could be simply added to from time to time, and would do far more to open the minds of theological students to the meaning and nature of science.

It is only fair to recollect that in his last letter dealing with this subject,* Dr. Driver corrects himself to some extent, when he speaks of "the *imperfect* science of antiquity." I think, however, that he would find very few Fellows of the Royal Society who would not be prepared to tell him that the science even of the twentieth century is "imperfect." Every Presidential Address to the British Association emphasises the fact.

(B) *The "Firmament" (Hebrew Expanse).*

Dr. Christopher Wordsworth (no mean Hebrew scholar) tells us in his *Commentary* that the Hebrew word *rakia* means "literally an *expanse*, not necessarily solid, but simply extended." The *LXX* render it by the Greek word *στερέωμα*, in which we may perhaps trace the influence of Egyptian mythology. Then the Vulgate translated that by *firmamentum*, which carries more the idea of something rigid, as a prop or support. But I would suggest that we are under no logical necessity of forcing into the Hebrew word *rakia* the conceptions of later ages and cultures involved in the words *στερέωμα* and *firmamentum*. It was therefore with no little surprise that I found a professor of theology, who is moreover a fair Hebrew scholar, saying in a letter to me a short time ago,† "Why the very idea of a 'firmament,' *the inverted bowl of the sky*, belongs

* *Guardian*, Dec. 11th, 1907.

† Following apparently the writer of the article "Creation," in Hastings' *Dictionary of the Bible*.

to a geocentric conception of the universe, doesn't it?" My reply was that we are not bound to the word "firmament" in its secondary (and poetic) meaning; and that, if you substitute the true word *expanses* the difficulty vanishes, and we get a *scientific fact* stated, the geocentric conception notwithstanding. It would seem almost that the poetic idea, as expressed (*e.g.*) in Addison's well-known couplet—

"The spacious *firmament* on high,
And all the blue ethereal sky,"

had so interwoven itself with modern literature that it required more moral courage than the Revisers of 1884 possessed, for them to boldly translate *rakia* by *expanses* in the text.—

Let us consider the three definite statements:—

- v. 14.—"Let there be lights *in* the firmament of heaven";
- v. 15.—"Let them be for lights *in* the firmament of the heaven";
- v. 17.—"God set them *in* the firmament of the heaven."

We shall have to deal with these more at length later on. For the present we do well to see what lead they give us as to the idea present in the mind of the writer of this chapter, when he used the word *rakia* in these places, and at an earlier stage of the narrative (v. 6, 7, 8). The most hostile critic will surely refrain from imputing to him such puzzle-headedness as to make him mean one thing by the word in the earlier passage and a totally different thing in the later. He identifies the expanse with "heaven," to which he does not even hint at assigning a limit. And if, by all canons of criticism, we have the common fairness to allow him to use the word in the two passages *consistently*, we are driven to the conclusion that when he spoke of "the waters above the firmament" in the earlier passage, as divided by it from the waters under the firmament (terrestrial waters) he placed the waters above the firmament *beyond* the region of space in which the great luminaries appeared to move. If this be admitted, then we may further assert that to him "the waters above the firmament" meant simply the nebulous and slightly luminous (or illuminated?) masses of the "Milky Way," which in those oriental skies, and to the keen sight of people living so much in the open air, could hardly fail to suggest the idea of fluidity. It is surprising to find this rather knotty point (where "science" must have something to say) evaded by Professor Driver in his *Genesis* (5th ed.). At any rate, I have failed to find it squarely dealt with in that most valuable and learned work.

III. THE SOLAR EARTH.

For a long time (see my previous paper to this Society) it was easy to point to a "manifest absurdity" in the Mosaic Cosmogony, since that represents the appearance of *light* at the first stage, while the celestial luminaries are represented as not appearing before the fourth. Such shallow criticism is now seen to be based, not on knowledge but on ignorance, since the fuller comparative study of the Solar System in recent years, and the extension backwards in time of the physical history of this globe, in the light of the great law of Dissipation of Energy and all that it involves, has given us a new mental perspective. The results of investigation on such lines have made it practically certain that our planet, in common with other members of the system, has passed through what Zöllner years ago called the "solar phase" of its history; and the results of the application of telescopic photography to astronomy have revealed things to us in the "spiral nebulae," which confirm my suggestion of more than twenty years ago as to the *nucleate origin of the planets*.* This hypothesis in a somewhat modified form has been more recently adopted by Messrs. Chamberlin and Salisbury in their great text book of Geology. In other words this dark ball, which now revolves round the sun, was in the remote past self-luminous, as the central orb of the system is to-day. Assuming that the elements appeared in the nebula in a state of elemental dissociation, as they appear to exist in the tails of the comets,† then *combustion* on an inconceivably enormous scale would go on during that solar stage to produce not only steam (H_2O), but also the oxides of the metals, of silicon and of carbon, which together form well over 90 per cent. of the constituent materials of the rocks, which make up the present lithosphere of the planet. If it did not involve the use of language too technical for the present occasion it would not be difficult to indicate roughly from the teaching of the higher chemistry the order in which such oxidation probably proceeded; and I go so far as to assert that we should arrive at results which would render the assumptions which underlie the theory as to the salinity of the hydrosphere propounded

* See my *Chemical and Physical Studies*, etc. (Longmans, 1899), pp. 22-24, also my previous paper, "Evolutionary Law, etc.," § IV, and *Trans. Vict. Inst.*, vol. xxxvii, pp. 210 ff.; also the "Note" at the end of this section.

† Cf. letter to the *Times* by Sir Robert S. Ball, F.R.S. (Feb. 10th, 1910).

in recent years by Professor Joly, altogether untenable. I had that in my mind when, in my previous paper, I spoke of the "diminution of the salinity of ocean waters" during the geological ages, as one of the conditions making for advance in the evolution of organic life.

Let us go a step further in the evolution of this planet. Owing to its comparative smallness the earth has long since passed its solar phase, though it has not yet reached the senile condition of the smaller planet Mars. By loss of heat through radiation into space, and by concentration under the influence of gravitation a stage was reached at which this globe consisted of a molten ball rotating in space, but for a long period of time enveloped in such a dense mantle of vaporous and gaseous matter (not water-vapour only), that the radiation of heat from the incandescent globe must have been effectually retarded, owing to the low conductivity of the vaporous envelope. Very great changes must have occurred during this long-continued "pre-oceanic stage," as I have called it,* of our planet's history, before the first portions of steam condensed into water upon its surface at a temperature much higher than that at which water boils under the pressure of our present atmosphere, which we measure daily by means of the barometer.† It has yet to be shown, I think, that the "Crystalline Schists" may not have their special characters accounted for by their production then through mineral changes in the presence of highly-superheated steam; conditions which would admit of such a kind of "sedimentation" as some petrologists perceive in them. The contention of mine more than twenty years ago that they represent the first-formed "crust" has since been endorsed by such an eminent geologist as Dr. Andrew C. Lawson,‡ the Professor of Geology in the University of California.

Note to III.—The paragraph in which I definitely put forward the idea of the *nucleate origin of the planets* runs as follows:—

"Given a nebulous mass of matter in a state of elemental dissociation and losing heat by radiation into space, a point must be reached, at which condensation of certain elements (those possessed of the highest condensation-temperatures and the least potential

* See *Chemical and Physical Studies on the Metamorphism of Rocks*. The mathematicians like Kelvin and G. Darwin seem to persistently overlook this, and the geologists seem to fail to understand it, which is not perhaps to be wondered at.

† See A. Irving (*op. cit.*); also letters to *Nature*, vol. lxxii, pp. 8 and 79.

‡ See *Bull. Geol. Soc. of America*, March, 1890.

energy of chemical affinity) must set in. As a direct result of this, concentration into a nucleus must follow from the law of universal attraction. As the nucleus (the embryo-sphere) is thus formed, latent heat is set free, and the temperature of the nucleus is raised, giving off its heat by radiation, to be absorbed for the most part by the surrounding nebulous matter, and ultimately lost by radiation into space. As dissipation of energy progresses, further condensation must follow, the newly-condensed matter gravitating towards the nucleus, every increase of mass in this increasing the force of gravitation."

In the light of this, which was published in 1889, but is now out of print, I think my remarks upon Dr. Warren Upham's paper (*Trans. Vict. Inst.*, xxxvii) were fully justified. (Through the great kindness of Mr. E. W. Maunder, I am able to illustrate this by a few lantern slides from the Greenwich Observatory.)

IV. EARLY LIFE ON THIS PLANET.

We may proceed next to trace in the light of science, the sequence of development of this planet as a member of the solar system, when the early oceanic waters condensed upon the surface. As steam was more and more condensed, with the gradual lowering of temperature, there must have been gradual dilution of the saturated brine, in which were dissolved the salts (chiefly sodium chloride) previously formed synthetically in "the dry way" during the "pre-oceanic stage," as the teaching of the higher chemistry ("physical chemistry") compels us to believe; and we brush aside the fundamental conception of Joly's theory, upon which he has attempted to calculate the age of the ocean.* Oxygen, nitrogen, and carbon were present (the last-named as carbon-dioxide, CO_2 , the result of the combustion of carbon during the solar phase) in the atmosphere and in the waters under the partial pressures of the respective gases; and these constitute along with the hydrogen of the water (H_2O) the most important elements of all those forms of matter with which *life* is known to be associated on this globe. It is the essential function of vegetable life to take up crude mineral matter to build up the *protoplasm*, which forms the "physical basis of life," as this comes under human observation; although it may be equally true, as the late Dr. Burden Sanderson† pointed out, to say that "life (in

* See *The Age of the Earth*, by Professor J. W. Sollas, F.R.S.

