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JOURNAL OF
THE TRANSACTIONS
OF
The Victoria Institute
OR
Philosophical Society of Great Britain

VOL. LXXXVIII

1956



LONDON:

PUBLISHED BY
THE INSTITUTE, 22 DINGWALL ROAD, CROYDON, SURREY

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938TH ORDINARY GENERAL MEETING
OF THE
VICTORIA INSTITUTE

AT
THE CAXTON HALL
WESTMINSTER, S.W. 1

ON
MONDAY, 7th MAY, 1956

R. J. C. HARRIS, Ph.D., B.Sc., F.R.I.C., in the Chair

**THE PRINCIPLE OF UNIFORMITY IN
GEOLOGY, BIOLOGY AND THEOLOGY**

By

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SYNOPSIS

THE principle of uniformity (actualism) is not a law of nature, but a methodological principle, showing the advantages and the weaknesses of analogical reasoning. It is an empty form, which, in practice, has been made conformable to the data of geology and biology, so that even conceptions which virtually amount to catastrophism have been fitted in with it.

As a consequence of a metaphysical prejudice, the "horror miraculi", the principle is sometimes applied in a dogmatic way. On the other hand, orthodox Christians, wanting demonstration of divine interference in the regular course of nature, have often been biased against uniformitarianism.

The biblical conception of nature liberates the scientist as well as the theologian from constraint and bias, as it admits a free application of the principle of uniformity, restricted, however, by submission to the facts revealed in nature.

I. THE PRINCIPLE OF UNIFORMITY IN GEOLOGY

THE methodological principle underlying modern geology and evolutionary biology is *the principle of uniformity*, which implies that "the course of nature has been uniform from the earliest ages, and causes now in action have produced the former changes of the earth's surface" (Ch. Lyell, *Principles of Geology*, sec. ed. I [1832], p. 357). This principle, accordingly, proclaims firstly that the *actually* operating causes have been always active (actualism) and, secondly, that their effect and their tempo has been always the same (uniformity). All geological changes of the past should be explained by forces not differing in *kind and energy* from those now in operation and all causes not supposed to belong to the present order of nature should be rigorously excluded from scientific explanations. Catastrophes might be introduced into speculations respecting the past, provided they are not supposed to have been more frequent or general than they are expected to be in the future (Lyell, I, 101).

On the other side there is *catastrophism*, which holds that the causes now in operation are not sufficient to explain the geological events of the past and that causes differing in kind and energy from those now in operation have to be introduced into geological theories (G. Cuvier, *Discours sur les*

révolutions de la surface du globe [1826], pp. 14, 20). Paroxysmal volcanic upheavals and universal floods are deemed necessary for explanation and while the uniformitarians are liberal with time and parsimonious with energy, the catastrophists are parsimonious with time and liberal with energy.

The principle of uniformity includes two things:

1. The physical laws now in operation have been always in operation.
2. The causes of geological changes (the geological forces) now in operation have been always in operation and their energy has always been the same.

These two things have been confounded in discussions about uniformity. Consequently, catastrophism has often been misrepresented as scientifically absurd and impossible from the methodological point of view. However, it ought to be stressed that catastrophists like Cuvier, Sedgwick, and Buckland never propounded the idea that the *physical* laws have changed in the course of ages.

The real controversy centred around the second point, and the catastrophists, while maintaining the constancy of physical laws, advanced the view that at certain intervals an unusual coincidence of circumstances caused revolutionary changes. Lyell, on the contrary, did his utmost to "reconcile" phenomena with the principle of uniformity in its most rigorous conception (op. cit., I, 189, 190). Consequently, though he did not make the mistake of speaking about a "law" of uniformity, his conception of the *principle* of uniformity certainly showed a tendency in this direction. He preferred a suspension of judgment to an abandonment of the principle in its strictest form. However, the best thing one can do seems to be to adapt the hypotheses to the facts to be explained, without violating the laws of physics. Strict uniformitarianism may often be a guarantee against pseudo-scientific phantasies and loose conjectures, but it makes one easily forget that uniformity is not a law, not a rule established after comparison of facts, but a methodological principle, preceding the observation of facts. It is the logical principle of parsimony of causes and of economy of scientific notions. By explaining past changes according to the analogy of present phenomena a limit is put to conjecturing, for there is only one way in which ancient causes are equal to recent ones, but there is an infinity of ways in which they could be supposed different. This sound methodological attitude, however, easily degenerates into a narrow dogmatism, namely when it is considered to be a physical law. In this case scientific theory becomes static, to the great detriment of science. Facts not supporting the supposed analogy between ancient and modern causes may then easily be overlooked or adapted to the established prejudice. Openmindedness towards the unexpected may disappear. However, it seems to be good policy in science to adjust