† See his Presidential Address, British Association, Nottingham, 1893.

another sense) is the basis of protoplasm." That power of building up the mineral constituents of our planet into living material,* is a function which animals in general do not possess. There seems to be little room therefore for doubt that the earliest living cells belonged to the vegetable kingdom. In the early Cambrian rocks, there is evidence of a practical differentiation of the animal from the vegetable; and we must suppose that the lowest forms of animal life began to feed upon vegetable matter, only as yet elaborated into very simple forms, and for a length of time attaining to no higher development than that of cellular cryptogams (algæ, lichens, etc.). Some light was needed for this, but not very strong light, such as we receive from the direct rays of the sun. In fact, reasoning from what we can actually observe of the conditions most favourable to the reproduction and development of such low living forms, we may safely infer that a permanent diffused light, accompanied by warmth and moisture, such as prevailed upon the earth universally in very early times, would be most favourable to the organic advance at that stage. And there is plenty of evidence to show that such conditions prevailed on this globe through the Cambrian and Silurian periods of its history; and to a less degree during the Devonian and Carboniferous periods, when the great developments of continental regions were outlined along with the permanent ocean basins, after our planet had passed through that stage of planetary development, during which there was practically a universal ocean,† retarding the cooling of the lithosphere, owing to the non-conductivity of water for heat, though allowing of transmission of heat upwards by convection currents. The physical conditions under which the enormous development of vascular cryptogams characteristic of later Palæozoic time took place, were—we may fairly believe—those of warmth and a moist atmosphere surcharged with CO₂,‡ with the further alteration

* But everywhere in the presence of the elements of water. Lionel Beale, *Trans. Vict. Inst.*, vol. xxxiv.

† In the *Guardian* (Nov. 6th, 1907) Professor Driver made his professorial *confrère* Professor Solas to say, in his characteristic manner, "Geologists know nothing of an universal ocean." It was easy to answer him, as I did; but he was made to contradict himself, when he endorsed, as "accepted universally by all geologists" (*ibid.*, Nov. 27th, 1907), the "table of succession of life on this globe" (*loc. cit.*), from which no other inference than the "universal ocean" view is deducible as I pointed out then (*ibid.*, Dec. 4th, 1907).

‡ "Surcharged," as compared with the present atmosphere.

of that atmosphere (as the result of further cooling), and the increasing intensity of the light-giving power of the central orb of our system. I have discussed all this elsewhere.* Here it may suffice to quote the conclusion at which Lord Kelvin (the "Prince" of Scientists) arrived after many years spent in investigating this profound problem. Towards the end of his address to the Victoria Institute on "The Age of the Earth" in 1897† Kelvin remarked :—

"Whatever may have been the true history of our atmosphere, it seems certain that, if sunlight was ready, the earth was also ready, within a few hundreds of centuries after *the rocky consolidation of the earth's surface*. But was the sun ready? The well-founded dynamical theory of the sun's heat, worked out and discussed by Helmholtz, Newcomb, and myself says No, if the consolidation of the earth took place so long ago as fifty million years; the solid earth must in that case have waited another twenty or thirty million years for the sun to be anything like as warm as at present. If the consolidation of the earth was finished twenty or twenty-five million years ago, the sun was probably ready though not nearly so warm as at present; yet warm enough to support some kind of vegetable and animal life upon the earth."

Not apparently so familiar with these speculations as he might have been, the satire of Professor Sollas‡ was rather cheap. He does me too much honour to suggest that all this is merely "Mr. Irving's Science," for it is simply a deduction from the science of Lord Kelvin, Helmholtz and Newcomb, three intellectual giants in the world of physical science (*stricto sensu*) representative of the science of Britain, Germany, and America respectively. It raises a suspicion that geological science in this country is tainted in some quarters with the pseudoscientific spirit and methods of the "higher criticism."

The teaching of Lord Kelvin has not been, I think, materially affected by what we have learned since of the recently discovered body *radium*, which has however revealed a mode of *storage and transmission of heat energy* previously

* *Trans. Vict. Inst.* (vol. xxxvii) and *Guardian*, Oct., Nov., Dec., 1907. By the courtesy of Dr. Horace Brown, F.R.S., I have also had an opportunity of perusing the MS. of the paper he read before the joint sections C and K of the British Association. He agreed with me that the effects upon Angiosperms (as in the Kew experiments), are not conclusive as to the effect upon Cryptogams.

† *Trans. Vict. Inst.*, vol. xxix (1897).

‡ *Guardian*, Nov. 6th, 1907.

unsuspected by most scientists. A little careful thought enables the scientific imagination to see vast possibilities of intimate relationship between various elements, under such conditions of high temperature and planetary pressure, continued through immense periods of time, as are altogether beyond the reach of the most powerful laboratory appliances.*

For reasons indicated above, and from other considerations, we may extend the interval beyond what Lord Kelvin suggests, for the early stages of the evolution of life, as it was manifested in those early forms, which represent the flora and the fauna of our globe down to the Carboniferous Period, when the atmosphere was by no means so clear as we know it in our experience,† and vast forests of vascular cryptogams (ferns, mosses, lycopods, etc.) grew and flourished in the feebly illuminated warm atmosphere with such luxuriance as they have never attained to since. There would seem to be no valid reason for denying that our earth passed through the condition in which the giant planet Jupiter appears to exist at present, and gradually advanced to those terrestrial conditions, which we know to be most favourable to the growth of the higher Cryptogams, so luxuriant and abundant in later Palaeozoic time; and we may fairly contend that the period of time roughly estimated by Kelvin since that stage of the earth's history as 25 millions of years, would amply suffice for the further evolution of this globe and of the fossilized forms embedded in the strata during the Secondary, Tertiary, and Quaternary stages of its history. Temporarily and locally such conditions may have partially recurred, here and there, as evidenced by the coal-seams (marked however by a different cryptogamous flora) of the Lower Keuper of Germany and the Alps, the Lias of Europe and Asia, the Dogger, the Wealden, the Cretaceous, and in the Tertiary formations, allowance being made for drift-wood as the leading material of the Brown Coal. Even at the present time it is possible to meet with those dusky and moist conditions favourable to the undergrowth of a sort of "carboniferous" flora, as we know from the observations of Hochstetter (quoted by Zittel‡) in the North Island of New Zealand, and from personal observations of my friend Dr. Gybon Spilsbury in the forest-region of the Amazon.

* Compare Supplementary Note A, to my previous paper to this Institute.

† Except under occasional local conditions, as in a London fog.

‡ *Aus der Urzeit*, p. 256.

I have omitted the consideration of *Fungi* here, with their anomalous physiological function in the absence of chlorophyll. It has long seemed to me conceivable that enormous and rapid fungus growths in the dusky dank atmosphere of later Palæozoic times, may account for much of the spore-containing material of the coal-seams, possibly washed down from the early continental regions by water.

V. THE BIRTH OF THE MOON.

We begin now to see the possibility of both marine and terrestrial vegetation appearing on this planet and reaching a fairly high stage of development before the sun appeared as a definite *luminous orb* to the earth itself. But what of the moon? It is necessary to remind ourselves that the inspired writer does not pretend to tell us anything as to the *modus operandi* of their origin; and he tells us nothing as to the time when they were made. He only recognizes them here as *set for lights in the heaven to give light upon the earth*, and to be for signs and for seasons, for days and for years; and this fits in with our conception of the sequence of things from the inferences which science justifies, as indicated in brief outline only in this paper. Well, the moon at its birth was probably thrown off the earth in a way with which Sir Robert Ball, F.R.S., the Cambridge Astronomer (following up the calculations of Sir George Darwin, F.R.S.) has made us familiar for some years past.* The writer of Genesis knew nothing of that portentous event, though it would be impossible to say what great ideas may not have flitted through his brain. At all events *he deals only with the moon as a luminous to the earth*. To argue therefore, as it was argued by Professor Driver—that according to the Genesis account the moon must have been thrown off the earth after vegetation appeared upon this globe involves a strange misconception. If the moon (according to the latest computations) was thrown off from the molten earth fifty million years ago, and (as we follow Lord Kelvin) the sun had not entered by contraction upon the “solar phase” before some twenty-five million years ago, ample time would seem to be allowed in the interval, for that development, up to a certain stage, of vegetable and animal life (both marine and terrestrial), of which the geological record

* On the authority of Professor Turner of Oxford, Professor Driver tells us that this is considered by astronomers to have taken place about 50,000,000 years ago. (*Guardian*, Oct. 23rd, 1907.)

informs us. During that vast interval the moon (with a mass about one-eightieth of that of the earth) must have soon lost its feeble initial luminosity, and revolved as a dark satellite round the earth, *becoming effective as a luminary only later on, when the solar rays became sufficiently powerful to strongly illuminate it.** This was pointed out by myself in the *Guardian*; but the point was entirely missed by the distinguished Professor of Hebrew at Oxford, who simply met the argument by a reiteration of his previous fallacy.

Having answered objections then, and put the matter more fully in the present paper, I repeat, that, however he may have got the idea, the inspired writer, in introducing the sun and moon (*quid luminaries*) at a stage when vegetable evolution had made considerable advance, gives expression to an idea, which does not conflict with the latest conclusions of science. As I read the passage, the statement—"He made the stars also"—is parenthetical, and simply reminds us that they were also embraced in the same range of the monotheistic idea of creation. We ought fairly to allow for a certain amount of temporal overlap, if not even parallelism, when we have dismissed from our minds the notion of "the days" as indicating periods of time, and become possessed of the far grander and more ennobling conception of them, as representing so many definite "phases of Creative Will and Thought realised."†

By a closer study in the light of advancing science of such apparent discrepancies as those dealt with in this paper and elsewhere, we are brought nearer to the acceptance of the thesis—"The Genesis account of Creation not inconsistent with the teaching of Geology";‡ and the truth of this is not affected by the fact that the Holy Scriptures were never intended to teach men the Sciences of Nature. May we not say with Mr. Manley§ that, so far as the Creation story is concerned, the grand old Book still stands out surviving the tides of criticism that have rolled over it, like the primæval rocks of the earth itself?

Note to V.—Those tides, in the early stages (when the moon was nearer the earth and the attraction of its mass upon terrestrial water

* The time required for the cooling of the Moon compared with the time required for the cooling of the Earth would be (*cet. par*) as 1 : 80³ or as 1 : 512,000.

† See further my previous paper, "Evolutionary Law, etc.": also the *Guardian*, Oct. 30th, 1907.

‡ Professor Edward Hull, F.R.S., in the *Church Family Newspaper*, Oct. 2nd, 1908.

§ *Guardian*, Oct. 9th, 1907.

greater in the inverse proportion to the squares of the distances) were much greater and more frequent than the tides of the present ocean, as Sir Robert Ball taught us long ago. On this point I wrote more than twenty years ago (see *Chem. and Phys. Studies, etc.*, p. 91):—"On the supposition that the 'crust' had sufficiently cooled to allow of a general condensation of water upon it, the vast accumulations of the materials of the Cambrian slates, grits, and conglomerates can be understood as resulting from the destruction, and deposition of sedimentary detritus from the cooled slaggy crust and its volcanic ejectamenta by the great tidal waves which swept over and levelled down the inequalities of that crust, even though (as some have thought*) there may have been no very general elevation of dry land above the ocean-waters in the Cambrian and Silurian periods." Those conglomerates, etc., have of course partaken in the great earth-movements since, which have resulted in the building of the present continents and mountain systems; and it would be a marvel if the contained blocks did not here and there simulate such signs of "glaciation" (smoothing, polishing, striation and scarring) as have been shown by Professor Albert Heim of Zürich† to occur in slow long-continued earth-movements. When these things are considered, the value of the evidence lately produced by Professor P. E. Coleman,‡ and the recorded evidence of a similar nature in the Permian conglomerates of South Africa, India and Australia, is very largely discounted as evidence of *glaciation*. Such a notion is opposed to an overwhelming mass of cosmic evidence.

VI. LIFE IN GENERAL

In concluding his address to this Institute§ from which I have quoted above, Lord Kelvin said: "Mathematics and dynamics fail us when we contemplate the earth fitted for life but lifeless, and try to imagine the commencement of life upon it. This certainly did not take place by any action of chemistry or electricity, or crystalline grouping of molecules under the influence of force, or by any possible fortuitous concourse of atoms. We must pause, face to face with the mystery and miracle of the creation of living creatures."

This is profoundly true. Later on (in 1903) I heard Kelvin emphasize this with all the force of his great personality in his

* See references above to the *Guardian* correspondence.

+ "Bergstürze," *Geol. Mag.* (March, 1883).

† See *Nature* (Nov. 17th, 1909).

§ *Trans. Vict. Inst.*, vol. xxix; compare Lionel Beale, F.R.S., *ibid.*, vol. xxxv.

remarks on a lecture by Professor George Henslow at University College.*

He remarked that "in the coming into existence, or the growth, or the continuance of the combinations presented in the bodies of living things, scientific thought is compelled to accept the idea of Creative Power." Again, "it is not in dead matter that we live and move and have our being, but in the *creating and directive power*, which science compels us to accept as an article of belief. . . . We have an unknown object put before us in science. In thinking of that we are all agnostics. We only know God in His works: but we are absolutely forced by science to believe with perfect confidence in a Directive Power—in an influence other than physical, or dynamical, or electric forces." He refers to a conversation many years before with Liebig, when they were walking together in the country. To the question put to him, whether he believed that the grass and flowers around grew by mere chemical force, the illustrious chemist replied,—"No, no more than I could believe that a book of botany describing them grew by mere chemical force"; and (adds Kelvin) "every action of human free will is a miracle to chemical, physical, and mathematical science." So we fall back upon creation as the process of Divine Will and Thought realising itself in life and form; and upon evolution directed to ends, as the Divine Method, though the Hand which guides it still wears the glove of mystery.

Attempts are made in one direction and another to pierce the veil, but without much success. One of the latest of these speculations has been put before the scientific world by the accomplished physiologist, Professor Starling, of University College, London.† It is an extremely interesting—one may almost say fascinating—address, as we are led on through the various stages in the evolution of the animal world to see how functional development goes *pari passu* with cerebral development. But the *cruv* is—as ever—at the first step. Professor Starling attempts, with not much more success than Haeckel before him, to explain this by a bold hypothesis. He attempts to account for the *origin of life*, by the accidental building-up of *endothermic* compounds, "during those chaotic chemical

* "Present Day Rationalism, with an Examination of Darwinism." (*Christian Apologetics*, London : John Murray, 1903.)

† Presidential Address to Section I of the British Association, Winnipeg Meeting, 1909, by E. H. Starling, M.D., F.R.S.

interchanges which accompanied the cooling-down of the molten surface of the earth, some compound being probably formed with absorption of heat, endowed with the property of polymerisation and of growth at the expense of the surrounding material." A rather big assumption, to which the physicist and the chemist are entitled to cry "Halt!" and to decline to be included under the little pronoun "we," when the learned physiologist says—"We can imagine" that to be "the first step in the evolution of life"; and further suggests that under such conditions "some complex analogous to the present chlorophyll corpuscles" could be formed. We have the right to ask him if he has not overlooked the conditions of exceedingly high pressure and temperature which then existed at and near the surface of the globe in "the pre-oceanic stage" of its history, or forgotten the rather narrow range of temperature within which life as we know it can manifest itself. The building-up of highly complex *mineral molecules* by an *endothermic* process under great heat and pressure, and their subsequent resolution *exothermally* into more stable molecules of less complexity has been long known to science. I discussed it myself years ago*; and it has long seemed to me that here we get near the true account of the genesis and behaviour of such a complex as *radium*; but Professor Starling would hesitate, I fancy, to suggest that radium even with all its wonderful properties, is an organic compound, or endowed in any way with life. Pressure applied hydrostatically makes for crystallisation in the densest and most stable form which the particular body can assume, as I showed more than twenty years ago.† But this implies an internal fixity of atoms, which is opposed to *the free atomic movement*, characteristic of the internal economy of the chlorophyll corpuscle.‡

We can follow Professor Starling more easily when he speaks of "methods adopted by organisms for their self-preservation in the production of some artificial surroundings, which protect from the buffeting of environmental changes." This is however a way of putting the facts, which gives the "go-by" to the Darwinian notion of *chance adaptation*; it recognizes "directivity"; it introduces the idea of working for ends; and it leaves us face to face with what Asa Gray§ calls "the mystery

* *Geological Magazine*, July, 1891.

+ *Chem. and Phys. Studies*, etc., Section "Metatropy."

‡ See my letter in *Nature* (June, 1905), on "the Romance of the Nitrogen Atom," and the correspondence *loc. cit.*

§ *Religion and Science*, Scribner, New York.

of a beginning," which is involved in every variation favourable to advance. The early stage of adaptation, to which Starling refers in the case of the *Celenterata*, may well be the beginning of an evolutionary process, which attained its minimum in the *Cephalopoda*, where we witness an extraordinary blunting-off of that process at the close of the Mesozoic Age in the extinction of the *Ammonitidae* and the *Belemnitidae*, leaving the cuttle-fish and the nautilus to represent the narrowed-down development of the series in modern seas; the whole of that evolution lying, it would appear, quite outside that which is beginning to appear from the researches of Dr. Gaskell* (to which Dr. Smith Woodward† has drawn attention) to have proceeded in quite another line through the *Arthropoda*.

On the one line, it seems, that *brain* is the fundamental basis of development, on the other *stomach*, with their respective functions predominating in the one case or the other. The Darwinian guess about the *Ascidian* or the *Tunicata* seems to fall through.

Dr. Starling's treatment of the subject seems to clash very seriously with the scientific romancing of Dr. F. Darwin about "Memory in Plants," a year or two before, in his Address to the Botanical Section. More sane are the remarks of the President of the Queckett Microscopical Club in May last.‡ After referring to Kant's confession of awe at the contemplation of "the starry heavens" without us and the "moral law" within us, Professor Minchin recognizes a third source of "wonder in the contemplation of the simplest living things, as revealed by the microscope, in the combination of apparent simplicity with infinitive complexity, and of extreme minuteness with the most extraordinary powers." In an amœba (*e.g.*) we see "a minute creature without definite parts or organs, which nevertheless exercises all the functions of *life*, and exhibits the germ of every faculty which we possess." What, again, he asks, "can be more wonderful to contemplate than that peculiarities in the complex mental endowment and physical structure of a human being can be transmitted from one generation to the next through the medium of a spermatozoon, the tiniest cell in the human body, in which the microscope reveals only a structure of the simplest kind?"