principles and theories to the data of observation instead of adapting these data to prejudices of any kind whatsoever. The first attitude might certainly give free play to phantasy, but it might also open new vistas. The uniformitarian position, at its worst, forces past phenomena into a preconceived frame built upon events occurring in our epoch; the catastrophist attitude, at its best, adapts scientific theories and notions to the records of the past. It seems, therefore, that the principle of uniformity should be abandoned or re-interpreted as far as strictly necessary, when a better co-ordination of the phenomena of the past could be attained by doing so.

On the other hand, it should be recognized that uniformitarianism ought to be adopted as much as possible. It seems indeed to be an innate quality of the scientific mind to strive after simplification of its conceptions of the world system by means of "economy of causes" and "analogy of causes". These are the mental keys by which we open the door to the treasures of knowledge. Hutton was enough of a philosopher to recognize this. Though his deistic metaphysics implied a rather rigorous uniformitarianism, his epistemology led to a less strict conception: "It is not given to man to know what things are truly in themselves, but only what those things are in his thought" (James Hutton, *Theory of the Earth; Transact. Edinb.*, 1788, p. 297). This critical idealism mitigated the dogmatic character of his interpretation of uniformity, as perhaps the uniformity might be in the human mind rather than in nature herself (op. cit., p. 301).

Consequently, one can share with Hutton and Lyell a bias for uniformitarian reasoning and try to "reconcile" phenomena as much as possible with it, without losing sight of the fact that it is but a *method*, which ought to be revised as soon as this seems expedient. However, as the great protagonist of this principle hardly succeeded in remaining quite free from dogmatism, this was even more so with his followers. To quote only some fairly recent ones: L. Kober (1928) spoke of "the law of actualism"; W. Salomon (1926) maintained that "every kind of rock has been formed at every epoch"; W. J. Vernadsky (1930) was of the opinion that "most certainly the minerals have always been the same . . . and also their paragenesis and their relative amounts have always been the same." Many geologists revolted against this uniformitarian dogmatism. Some of them (e.g. Erich Kaiser, 1931; *Z. deutsch. geol. Gesellsch.*, 83, pp. 389-407) held that the same forces formerly under dissimilar circumstances worked with greater energy; others, without resorting to catastrophes, yet recognized "ancient causes" differing in *kind* from those at work now (Lucien Cayeux, *Causes anciennes et causes actuelles en géologie*, 1941). Emmanuel Kayser (1921) advanced the opinion that actualism does not oppose the possibility that, as a consequence of dissimilar circumstances, former manifestations of force may have been more powerful. E. Kaiser, J. Walther (1893; 1924) and K. Andree (1930) arrived at the conclusion that the actualistic method should be applied

only with great prudence to geological history, especially to the palaeozoic formations. Before the continents were covered with plants, weathering, erosion, and sedimentation were different from the same processes going on at present. The humid, vegetationless primeval desert is not to be compared with the recent vegetationless dry deserts. Cayeux pointed out that phosphate deposits in the ocean are now very rare and differ much from ancient phosphate deposits, and for this and other reasons he concluded that in the modern epoch a whole series of activities has come to rest, which formerly played an important rôle in the formation of sediments (Cayeux, op. cit., p. 75).