So it remains that where people, whose science consists in the manipulation of scientific phraseology (with more or less

* *Nature*, May 13th, 1909.

† Address to Section C (Geology), Winnipeg Meeting, 1909.

‡ See *Nature* of that date.

literary skill), strut upon the stage, the real student of science uncovers his head with a sense of awe and mystery, and can share the humility of Lessing, when in his *Streitschriften* he writes : " If God should hold in His right hand all truth, and in His left hand the ever active desire to seek for truth though the condition be of perpetual error, I would humbly ask for the contents of the left hand saying, ' Father, give me this ; pure truth is only for Thee.' "

VII. HUMAN LIFE.

The physical laws which come under " the law of universal causation " * reveal to the believing man of science one phase of the Divine Immanence, and Life in its manifold manifestations reveals to us another phase. In the latter phase we see the more direct revelation of the Divine Transcendence which is behind all phenomena. There is yet a third phase within our ken of the Divine Immanence ; and that is to be found and observed, and inferences drawn from it, in all that region of consciousness, which has to do with reasoned thought and reflection, with those powers of the human mind by which scientific investigation is carried on, with the affections and instincts of the soul, and in that still higher plane of consciousness which belongs to the realm of spirit and to the faculty of worship. It is here surely that our perceptive faculties realize most directly the Divine Transcendence. For, as life is not the same in kind as gravitation or chemical affinity or electric force, nor the sum of all these together, there is manifestly something of another kind or order included in it ; and in that something we recognize another phase of Creative Will and Thought. Just so in the spiritual nature of man there is a something superadded which is no part or factor of mere physical life ; and in that too we can recognize a third and higher phase of Creative Will and Thought. And we can only conceive of the spiritual nature of God and His Fatherhood, through what is highest and best in ourselves, as Christ Himself teaches us.

The late Aubrey Moore, a keen student, in his brilliant essay in *Lux Mundi*, on " the Christian doctrine of God," has well remarked—" We do not read our full selves into the lower world [of being], because we are higher than it ; we do not transfer [in thought] to God all that belongs to our own self-

* See J. S. Mill, *Logic*, B. iii, c. 5.

consciousness, because we know that He is infinitely greater than we are. But we should be wrong not to interpret Him in the highest category within our reach, and think of Him as self-conscious life." Add to this Will or Volition, and we get the fundamentals of *personality*. Here perhaps we get nearest to the true inwardness of the phrase, "In the image of God," by which the inspired writer of Genesis designates the highest act known to us of Creative Thought and Will, where there appears the very topstone--the crown and summit of the progressive creation, with its "groaning and travailing in pain"—in painful effort, which is written upon the whole sentient creation, from the first dawn of conscious life on this globe, to the present, as the universal law of Redemption through sacrifice works itself out.*

In what the Bible teaches us of the *Ādhām* (the *Man*), as distinct from the *Homo*, a race (the presence of which on this globe the Genesis cast of the traditions of prehistoric times assumes before the appearance of Adam and his progeny) we have a differentiation indicated in the general stream of human life on this planet. The race of the *Ādhām* is endowed with those spiritual powers and faculties and capabilities for response to spiritual influences, which mark off the "Man" of Scripture and philosophy, as a being distinct from *Homo sapiens*. Along with these endowments comes in the crowning intellectual gift of *language* or *speech*, the essential instrument of that evolutionary illumination of the human mind, which is written upon the history of recorded thought, from its inception in the earliest Sumerian script, or the unknown vocables of Neolithic man, to the finished structure of the Greek language as an instrument of thought.†

As I said a year or two ago,‡ in reply to criticisms of a previous letter of mine from the pens of Mr. Woods Smyth and Dr. Dukinfield Astley, "Somehow and somewhere a being possessed of higher endowments than those of a mere highly intelligent biped does appear on the stage of the world; and I think it has yet to be shown that the conception of an Adamic race, such as we can form from the Creation story of Genesis, clothed in oriental figure and hyperbole, conflicts substantially with the evidence that can be drawn from true science." The paragraph is too long to quote here *in extenso*.

* St. Paul, Romans viii, 22.

† Cf. an interesting article on "Hereditv and Tradition" in the *Times* of June 22nd, 1910.

‡ *Guardian*, Dec. 23rd, 1908.

but it is easily accessible. As regards the time-age of Man (in the wider sense) on this planet, much (I have pointed out, *loc. cit.*) depends upon our definition of the terms *Man* and *Homo*, and I give reasons for bringing down Dr. Astley's positive assertion that its duration reaches 80,000 to 120,000 years,* to something more like a fourth of such estimate. To me, as a geologist, it seems preposterous to build up a piece of theory—as Dubois has done—upon such flimsy evidence as he has been able to produce. We have no evidence even that the anthropoid fragments which he found belonged to the same individual; and it may be seriously questioned, whether, in the want of a geological survey, the assignment of the deposits in which those remains were found to the later Tertiary is anything more than guesswork. We are not justified in reasoning from the recognized succession of superficial deposits in Europe, where the glacial epoch furnishes us with something like a definite horizon, to an unsurveyed region in the heart of the Tropics. Anyone, moreover, who has like myself recently been engaged in an investigation involving exact correlation of later deposits, in which the later Tertiaries shade off in some regions into the Quaternary, as in Britain the post-glacial Pleistocene shades off into Post-pleistocene and recent alluvial deposits, knows how exceedingly difficult it is to get conclusive evidence as to the exact place in the time succession of a given superficial deposit, where redeposition has often to be allowed for, unless we can get clear evidence derived from contemporaneous fossils, and can make pretty sure that such remains as occur are not derived from older strata. I am not aware that anything like such conclusive evidence has been brought forward by Dubois for his *Pithecanthropus erectus*.

During the past year the scientific world has had its curiosity aroused by the announcement of the discovery of a massive human jaw under some 80 to 90 feet of stratified diluvial sand at Mauer in the Neckar Valley, near Heidelberg—a locality with which I am pretty familiar. There is an excellent model of the jaw in the Geological Department of the Museum of Natural History at Kensington, with a modern human jaw placed above it for comparison. To Dr. C. W. Andrews, F.R.S., who kindly drew my attention to it, I am indebted for a perusal of Schoetensack's Monograph on this supposed late Tertiary "man," which he named *Homo heidelbergensis*. It is a magnificent piece of descriptive work; but unfortunately the

Following Prof. T. Rupert Jones, F.R.S., and others of the Lyell School.

conclusion of its author, as to the age to which the individual is to be assigned, is mercilessly cut up by Dr. Emil Werth, who has shown that he belonged to about the middle of the Glacial period. He shows that *H. heidelbergensis* does not represent the Diluvial Eolithic age (so-called), still less is he a type of such a creature as Tertiary man; and that "the end of the Tertiary period was as remotely behind him as his ancient Chellean culture is behind us."* It seems that this criticism from Werth appeared too late for the use of Professor Windle, F.R.S., in the new edition of his valuable work, *Remains of the Prehistoric Age in England* (new ed.), p. 307.

Within the last few weeks, another most important "find" has turned up,† this time a fairly complete skeleton of a Palæolithic *homo*, in the Dordogne, which has been identified as of the early Mousterian age, and therefore nearly contemporaneous with the *homo* of the Neckar Valley. The remains have been carefully preserved and removed to Paris for complete examination. Here again no evidence appears to be forthcoming, which would date the appearance of the *homo* further back than 20,000 years.

And as regards the time-age of "man," in the wider sense, upon this planet, if we accept the conclusions of Dr. G. F. Wright, and his American geological *confrères*,‡ drawn from what appears valid evidence, and allow 10,000 years since the retreat of the ice§ and if we further accept the latest conclusions of the French savants, in allowing 20,000 years to carry us back to the beginning of the Mousterian age, with its lowest possible degree of culture, as the artefacts of that age prove, there is not much left behind that, which we can assign with any great degree of certainty to the presence even of the *homo*. And as regards the intermediate periods, the Solutrean and the Madelainean, there may have been a certain amount of temporal overlap, so that mere addition of inferred time-periods may mislead us as to the aggregate.

With such increasing evidence, as it comes to be sifted, we are surely warned more and more against following the speculations of some, who, upon very flimsy evidence, attempt to date

* See *Nature*, Nov. 25th, 1909, p. 105; also *Globus*, Bd. xcvi, No. 1 (Vieweg, Braunschweig).

† See *Nature*, Feb. 24th, 1910 (and the photograph of "la Squelette de la Ferrasie" in *La Nature*, 25 Décembre, 1909, p. 51).

‡ *Trans. Vict. Inst.*, vol. xl.

§ The late Sir Joseph Prestwich, F.R.S., the Oxford Professor of Geology, arrived at a similar conclusion.

back the first appearance of the *homo* on this planet, to hundreds of thousands of years. But whatever the date of his first appearance may be—and perhaps we shall never know—I think we may fairly contend that Man, as he is represented to us in the Adhām of the early chapters of Genesis, appears at a much more recent date, and that he received, as a special endowment from his Creator, those faculties which carry with them *moral responsibility*. This contention was sustained by me in the *Guardian*,* and challenged by Dr. Astley and Mr. Woods Smyth. The latter gentleman (who is known in this Institute) maintained that "evolution is sufficient to account for the whole chain of sequences from the *Protistæ* to *Man* in the highest sense." I had only to let him refute himself; for after elaborating this statement in the first paragraph of his letter (Dec. 23), he occupied the second half of his letter in contending for what constructively amounts to a special Divine interposition at the inconing of man (*sc.* more than *homo*) upon the stage of Creation. He even quoted Samuel Laing (for what his opinion may be worth) as saying that "there is no evidence of any people having arisen by themselves out of a state of savagery." He continues—"This then is the most significant place in human history; this is the time when the same Divine Being, who had been disciplining life for long ages up to man's estate by natural conditions, now, at the demand of, and in harmony with, the position man had reached, came into intelligent converse with His intelligent creature in a new and higher form." So Mr. Woods Smyth, I may fairly think, surrenders his case to my contention all the way through, that something more (and more special) than *evolution* in the Darwinian, or the Spencerian, or the Haeckelian sense of the word, is required to account for all the cognizable facts. (See further *Trans. Vict. Inst.*, vol. xl, pp. 136–139). He seems to fall into line with the dictum of the great Apostle (1 Cor. xv, 46), "That is not first which is spiritual, but that which is natural; then that which is spiritual." We cannot in the nature of things expect to find any physical record of this. The important point is that (so far as we can see) the teaching of Science leaves us free to accept the view of the place assigned to the Adhām (the Man) in the pictorial grouping of facts about Man as the centre, which is put before us with much legendary embellishment in the second Genesis description of the Creation, and of Man's place in it, as

* Dec. 9th and 23rd, 1908.

that of a being possessed (potentially or actually) of *endowments of a higher order* than the rest of that Creation. We have much yet to learn, no doubt, on this supremely interesting question; but I doubt if we shall ever explain, by any evolutionary theory, the possession by Man of "the Inner Light," the God-consciousness seen in its full development in the Second Ādhām.

DISCUSSION.

On the conclusion of the paper the CHAIRMAN expressed the thanks of the meeting to Mr. Irving for so ably supplying his father's place, and the great regret that must be felt by all that Dr. Irving could not himself be present to take part in the discussion of his extremely interesting paper. They all hoped that Dr. Irving would soon be restored to health.

Dr. WOODS SMYTH.—We have listened to an able paper which has been excellently well read by Dr. Irving's son. With the criticism of Canon Driver's views I entirely agree, yet he *mis-directs* the views of the great majority of the clergy and ministers of the churches. Gesenius and Kalisch, rather than Wordsworth, are our chief authorities for translating the word for "firmament" as an *expanse*. Dr. Irving's idea, that the writer of Genesis i, regarded the Milky Way as the waters above the firmament is, I believe, doubly untenable. The writer of the cosmogony did not write from observation, but from Divine inspiration. The waters above the firmament are the clouds which are not vapour but true water. They often lie in seas above the firmament, roll in waves and break in spray upon mountain summits. The "firmament" is also used in a more extended sense than this. The views of Lord Kelvin which Dr. Irving adopts, were refuted at the Cambridge meeting of the British Association—the folding of the crust of the earth render Kelvin's view, that the earth solidified from centre to circumference, an impossibility. Professor Sollas has adopted Kelvin's view, and finds it necessary to regard the earth as having been a frozen globe for about twenty millions of years! Now when the sun would have gained sufficient power to melt this frozen globe, his

fierce sunshine would have rendered the era of warmth, moisture and dim light, of which Dr. Irving speaks, an impossibility. Again the "directivity" in which the doctor believes, is rejected by every accredited authority on the doctrine of evolution. The idea of interference in man's evolution is not Dr. Irving's, but is A. R. Wallace's, who considered that some ultra-natural interference was necessary to complete the creation of man. Among our highest authorities on man's genesis, Wallace here stands alone. I regret exceedingly in this nexus, that Dr. Irving has greatly misrepresented my views, and in a form of words which I hope he regrets. I have clearly taught that Evolution (a Ministry of God), was all-sufficient for man's creation, and to a degree of perfection not possessed by any man living on the earth to-day (*vide Victoria Institute Transactions*, vol. xxxviii, p. 214). But that evolution possessed no means of satisfying man's aspirations for endless life, and that these aspirations were met by the revelation of God recorded in Genesis. I was first enabled to perceive this important truth, and to publish it 37 years ago, while yet a young man.

Rev. JOHN TUCKWELL, M.R.A.S.—Mr. Chairman, may I be allowed to express my great appreciation of the paper to which we have just listened. But with reference to the suggestion made by yourself, sir, that the first verse of Genesis may be regarded as separated by a wide interval of time from the second, I do not think that can be sustained. The first verse is a general statement of the whole creative work of God. The second verse takes up the creative history of the earth from its gaseous or nebulous condition just as one might say "Sir Christopher Wren built St. Paul's Cathedral," and then proceed to give a separate account of the building of the nave. The Hebrew verb *hayah*—"the earth *was* without form and void"—is the substantive verb and cannot correctly be translated "the earth *became*." The LXX accordingly translates it not by *γίνομαι*, "to become," but by *εἰμί*, "to be." Besides, if this story is only a superficial story of something which took place in six solar days, then it is not the actual story of the creation of our world at all, and scientific research has never found any trace or shadow of any such creation. Moreover there are certain forms of mammalian life indicated by the Hebrew word translated "cattle" which are found hundreds of feet below the earliest trace of man in the geological strata which cannot possibly

have come into existence within only a few hours of man himself. If on the other hand we take this story as a veritable story of the creation of our world from the time when it was "without form and void"—its nebulous condition—it is one of the most extraordinary proofs of supernatural knowledge communicated to man which the whole Bible contains. It deals with events which transpired ages before man existed, and there is not the slightest evidence among all the Egyptian records or the myriads of Babylonian tablets that any of the most learned nations of antiquity possessed knowledge enough to account for it.

With regard to Dr. Irving's remarks concerning *raqia'* and *firmamentum*, he missed a point which should be noticed. The *expanse* which divides the waters below from the waters above, *i.e.*, the clouds, is called simply "the expanse," but the expanse in which the celestial luminaries are placed is called "the expanse of the heaven," and the form of the Hebrew word for heaven—*shamayim*—suggests the idea of more than one heaven.

If I may venture a word of criticism, I think the writer of the paper has fallen into a little confusion of thought concerning the presence of steam during the formation of the mineral deposits of the surface of our globe.

Then with regard to the human race, I know no reason why we should not suppose that other intelligent beings have existed upon our globe as well as ourselves. In Gen. vi, we have the *Nephilim* or "giants," spoken of, the *Elohim* and the *Adham*; these may perhaps be regarded as three species of the genus *Homo*. The *Nephilim* are only once mentioned after the Flood, and that is in the lying report of the land of Canaan brought back by the spies. It is very remarkable that in the Babylonian account of the deluge, the gods are said to have taken refuge in the heaven of Anu. As to the *Elohim*, we do not know who they were, but our Lord refers to the word when, in vindicating Himself from the charge of blasphemy, He says, "If He called them *Elohim*, unto whom the word of *Elohim* came, etc."—in post-diluvian times, therefore by our Lord's definition the word was applied to persons "unto whom the word of *Elohim* came," and that may have been one of the functions of *Elohim* in antediluvian times. With regard to the expression, "sons of God" (*Elohim*), the general idea, so far as I have been able to make out, is that of beings deriving their existence immediately

from God. Hence the Christian—the regenerate man is called “a son of God.” There are physiological reasons against the old idea that they were angels whom our Lord says, “neither marry nor are given in marriage.” I am glad Dr. Irving has brought up this racial question also in the very valuable paper to which we have just listened.

Lieut.-Colonel M. A. ALVES.—Referring to a remark by one of the speakers as regards “the sons of God” and the “Nephilim,” the former phrase seems to be confined to direct creations of God, as *e.g.*, Satan (*Job i, 6, and ii, 1*), Adam (*Luke iii, 38*) and regenerated descendants of Adam (*1 John iii, 1, 2*); angels would be among such; and, if they marry, they do not keep their first estate. *Jude 6* seems to be a reference to *Gen. vi, 4*, which, in my judgment, teaches that some fallen angels formed alliances with women, the result being the Nephilim, whose presence on the earth is associated with violence. Og and Goliath appear to have been of this stock; for “the Nephilim were on the earth in those days, and also after that. . . .”

As regards the history of the creation in *Gen. i*, I think that verse 1 alludes to an ordered state, followed in verse 2 by a fall into ruin, the remainder of the chapter describing a restoration by a series of miracles in rapid succession. I think so for a three-fold reason:—

- I. *Gen. i, 2*, says “the Earth was (or became) Tohu. . . .”
Now Isaiah says, “He created it not Tohu. . . .”
- II. The crust of the earth gives evidence of a long period in the making.
- III. Plant life appears on the third day, and sentient life not until the fifth.

As all the higher plant life needs insects to fertilize it, the period between the third and fifth days must have been short, and we must therefore relegate the long geological period to the 1st verse and not to the third and following.

I consider that *Gen. ii, vv. 7 ff.* is an expansion of *Gen. i, 26–31*, and not a different story. Man is God’s great work; and, after a general summary of all His work, it is only reasonable to suppose that Man’s creation should be dealt with in more detail than the rest of His creation.