The *facts* adduced by Cayeux are accepted by his opponents Laffitte and M. Rutten, who, however, combat his "ancient causes". Yet these two defenders of uniformity recognize that the same events did not occur in all geological epochs (Rutten, in *Geologie en Mijnbouw* 11 [1949], pp. 222, 227), or that, if the same events did occur, the intensity was not the same (R. Laffitte, in *Annales Hébert et Haug*, 7 [1949], p. 245). The circumstances were different and, consequently, also the effects caused by forces of the same kind differed. According to Laffitte, in order to save actualism it is sufficient to imagine the actual causes working upon a world differing from that which we see at present, and, accordingly, producing different effects (op. cit., 255, 258). He concludes that "there are permanent causes which have a different effect in different periods" and that "the variable states of the globe are the result of the variation in activity of internal causes which work in cycles, making periods of rest alternate with periods of activity" (*ib.*, p. 258). Thus critics of actualism (E. Kaiser, J. Walther) demonstrated that *external* geological forces (erosion, etc.) are not always the same, whereas defenders of actualism (Laffitte) demonstrated that *internal* geological (orogenetic) forces are not always equal.

Strictly speaking, the defenders of actualism maintain the equality in *kind*, but abandon the equality in *energy*; actualism (but an actualism with some qualifications) rather than uniformitarianism would be the right name for the now prevailing doctrine.¹ Historical geology is a reconstruction of past events within the limits of the analogy of recent occurrences. This analogy, however, does not exclude the supposition of multiplied "energy" of the causes active in the past, provided they be of the same kind with those now in action. Moreover, it admits that certain circumstances prevailing now are eliminated from the picture of the past and that circumstances not occurring now are imagined to have prevailed in the past.

¹ It should be noticed that continental writers almost always use the term "actualism", whereas in English publications the term "uniformity" is prevalent.

II. THE PRINCIPLE OF UNIFORMITY IN BIOLOGY

As to the history of the organic world several views have been propounded.

A. There is no progressive development of the organic world.

1. Species are variable within very narrow limits only. The species that are now, have always existed. This is the opinion of medieval Averroists and of many conservative Christians.

2. Species are variable within very narrow limits only. The species that are now have not been always; they replaced extinct species which were on the same level of organization. This was the view of Lyell in 1830.

B. There is a progressive development of the organic world.

3. Animals of a higher degree of organization suddenly arose by new creation (Buckland, Sedgwick, Hugh Miller).

4. Animals of a higher degree of organization suddenly arose by transmutation of lower forms (Étienne Geoffroy St. Hilaire, Schindewolf).

5. Animals of a higher degree of organization arose by transmutation of species in a continuous mode and an extremely slow tempo (Lamarck, Darwin and most modern evolutionists).

The adherents of the theory of development (B) may also be divided into *progressionists* (3), who accept saltatory changes in the organic world by means of creative intervention, and *transmutationists* (4 and 5), who hold that evolution always takes place through descent with modification from lower forms (cf. Lyell, *The Antiquity of Man*, sec. ed. [1863], p. 395).

About 1800 palaeontology seemed to support geological catastrophism (Cuvier, op. cit., p. 145). Cuvier, who mainly investigated vertebrate fossils, was of opinion that the geological marks of each great revolution of the earth's surface are accompanied by the appearance of a new batch of fossils. According to him the sudden appearance of reptiles and mammals corresponds with the beginning of subsequent geological eras (op. cit., p. 55). He rejected the transmutation of species on rather actualistic grounds; there is practically no difference between mummified animals from Egyptian tombs and recent animals. Lamarck answered that a few thousand years is too short a period to have a perceptible effect, whereupon Cuvier retorted that multiplication of zero yields zero (cf. op. cit., p. 63).

It stands to reason that a catastrophist in geology is also a catastrophist in biology. Similarly, on the same principle (viz. the parallel between geological and biological history), one would expect an actualist in geology also to be an actualist in biology. However, it turns out that this biological actualism may be conceived in different ways:

(a) Geological uniformity means that the earth has always been as it

is now, whereas in the organic world the scale of beings is gradually extending to higher organization (Lamarck, *Philosophie Zoologique*, 1809).