Dr. THIRTEL.—Adverting to a remark by Mr. Tuckwell, I call

attention to a historic interpretation of the expression "sons of God," as found in Gen. vi, 2. As is well known, in Codex A of the Septuagint, the rendering is "angels of God," which is in agreement with the meaning accorded to *b'nê-ha-Elohim* (and *b'nê-Elohim*), as found in Job i, 6 ; ii, 1 ; xxxviii, 7, and elsewhere, and also to the cognate Aramaic *bar-Elâhin* in Dan. iii, 25. In other words, "sons of God" is a periphrasis for "angels," as is abundantly borne out in subsequent Jewish literature. The statement that there were *Nephilim* in those days (Gen. vi, 4), rendered, after the Septuagint, "giants"—has led to much speculation, and suggested that the passage as a whole speaks of an illicit commerce such as recalls familiar points in heathen mythology, as, indeed, a host of exegetes, ancient and modern, have maintained (see 2 Pet. ii, 4 ; and Jude vi).

HENRY PROCTOR, Esq., F.R.S.L., M.R.A.S., writes:—I have been deeply interested in Dr. Irving's splendid paper on "Light, Luminaries and Life," and desire to add to my former remarks on Genesis to which he refers therein as interesting and suggestive. I have for a long time held that the Book of Genesis everywhere assumes the existence of Pre-Adamic Man, and that it actually mentions them as the "Nephilim," which the Septuagint renders "*γεγαντες*," and speaks of their race as "men of renown which were from everlasting."* We may note also that the signification of *γεγαντες* from its root meanings (*γη* and *γενω*) would be "earth-born-ones," indicating antiquity as much as stature.

In regard to the Noachic flood the Biblical evidence is generally supposed to be on the side of its universality,† but this is only in appearance, for the word translated "earth," no less than nine times in regard to the flood, is "adamah" in Hebrew, not "erets."‡

Now "adamah" implies a locality, and particularly that district where Adam lived, as proved by Cain's words, "thou hast driven me to-day from the face of the adamah . . . and I shall be a fugitive and a wanderer in the 'erets.'"

Again God is said to have set a mark or sign upon Cain, "lest any one finding him should kill him."§ Of what use would such a mark

* LXX *ἀπ' αἰώνιος, οἱ αὐθρωποι οἱ ὀνομαστοί*, Gen. vi, 14.

† Gen. vi, 7, 20.

‡ Gen. viii, 8, 13, 21.

§ Gen. iv, 15 ; vii, 4, 8, 23 ; ix, 2.

be if there were no sentient beings who would be restrained by its significance from killing him ? It is clear from the narrative that Cain had no brothers at the time, for Seth was yet unborn, and his very name betokens that he was given to Eve in place of Abel ; for God, said she, " hath appointed (sheth) me another seed instead of Abel," showing that no other children were born till after the death of Abel.

In the second place Cain is said to have gone out from the presence of Jehovah and to have " dwelt in the land of Nod," eastward of Eden, *i.e.*, eastward of that tract of country called in the Assyrian " Idinu " where Yahveh Elohim had planted the Garden or Paradise. In the land of Nod, Cain takes a wife, who bears him a son who is called Enoch (Khanoch), and he then builds a city,* and calls it after the name of his son " Enoch." Now to build a city implies, first, a number of people to build it, and surely a far larger number to inhabit it.

Again it is quite in accord with Genesis to believe that *only* the Caucasian or so-called White Race sprung from Adam. This is proved by a study of the tenth chapter of Genesis, where, after the flood, the earth is said to be repeopled—*spreud abroad*—by the three sons of Noah and their descendants.

For it can be fully demonstrated that all the nations named in this great ethnological chapter are of the Caucasian Race. In regard to two of them, Shem and Japheth, we have always understood that their descendants are white, such as the Jews, for instance, who are certainly descended from Shem, as were also the Assyrians, Lydians, Syrians and others. From Japheth, among many other nations, it is certain that the Greeks are descended, for in the Hebrew Bible the word " Javan " is generally used to designate Greece. Now Javan is the fourth son of Japheth. Kittim and Dodanim also are the ancient names of Rhodes and Cyprus.†

The descendants of Ham are also of the Caucasian Race. " The sons of Ham were Cush, Mitzraim, Phut and Canaan."

Cush represents Ethiopia (Abyssinia), Mitzraim, the ancient Egyptians; Phut, the Libyans; Canaan, the Canaanites, etc., who were all of the White Race. The Caucasian Race is thus divided

* Gen. iv, 17.

† Gen. x, 2, 4.

into three groups or families corresponding to the three sons of Noah, viz., the Semitic, Hamitic and Aryan.

All the descendants of Shem, Ham and Japheth being of the Caucasian or White Race, they themselves must have been white, as well as Noah their father, and he being only of the tenth generation from Adam ; Adam was also white, and he being therefore the progenitor of the Caucasian Race only and the Mongolian and Negro Races not being descended from him, these latter must be the living representatives of Pre-Adamite Man.

Lieut.-Colonel W. H. TURTON.—With reference to Mr. Irving's paper, I think he could have strengthened his argument as to the *firmament* meaning the atmosphere, and not a solid vault, by the following considerations :—*

In the first place the firmament was called "Heaven," and the upper waters, above the "heaven," must mean the sources from which the rain from heaven comes. And these sources are easily seen to be *clouds*, and are continually spoken of as such in the Bible (*e.g.*, Judges v, 4; Ps. lxxvii, 17; cxlvii, 8; Isa. v, 6). And no writer could have thought that a solid firmament intervened between the clouds and the earth ; more especially as we read later on that birds are to fly in this firmament, which are also spoken of as birds of the air (v, 28). And though at present the amount of water in the clouds seems quite insignificant, it was probably much greater at the time in question.

On the other side, may be quoted the expression about opening the *windows* of heaven when it rains (Gen. vii, 11; 2 Kings vii, 2; Mal. iii, 10). But this cannot be taken literally, any more than that about the *doors* of the sea (Job xxxviii, 8–11); since, as just said, every one can see that the rain comes from the *clouds*, and not from any openings in a solid reservoir.

Secondly, the writer of Genesis omits to say (as he does in other cases) that when God made the firmament, He saw that it was *good*. Now if the firmament means the *atmosphere*, that is the (apparently) empty space separating the clouds from the seas, this would be quite natural : just as an artist, though he might examine each of his pictures to see that it was *good*, would not examine the empty

* I have touched upon these in my *Truth of Christianity* (seventh edition, p. 114).

spaces between them. But it is difficult to account for, if it means any material object, which would seem to require God's approval like everything else.

The only other instance in which God did not examine what He made, to see that it was *good*, is *man*. And this is at once explained when we remember that goodness in a free being must include *moral* goodness or *righteousness*. And man could not have been created righteous, using that word in its strict sense. He might have been created *perfect*, like a machine, or *innocent*, like a child, but to be *righteous* requires his own co-operation, his freely choosing to act right, though he might act wrong. No doubt he was made in a condition perfectly suited for the *exercise* of his free choice; but this seems included in God's final approval of the whole creation that it was all *very good*.

Thirdly, this view is confirmed by the *symmetry* of the narrative, for the six days are divided into two groups of three each, the first set being clearly a sort of preparation for the second. Thus we have light on the first day, and the light-giving bodies, the sun and moon, on the fourth day; and we have land and vegetation on the third day, and animals and men, who live on the land and feed on the vegetation, on the sixth day; and therefore we should expect a similar agreement between the second and the fifth day. Now on the fifth day we have fishes that live in the water, and birds that fly in the air; and if the work of the second day was the formation of the water, and the *air* (*i.e.*, the firmament), then, and only then, is the symmetry perfect.

REPLY BY THE AUTHOR.

Mr. Woods Smyth, L.R.C.P., etc., has been liberal in his criticisms. On the points which he has raised, I will endeavour to remark as briefly as possible, but the field covered is a large one.

(1) I must insist upon the *observation of nature* as a source of knowledge, and even of primitive science in a crude way, to the early races of mankind. Evidence of this is referred to in my paper, and it might be greatly extended from the resources of anthropology. My contention is, that the "inspiration of selection" comes in here, as well as in dealing with prehistoric traditions. One of the greatest Biblical critics of Germany (Professor Zittel of

Leipzig) tells us that "this much is certain: the Biblical conception of the universe, which constitutes part of our faith, and in so far as it does so, is for us, not a Babylonian conception, but extremely ancient knowledge, partly the result of experience [including observation of nature] and partly revealed by God to man and preserved among His people."* Philology and archæology alike bear testimony to this.

(2) As to *the Expanse*, the old notion of the atmosphere constituting the expanse ("firmament") and the clouds "the waters above the expanse" will not work at all scientifically, and to import "inspiration" here is simply to "beg the question." Every student of physics knows that the clouds are water, and my critic waxes eloquent over the phenomena of clouds. But one wonders if he has ever travelled for two or three hours together through an alpine cloud, as through a vapour-bath, with the atmosphere, in which the clouds float, above him as well as below him; or stood on an alpine peak or pass, and gazed on clouds far below, as they appear (*e.g.*) to an observer on the summit of Mount Pilatus near Lucerne, when (according to a local Sprüchlein) that giant "wears his collar." I cannot help thinking that the writer of Genesis i was a better observer of nature than my critic appears to be.

(3) *The view of Lord Kelvin*, to which he refers, did not need refutation at the Cambridge Meeting of the B.A.,† at which I was present.

He is mistaken in asserting—Dr. Irving adopts Lord Kelvin's view—"that the earth solidified from the centre to the circumference." On the contrary (following such masters of geological science as Credner, Heim and Suess, of the continental school), I have for more than twenty years advocated the opposite view, as Mr. Woods Smyth may see for himself, if he will be so good as to look into my geological writings.‡

* Quoted by Dean Wace, D.D., in his lecture on "the Book of Genesis," *Christian Apologetics*, John Murray, 1903.

† See Report for 1904.