(b) Geological uniformity means a gradual "development" of the earth and also a gradual development of the organic world (R. Chambers, *Vestiges of Creation*, 1844).

(c) Geological uniformity means that the earth has always been as it is now, and that the organic world also did not essentially change (Hutton, 1785; Lyell, 1830). Only in the two latter cases is there a true parallel between the history of the organic world and the history of the earth; the geological and climatological circumstances influence living matter. From the strictly actualistic standpoint there is no progression in the history of the earth and, consequently, neither is there any progression in the history of the organic world (Hutton, Lyell). In the second case there is a parallel between biological evolution and the history of the earth and this requires (against Hutton and Lyell) a "progressive" evolution of the earth (whatever that may mean), which influences living matter in such a way that in the course of time more complicated forms arise (Chambers; Ét. Geoffroy St. Hilaire, 1825, 1828, 1833). If, however, geological uniformitarianism is strictly maintained and at the same time the progressive character of biological development is put forward, the parallel is abandoned and an additional explanatory principle has to be introduced. In that case biological evolution bears no cogent relation to geological uniformity. If T. H. Huxley's contention (cf. *Darwin's Life and Letters*, II, p. 190) that "consistent uniformitarianism postulates evolution as much in the organic as in the inorganic world" be true, most evolutionism is *inconsistent*.

In a certain respect Cuvier was more actualistic than Lamarck. He rejected the progressive change of species because it is not demonstrable at present, whereas Lamarck, on account of the supposed scale of beings ("échelle de la nature", i.e. the continuous series of animal types from the lowest organisms up to Man) posited an imperceptibly slowly working "tendance de la nature", which caused evolution by descent with modification. While true actualism *starts* from causes now in operation, the effects of which are indeed *observed* directly, the actualism of Lamarck (and of many modern biologists) is in one respect a perverted one. It *starts* from a great *progressive* change effectuated in millions of years, and supposes this to be the sum total of small actual variations of which the progressive character is not evident. However much small variations in the animal world may be going on at present, there is no warrant in experiment or immediate observation for concluding that these changes, in the majority, are going in a certain direction. Certainly, Lamarck pointed to variations which arose in the organisms in response to external circumstances, but—as his *geological* theory was strictly uniformitarian and actualistic—this "inheritance of acquired characters" could not be the cause of an evolutionary *progress*. Therefore it should be emphasized

that the heart of Lamarck's theory of evolution is not, as is generally supposed, the "inheritance of acquired characters", but a "tendency of nature to progressive improvement". However mystical and purely verbal this "cause" of evolution may be, it shows at least an awareness of the fact that not only the *transmutation* of species, but also the *progressive character* of that transmutation would require an explanation.

Uniformitarianism required gradual changes, slow changes, and changes of the same character as those now occurring. In fact only the *slowness* and the *continuity* of change, posited by the uniformitarians, were borrowed from geology and transferred to biology when Lamarck, Chambers and Darwin put forward the extreme slowness and the continuity of biological progression. However, as to the fact of the transmutation of species this procedure failed and it was not the present but the past that led the way. The slow *geological* changes might be clearly perceptible within the period covered by human history, as K. A. von Hoff pointed out, but the animal world only showed new varieties which were not "progressive" and which could only be interpreted as "incipient species" on arguments borrowed elsewhere. That is why Lyell was antagonistic to Lamarck's theory and—in spite of his opposition to catastrophism and to the doctrine of progressive creation—accepted Cuvier's views concerning the constancy of species (Lyell, *Principles*, II, 21). Of course, he recognized that there are fluctuations in the history of the earth and that, similarly, animal species disappear and are replaced, but this happens, according to him, within the limits of a genus (cf. Lyell, *Antiq.*, p. 422; *Principles*, II, c. xi; III, pp. 156–157). Consequently, the remarkable situation was that to the progressionists (Buckland, etc.) the lack of mammalian fossils in the most ancient strata of the earth's crust needed no further explanation, whereas Lyell had to suppose that they had disappeared (*Princ.*, I, 145–153). Actualism in the historical sense excluded evolution as well as progression, it is a-historical. Progressionism, on the contrary, admits a *history* of the animal world; it is foreshadowed in the first chapter of Genesis (if conceived neither in a too literal nor in an allegorical sense). The doctrine of evolution, as enunciated by Darwin, borrowed from actualism the idea of extremely long periods and extremely slow and continuous changes, but not the idea of progress, which (as Lyell recognized after his acceptance of Darwinism) was held mainly by the opponents of actualism.