‡ Such (*e.g.*) as—(a) "Chemical and Physical Studies in the Metamorphism of Rocks." (Longmans, 1889); (b) "The Malvern Crystallines" (*Geological Magazine*, October, 1892); (c) "On the Consolidation of the Earth" (*Nature*, May 25th, 1905), to which I specially draw his attention.

The notion of a "frozen globe" melted by "fierce sunshine" is one of which, as a geologist, I have never heard until now, and is on physical considerations inadmissible. I have adopted the *calculations* of Lord Kelvin, as a working hypothesis; but we have it on his own authority, that the "matter-of-fact foundation" for his conclusion (that is to say, his primary data) is furnished by "*the heat which we know to be now conducted out of the earth yearly.*"* Such observations and measurements are as independent of the hypothesis of the consolidation of the earth from the centre to the circumference, as the use of the balance in the determinations of atomic weights (and in quantitative analysis generally) is independent of the theory of "electrons." For my purpose "consolidation of the earth" need mean no more than consolidation of the external crust. The conclusion as to the *age of the sun*, in comparison with that of the earth, based on "the well-founded dynamical theory of the sun's heat," seems to me independent of such considerations. However, I am obliged to my critic for giving me an opportunity for putting this point more definitely.

(4) The notion of *directivity* is one which gives my critic much trouble. Even if the consensus of "accredited authorities" were so one-sided as he asserts, the thoughtful student of science would not be bound by their *credo*. To admit such an assumption would be to put an end to scientific enquiry. Mr. Woods Smyth does not attempt to answer the arguments adduced in my two papers: he merely contradicts on the strength of his own summing-up of "authorities." That is rather the way of "Vaticanism" than of either science or philosophy. I deny that "authority" on this question belongs to the biologists exclusively, or even in any special degree to such men as Herbert Spencer (who was not a scientist) or the prophet of Jena.† Men like Lord Kelvin, who speak of "Creative and Directive Power," and look at these matters in a

* See his lecture on "the Age of the Earth," to the Victoria Institute. (The italics are Kelvin's own.)

† "Has the mantle of Infallibility been torn from the shoulders of the Pope merely to be placed upon those of the Professor?" sagely asks Mr. G. T. Manley in his splendid paper on the "Old Testament in Relation to Science," read at the Church Congress in 1907. (See the *Guardian* October 9th, 1907.)

broader perspective, have surely a right to be heard ; and I should reckon Professor George Henslow among " accredited authorities," as well as Professor A. H. Church, F.R.S., from whom he borrows the word "directivity."

The only ultimate logical conclusion, to which evolution without directive power can lead, is blank "determinism" (the result of blind fortuity) which refuses to recognize that "working for ends," for which such "authorities" as Asa Gray have contended, and which even Professor Starling tacitly recognizes, as I have pointed out in my paper. If Mr. Woods Smyth is not prepared to deny that the mind of the chemist *directs* the reactions of the laboratory to synthetic ends,* how can he refuse to recognize similar or analogous working of Creative Mind in the vast laboratory of the universe ? But his contention and that of his "authorities" really amounts to a negation of a Divine Providence and the reduction of prayer to an absurdity ; and that is, I am sure, far from what he intends.

(5) As to the idea of "*Interference in Man's Evolution*" (which I hold to be special *creation*), I am glad to know that I have the support of Wallace, as I most certainly have of the writer of the early chapters of Genesis and of the Bible *passim*. But I do not borrow from Wallace. I have held and taught it on scientific and philosophical grounds for years past, as I stated a short time ago in the discussion of Professor Orchard's paper on "Philosophy and Evolution."† Seventeen years ago, as I wrote, "the projection of life into the world of matter from 'the unseen universe' is the only theory that meets at once the requirements of religion and science," so I wrote also, "the catholic idea of the projection of the spiritual life is after all but the logical counterpart of the projection of the natural life into the world of matter, which (with its energy and properties) has existed, and may exist again, without being

* I am glad to find that Professor Church had anticipated me in the use of this illustration in my previous paper, "Evolutionary Law, etc." (§ II).

† *Trans. Vict. Inst.*, vol. xl, pp. 136 ff. Some very sane and cogent remarks for our present purpose were contributed to that discussion by Professor George Wright of America, to which most of us would probably subscribe.

associated with life at all."* In a paper on "Faith and Science,"† and again in a sermon, "The New Creation,"‡ I said, "Anything like a gradual development of the spiritual life out of the physical life seems to be as untrue as the doctrine of the development of life from non-living matter, with its energy and properties. . . . Each life has its place in guiding and controlling, to higher ends, properties and forces of a lower order than itself. As science can tell us nothing directly of the intrinsic nature of physical life, so can it have nothing to say for or against the spiritual life: for this we must turn to the revelation of Jesus Christ"; and (I may add here) to the "inner light" of that "God-consciousness," which man has, because man is a soul, a creature *sui generis*.§

The term "Man" (in the highest sense) then must include this, the central factor of his individuality (his self-hood); and carries with it the refutation of Mr. Woods Smyth's *dictum*, "Evolution is sufficient to account for the whole chain|| of sequences from the Protistæ to Man in the highest sense." Evolution has to do with matters belonging to the lower grades of consciousness.

I thank Mr. Tuckwell for his appreciative remarks. As to the *rakia* (expanse), his remarks, I think, tend to confuse what I find actually stated in Gen. i. The author of that chapter even seems to go out of his way to preclude that, by anticipation; for in v. 8, he expressly defines the "expanse" of vv. 6, 7, when he says—"God called the expanse heaven," so as to make it quite clear that in the succeeding verses, from which I have quoted, he is speaking of the same thing three times over. I can find in the text no countenance to the idea of more than one expanse.

* "Things New and Old"; a sermon published in the *Clergyman's Magazine* (January, 1893) and referred to in my previous paper.

† *Ibid.*, June, 1893.

‡ Written and preached on the occasion of the Meeting of the British Association at Nottingham in 1893, and published in *The Churchman* (August 1894).

§ Cf. the very able paper by Professor Caldecott, D.D., Litt.D., read at the Victoria Institute on May 23rd, 1910, and the discussion thereon; also *The Inner Light*, by the Rev. Arnold Whiteley, M.A. (Camb.), D.D. (London), with Introduction by Dr. Caldecott.

|| The misprint of "claim" for chain must have been too obvious to mislead anyone.

Mr. Tuckwell has, however, committed himself to a definite piece of "criticism," in which he questions my physics. He might have been, I think, a little more cautious. He says there is a little confusion of thought concerning the presence of steam, in what I have for the last twenty years or more spoken of as the "pre-oceanic stage" of planetary development. There is some "confusion of thought," but the confusion is Mr. Tuckwell's. He has confounded two physical facts, which are entirely distinct, when he makes the critical temperature of steam to mean the temperature of dissociation. The *critical temperature* of steam is that temperature above which no pressure can coerce it into a liquid; and that, as he says, is about 773° Fahr., or a little above 400° C., about the melting-point of zinc. But the steam remains a true dry gas of the molecular composition H₂O, as every student of physics knows. The *temperature of the dissociation* of steam is far higher. Under ordinary atmospheric pressure, the dissociation of steam is known experimentally to begin at about the temperature of white-hot platinum; but the temperature of complete dissociation is far above the melting-point of platinum, which is about 2,000° C. (= 3,632° Fahr.) This is known from the fact that platinum melts readily in the flame of the oxy-hydrogen blowpipe, in which hydrogen and oxygen are entering into combination at a temperature which of necessity is below the temperature of complete dissociation of H₂O. I have often demonstrated this in former years in lectures to my pupils. Perhaps the best account of "dissociation," which occurs to me, is that given in the Introduction to Professor Wislicenus's *Lehrbuch der Anorganischen Chemie*. He might also possibly find of some interest my two papers on "Dissociation," read before the British Association in 1886 and 1888, and published *in extenso* in the *Chemical News*. The electrolytic decomposition of H₂O into oxy-hydrogen gas is of course a different matter.

"Sons of God." Without attempting any definition of "inspiration," though insisting upon revelation coming to mankind through an "inspired race," leading up to the greater Pentecostal Illumination of the Church,* we may reason inductively from the use of this expression in the Bible; and it is only fair to claim that the fuller

* Professor Masterman's little work, *I believe in the Holy Ghost*, is useful in this connection (Wells Gardner & Co., 1906).

light of revelation given to us by Christ and His Apostles in the New Testament may be invoked to throw light upon the Old Testament use of it, assuming (as we are justified in assuming) that Revelation was *progressive*, and that the same presiding Spirit illuminated the organs of both Old and New Testament revelation. Now the writer of the Epistle to the Hebrews* speaks of God as the "Father of Spirits" in such a way as to appeal directly to the consciousness of the spiritual man, and he interprets all the discipline of life as the chastisement of *sons*. Paternity necessarily implies *sonship*; and in the Introduction to St. John's Gospel we are expressly told that those who (from the earliest dawn of the religious consciousness in man) received by a responsive faith the illumination of the divine Logos, in whom was "that life, which is the light of men," had given to them the "power" (A.V.) the "right" (R.V.) (*εξουσία*) to become the "sons of God" (John i, 12). This I take to be the key to the whole teaching of the New Testament, as the thought is developed in St. Paul's own masterly way in the eighth chapter of his Epistle to the Romans, which Dean Vaughan used to speak of as "the heart of the New Testament." At the same time, standing as it does, this phrase seems to me to link up the deepest teaching of the Old Testament (as that was understood in the time of Our Lord) with the fuller teaching of the New. It is moreover a favourite expression of St. John's, and Christ the Lord clinches it, when He teaches us to say "Our Father." The prophet Hosea (i, 10) uses the very expression when he predicts the *status* of the spiritual man in the Church of the then future, as St. John (I, iii, 1) applies it; and St. Luke expressly speaks of Adam as "*the son of God*." For such reasons I am inclined to take the use of the term in Genesis to mean those to whom the God-consciousness was imparted, as to "*living souls*,"

* In a sermon published sixteen years ago I ventured to say that—"Regarded from a philosophical point of view, that Epistle is the one supreme effort of Christian philosophy of the first century in applying the inductive method of reasoning out from the records of the Old Testament the higher meaning, the heavenly interpretation, of the more material and earthly facts which were to be found in the law and history of Israel and in the Mosaic religion" (see *Clergyman's Magazine* for February, 1894).

which could hear the voice of God saying to them, "The fear of the Lord, that is wisdom; and to depart from evil is understanding" (Job xxviii, 28); or (as St. Paul puts it) "as many as are led by the spirit of God, they are the sons of God" (Romans viii, 14).