In one respect, however, Lyell never was a strict uniformitarian, nor (after his conversion to evolutionism) an orthodox Darwinist. The origin of the human rational mind was regarded by him as a break in the uniformity (*Princ.*, I, 176–179; *Darwin's Letters*, II, 210–211; *Antiq.*, 469). A. R. Wallace, the co-founder of the theory of evolution by natural selection, held the same opinion (*More Letters of Darwin*, II, 36–39; Wallace, *Darwinism* [1889], p. 391). Wallace believed that in the course of evolution three times a "new cause" had been introduced, to

wit at the rise of unconscious life, conscious life, and spiritual, intellectual life (Wallace, op. cit., pp. 474-475).

Darwin absolutely rejected any break in the continuity of development, whether by new creations or by saltatory development. The idea of Étienne Geoffroy St. Hilaire, St. G. Mivart and many others, who, in analogy with the birth of monstrosities, supposed the sudden transformation of the reptilian embryo so that a bird-like creature would arise, gave him "a cold shudder". Biological uniformity in his opinion was closely tied up with the small variations upon which natural selection worked. In spite of his great authority, however, these theories cropped up again and again, and recently the American geneticist Richard Goldschmidt (*The Material Basis of Evolution*, 1940) has put forward the theory of saltatory evolution by "systemic mutations" arising from early embryonic changes. Amongst his supporters the German palaeontologist O. H. Schindewolf (*Grundfragen der Paläontologie*, 1950) takes a prominent place. He starts from the fact that in the palaeontological record large gaps exist, and this the more frequently the higher the systematic category concerned. He deems it an exceptionable method exclusively to admit micro-evolutionary changes; the occurrence of monstrosities gives a plausible analogy for the sudden rise of new animal types. He supposes that there have been periods of explosive origination of new types of organization (typostrophes) and he is of opinion that biological theory should *explain* the gaps in the palaeontological record *instead of explaining them away*, as the orthodox Darwinists do.

The opponents of saltatory development, the American triumvirate Th. Dobzhansky, E. Mayr, and G. G. Simpson tenaciously cling to micro-evolution in small steps. The difference is not about the paleontological data; Simpson too acknowledges that "the facts are that many species and genera, indeed the majority, do appear suddenly in the record, differing sharply and in many ways from any earlier groups", and this appearance of discontinuity becomes more common on a higher level, until it is virtually universal as regards orders and all higher steps (G. G. Simpson, *Tempo and Mode in Evolution* [1947], p. 99; cf. p. 107). He deems it too easy simply to refer to the imperfection of the palaeontological record; the gaps occur too systematically for that. But, according to him, palaeontology clearly indicates intervals of time between the beginning and the end of a transformation, and this would be impossible in Goldschmidt's theory. Therefore some reason must be found for these gaps and this is the postulate that during the transitions the number of individuals was small and the tempo of evolution very fast, so that there was little chance of fossilization (Simpson, op. cit., p. 117; cf. Schindewolf, op. cit., p. 293). Both parties recognize the constancy of physical laws and both parties have to infringe strict uniformity. External circumstances of a geological and climatological character in one case cause large mutations, in the other case they cause exceptionally great velocities of evolution.

III. THE LOGICAL CHARACTER OF THE PRINCIPLE OF UNIFORMITY

It has become evident from the above that the protagonists of the principle of uniformity differ widely as to their conception of the implications of this principle.

1. What happens now, happened always in the same manner, in the same tempo, on the same level. (Graphically this means that there are small fluctuations about a horizontal line in a diagram with "time" and "events" as co-ordinates.) This is Lyell's original view.

2. There is a gradual evolution with a constant velocity. One can accept 1 in geology and 2 in biology (Lyell's later view) or admit 2 in both disciplines (Chambers's original view). The uniformity is in the *change* of the situation (in the gradient of the curve).

3. Geological change is supposed to happen in alternative periods of orogenetic activity and periods of rest in which erosion preponderates. (These geological cycles may be represented by a sinusoidal curve.) The repetitive unit consists of a period of activity and a period of rest. This is the theory of neo-Huttonists.

4. In palaeontology periods of rapid evolution (Simpson), or even extremely rapid evolution (Schindewolf's *typostrophes*) alternate with epochs of gradual orthogenetic development (to be represented by an ascending line broken by steeper stretches). An actualistic interpretation demands either that a stretch covering an explosive phase and an orthogenetic phase should be considered as a unit, or that the principle be applied to each kind of change separately.

5. There have been periods of great geological activity, but now all things are almost at rest. If it is supposed that a new sequence may occur in the future, this is also uniformitarian, as this but requires "causes now in operation, or causes that *could be* now in operation".

From the catastrophist point of view the line of history breaks off abruptly and then continues on a higher level.

It may be concluded that there is no sharp borderline between actualism and catastrophism, nor between change of tempo and change of mode. The interpretation of events as catastrophic or actualistic largely depends on the interval of time considered and on the entity taken into account (the state of things or the velocity of events).

Now uniformitarianism makes use of analogical reasoning. The value of analogies, however, depends on the choice of the qualities or functions that are compared. In natural science analogical reasoning is founded upon resemblance, not upon equality of two relations. And this resemblance may be rather superficial, the choice of the things compared may be an unhappy one, so that Davy's judgment on chemical analogy ("the substitution of analogy for fact is the bane of chemical philosophy; the legitimate use of analogy is to connect facts together, and to guide to new

experiments") could be applied, *mutatis mutandis*, also to geology. The difficulty, however, is that nobody can give a rule to test the "legitimacy" of the use of analogy. Uniformitarian geology demands that the change in the earth's crust in a certain period is to the duration of this period, as the change in another period is to the duration of that other period. And actualistic geology demands that a geological change now is to its cause now in operation, as a geological change in the past is to the cause in operation then.

Uniformitarianism proclaims that something is repeating itself in the course of time, but it does not say anything about the length of the period that ought to be taken into account in order to perceive such a repetition. If we take as the "present state" the situation since the dawn of civilization, biological evolution stands upon weak ground. On the other hand, the introduction of almost limitless time offers an easy escape from rigorous uniformity (as conceived by Hutton and Lyell) and it has made evolution more acceptable. But to the adherents of saltatory evolution should also be granted the right of introducing millions of years in order to state the regular recurrence of macrosaltations suggested by palaeontological finds, as well as to account for the great difficulty of finding an example of them in the immediate present. Thus analogical reasoning, which is always behind actualism, once more turns out to be an empty form, which, under the pressure of facts and theories, may be filled up with widely different contents. It only propounds that *there is some kind of uniformity*, not of *what kind* this uniformity is. It is a methodological principle, no *law of nature*. That form of uniformitarianism or actualism has to be chosen which is most conformable to the available data of geology and palaeontology and (this only in the second place) which can be made plausible by modern experiments and observations which may serve as *models* of past events. This should be preferred, even when it virtually amounts to catastrophism.

The "horror miraculi".

Geologists and biologists, even when virtually accepting a mild form of catastrophism, will proclaim their allegiance to the uniformitarian creed and their disgust at the supernatural or the marvellous in general. This *horror miraculi* is so deeply ingrained in the scientist's soul that it is often used as a formidable threat: unless a certain theory be accepted, a miracle will be introduced. In order to discredit the theories of an opponent, scientists sometimes label them as "miraculous" explanations. The protagonists of the doctrine of spontaneous generation (Haeckel, Naegeli) as well as those of the diametrically opposite doctrine of the eternity of life (Preyer), pretended that their hypothesis was the only one that avoided "miracles". Darwinists charge Goldschmidt and Schindewolf with introducing "miracles" (e.g. Dobzhansky, *Genetics and the Origin of Species*, sec. ed. [1941], p. 53), whereas Schindewolf deems the liberal use

of "missing links" by the Darwinists verging on "faith in miracles" (op. cit., p. 131), and Goldschmidt thinks it an advantage of his system that there is "no mysticism" in it (op. cit., p. 206).