On anthropological grounds I go so far (*pace* the older exegesis) as to apply all this even to the use of the expression "Sons of God" in Job i, 6 and xxxviii, 7; the former implying ancient and primitive corporate worship outside the pale of the Abrahamic Covenant—the latter the early and primitive conceptions of God as revealed in Nature. (*Cf.* also the heathen poet Aratus, Acts xvii, 28, quoted by St. Paul to the sharp-witted Athenians.)

It was surely a sound maxim of St. Augustine that "the Old Testament prepares for the New, and the New explains the Old"; and I see no valid reason for making an exception in this case. That "light of men," of which St. John speaks, has never been entirely extinguished in the best human spirits, though much obscured by sin, which consists essentially in the misuse (through perversion of the Will) of those powers and faculties and instincts with which God has endowed humanity. I have worked at this line of thought in a sermon of mine, which was published in 1893, as indeed also in many sermons.

To refuse to look at the early chapters of Genesis in the light of the Incarnation and of the New Testament, is surely to go out of our way to create Scriptural difficulties. Mr. Tuckwell does well to refer us to the teaching of the Living Word Himself in John x, 34-36; although, if he will refer to Bishop Perowne's learned commentary on the Psalms (resp. Ps. lxxxii), he will see that the meaning of that passage is somewhat obscure. For myself I should interpret it in the sense of the remarks which I have ventured here to make. Mr. Tuckwell is evidently more at home in Bible studies than in physical science.

Mr. HENRY PROCTOR has sent a most valuable note from a real student. I am glad to have the opportunity of explaining away what is said in my paper (p. 180) as to certain criticisms of his former remarks which had reached me. On passing on the criticism to Mr. Proctor I received such a full explanation of the points raised as seems to me fully to meet the criticisms referred to, and I thank him for the information. In a subject, which Mr. Proctor (as a Hebraist) seems to have made his own, I feel that it

would be presumptuous on my part to offer any criticism of what is contained in his present communication ; but we must all thank him for the light which that seems to throw upon the Genesis cast of prehistoric traditions contained in chapters i-xi. I may be permitted to add that his idea, as to the "Nephilim" being impure offspring of a previous race of *Homo*, of whose remote origin tradition had lost all traces, seems to receive support from what I have drawn attention to in the Presidential Address of Dr. Smith-Woodward, F.R.S., to the Geological Section of the British Association last year at Winnipeg.* The *Homo* (whether Neolithic or otherwise) would seem to have developed the same tendency as some other races of mammals, "to store up mere dead mineral matter as bone" before they became extinct. It would be interesting to have Mr. Proctor's idea, as to any possible correlation of the primitive Nâdu of the Euphrates-Tigris region with the Neolithic men (of unknown date as to origin), who were overmastered and superseded by the "Bronze" men, as they, in their turn, were by the Achaeans, with their use of iron, in Crete. (See *Crete the Forerunner of Greece*, by C. H. and H. B. Hawes, Harpers, 1909.) The Genesis tradition (iv, 22) seems to point to such superior power of the forgers of cutting "instruments of bronze and iron" among the Cainites.

It is scientifically impossible to follow the gallant Colonel Alves in his speculation. That Dr. Thirtle should attempt to make the Genesis narrative carry the burden of such things as he refers to in heathen mythology, is bad enough from the theological point of view ; but the idea of angels forming alliances with women is such a physiological absurdity† that it must be relegated to the limbo of a pre-scientific age. It traverses moreover the teaching of the Master of masters, when He tells us in effect that the sexual function is something entirely outside the range of angelic existences (Matthew xxii, 30). Science here seems to me to make a clean sweep with its besom of a great deal of rubbish, which a fanciful exegesis has read into the sacred text, and the recognition of a pre-Adamic race moreover renders unnecessary. I

* See the discussion of the paper on "Darwinism and Malthus" by the Rev. James White, M.A., read before the Victoria Institute on April 4th last.

† Despite even *Hastings' Dictionary* (article "Nephilim").

do not see that the substitution of Aryan for Babylonian myths does much to clarify our idea of the "inspiration of selection" of prehistoric traditions.*

That idea of Gen. iv, alluding to an "ordered state," is an old one, with which I have been long familiar. Something like it is put forward in his *Commentary* by the great divine and scholar, Bishop Christopher Wordsworth of Lincoln. But Wordsworth was not, and never pretended to be, a student of science; though he maintained an open attitude of mind towards the teaching of science, as I have reason to know.

Lockyer's hypothesis of the meteoric origin of planets might seem to favour the notion of a state of things brought about by the collision of two bodies moving in space;† but if Colonel Alves will think the matter out, he will see insuperable difficulties in the way of its application; since it would have to account for each and every planet of the solar system by a special event, instead of regarding (as the "nebulär hypothesis" does) the whole series as the result of the regular and simple operation of physical laws in their evolution, as I have attempted to show in my two papers.

His remarks about insects and "the higher plant-life" are beside the mark. If he will study what I have put forward in my former paper and the "analytical parallelism" there suggested, he will, I think, come to see that, though a few insects did exist in the Carboniferous period, their agency was not required for the fertilization of the cryptogamous flora, which was then predominant; nor even was it wanted for the early forms of Coniferæ, which do not depend upon insect fertilization.

Professor Driver's *Genesis* will give him some useful information, as to the reasons for separating the two accounts of the Creation. I have long maintained that they are written from two different points of view: the one may be regarded as a sequential account of a continuous evolutionary process, while the other is a pictorial grouping of leading and striking facts of creation about Man, as the head and centre of it all. "Image of God" in the one may, I

* Cf. Dean Wace, D.D., on "The Book of Genesis" in *Christian Apologetics* (John Murray, 1903).

† Cf. Sir Robert Ball's lecture to the Victoria Institute in 1901.

think, be taken as the counterpart of "living soul" in the other. I find it difficult to attach any clear meaning to the phrase, "the long geological period." On this point he will, I hope, pardon me for again referring to my previous paper, to which the present one is professedly supplementary. It is important not to overlook the fact, that the second of the two accounts of creation is but the first "Act" of the drama, which runs on from chapter ii, 4, to chapter iv, 24.* There is internal evidence of this. In all our studies of these old Scriptures we must learn to "think orientally,"† if we are to get away from the bondage of what the late Sir Gabriel Stokes, F.R.S. (a former President of the Victoria Institute), used to call "a slavish literalism." (See further on this point correspondence in the *Guardian* in the autumn of 1907, on "Genesis and Science.")

Colonel Turton refers to his book, *The Truth of Christianity*, which I procured and read with much pleasure on its appearance. Though the science of it is weak in places, the book as a whole is a valuable addition to the literature of Christian Apologetics. Unfortunately he, like some others, has not been at the pains to make a real study of my paper before criticizing it; and so he has misunderstood that part with which he deals in his *quasi-criticism*, consisting of little more than quotations from his own book. If the Colonel would do me the favour of making a careful logical analysis of Section II (B) of my paper, he will see that the notion of the atmosphere constituting the "expanse" is one which is entirely ruled out by the argument adopted. That argument is based upon what the inspired writer actually says, and not in any way upon what others have read into it. The word "expanse" means an indefinite portion of extended space, and cannot possibly mean a material substance, such as the atmosphere of this planet undoubtedly is. If the gallant Colonel doubts that, it must be because he has forgotten the laboratory-teaching of his Woolwich days, which must have familiarized him with the air-pump and its applications. My conception of the "expanse" is that of interplanetary space, on the assumption of the *nucleate inception* of the planets, as separate centres of condensation in the nebula; and it

* See further Driver, *Op. cit.*, page 35 ff.

† Mackinlay in his book, *The Magi*, etc.

was for the express object of demonstrating this, that the Greenwich photographs of the "spiral nebulæ" were thrown upon the screen. I regret that my enforced absence from the meeting on March 21st prevented me from emphasizing this at the time. The difficulty raised as to the winged creatures (v. 20) flying "above the earth in the open firmament of heaven" is more apparent than real; as we see at once if we follow the literal Hebrew (and we can hold the author responsible for naught else), which says "on the face of the expanse of the heaven" (margin), as they of course appear to do to a spectator on the surface of the earth.

As to the points 2 and 3 of Colonel Turton's criticism, I am unable to follow him, nor do I see that they have any very cogent bearing upon the point under discussion.