Here three causes may be in operation: (1) scientific methodology, (2) scientific rationalism (versus empiricism), (3) a metaphysical doctrine.

Let us first consider the first two points. Scientific method tries to classify all phenomena under certain rules and laws of nature. The scientist as such has a passion for laws, he does not deny miracles, just as he does not deny moral laws, but he is simply blind to them. The scientist as such has a bias for order and, consequently, for the principle of uniformity, for parsimony of causes, and for the "analogy of nature", and therefore he will not admit more diversity in the scientific system than is strictly necessary. These laudable principles, however, easily stiffen into dogmas: anything not standing the test of these dogmas is rejected as "unscientific" or "miraculous".

Theoretical explanations have often been discarded as "miraculous" or "supernatural", because they seemed "irrational", and facts have been denied because they were "extraordinary". But as long as catastrophic or unusual events are reducible to physico-chemical laws or are analogous to well-known physico-chemical phenomena, uniformitarianism cannot dismiss them as "miraculous", but at best as "improbable". Dobzhansky, who regards Goldschmidt's "hopeful monsters" as miraculous ("the assumption that such a prodigy may, however rarely, walk the earth overtakes one's credulity") has to admit that the existence of life in the cosmos "is in itself an extremely improbable event" (op. cit., p. 53). As to the charge of being "irrational", this seems to be on the epistemological level. The old war between rationalism and empiricism continues to be waged. The history of science shows so many examples of the "irrational" notions and theories of to-day being the "rational" notions and theories of to-morrow that it seems largely a matter of being *accustomed* to them whether they are considered rational or not. The rejection of "uncommon" things and the rejection of "unreasonable" things are psychologically on the same level.

IV. THE PRINCIPLE OF UNIFORMITY IN THEOLOGY

THE principle of uniformity being a methodological principle, it should be independent of metaphysical or religious convictions. In reality, however, metaphysics has played a large part in the acceptance or rejection and in the interpretation of the uniformitarian doctrine.

I. *Atheism* (monism, materialism, naturalism) holds that the necessity of immanent laws rules nature. No design or plan, no final causes, are admitted. People taking this point of view mostly are strict uniformitarians. Darwin, though no theoretical atheist, virtually assumed this position. Lyell's suggestion that creative power made man supervene was energetically rejected as a "miraculous addition" to the theory of

descent. When Wallace propounded his non-evolutionistic conception of the origin of the human mind, Darwin answered: "I hope you have not murdered too completely your own and my child" (*More Letters*, II [1869], 39). He spoke of natural selection in religious terms and Lyell was of the opinion (not without reason) that he (and Huxley) deified secondary causes too much (*Antiq.*, p. 469; *Lyell's Life and Letters*, II, 363, 384). Wilhelm Preyer, a German zoologist, went even further. His (negative) religious prejudice made him prefer to revolutionize the whole science of life and matter rather than "concede" that a divine creative act had taken place. Consequently, he supposed life to be eternal: in the incandescent state of the earth there must have been "glowing organisms . . . whose blood perhaps was liquid gold" (in *Kosmos* [1877], p. 382).

II. *Deism* supposes that God created matter and endowed it with laws from which the world and all its inhabitants ensued according to the plan and design originally laid down in matter to be realized in the future. This world-view too is uniformitarian. Hutton's *Theory of the Earth* (1788) was largely inspired by his wish to demonstrate that God's work is absolutely perfect and that all forces and events are "wisely adapted to the purpose for which they are employed" (*Edinb. Transact.*, I, p. 213), to wit the construction of a world habitable for mankind (op. cit., p. 294). The principle of uniformity was rooted in his belief in the infinite wisdom of God and, consequently, in the absolute perfection of the world, which, like an organized body, renovates itself in endless repetition of geological cycles (ib., p. 216), so that we find "no vestige of a beginning, no prospect of an end" (ib., p. 304). For Hutton "tout va pour le mieux dans le meilleur des mondes", and therefore the idea of evolution is not accepted, as it would imply that still higher perfection would be possible.

Yet it was easy to give deistic uniformitarianism a twist by which evolution became possible without abandoning "design" and "perfection". "Perfection" could be conceived as a potentiality not fully realized all at once and a beneficent deity could have endowed matter with permanent laws of *constant physical order* as well as with permanent laws of *continuous development* and improvement. This type of evolutionism has been advanced by Erasmus Darwin in his *Zoonomia* (1791) and in his *Temple of Nature* (1803).

By firm, immutable immortal laws
 Impress'd on Nature by the Great First Cause,
 Say Muse! how rose from elemental strife
 Organic forms, and kindled into life

(*Temple of Nature*, canto I, lines 1-4).

He described how "from embryo births her changeful forms improve" (ib., line 225). Robert Chambers, the anonymous author of the *Vestiges of Creation* (1844), assumed a similar position. Both were of opinion that

“there is more dignity in our idea of the supreme author of all things, when we conceive him to be the cause of causes, than the cause simply of the events, which we see” (*Temple of Nature*, add. notes, p. 1; Chambers, op. cit., sec. ed., pp. 153-158).

III. It may appear odd to place a large number of orthodox Christians (Buckland, Sedgwick, Conybeare, etc.), who were defenders of catastrophism, in the deistic group. But in their very combating of uniformitarian deism by the demonstration of “divine intervention in the course of nature”, they practically accepted the basic assumption of their opponents; they grafted a “theistic” branch on the deistic tree. In the deistic scheme God is too exalted to meddle with “unimportant” or “special” things, and the orthodox, whose faith had been unconsciously shaken by the attacks of deism, seem to have held virtually the same belief. Although they recognized God’s sustaining of all things, they wanted to demonstrate His special care by “interventions” in the course of nature. This attitude was heralded by Thomas Aquinas, who held that God’s “common” activity coincides with the natural order of events as it had been logically deduced by Aristotle, whereas deviations from that regular course could be recognized as supernatural interventions (cf. R. Hooykaas, “Science and Theology in the Middle Ages,” *Free Univ. Quarterly*, 2, 77-163). In his inaugural lecture William Buckland attacked the deistic interpretation of the results of science, which implied that the universe is carried on by the force of the laws originally impressed upon matter, without the necessity of fresh interference on the part of the Creator. Geology, however, gives “proofs of an overruling Intelligence continuing to superintend, direct, modify, and control the operations of the agents which he originally ordained” (*Vindiciae Geologiae* [1820], p. 18-19). Similarly, palaeontology gives evidence of the beginning and end of several systems of organic life and thereby affords “proof of the repeated exercise of creative design, and wisdom, and power” (W. Buckland, *Geology and Mineralogy considered with reference to Natural Theology*, vol. I [1836], p. 55).

It appears that the arguments for divine intervention based upon the data of science in the long run turn out to be founded upon quicksand. In the sixteenth century new stars and comets presented the believers with so many proofs of God’s “intervention”. However, when astronomy had divested them of their marvellous character, geology came to the fore and God’s interference with the regular course of nature was considered evident from universal floods, or—when Neptunism had been substituted by Plutonism—from volcanic catastrophes. The triumph of uniformitarianism left only the organic world as a sign of God’s intervention, but when the belief in the sudden creation of animals was shaken, the origin of Man, and finally, only the origin of Man’s mind, was considered to be above the laws of nature. This elastic retreat clearly shows that, as J. D. Hooker put it, Natural Theology is “the most dangerous of all two-edged weapons” (*Hooker’s Life and Letters*, vol. II [1868], p. 67).

Natural theology as well as natural anti-theology tried to interpret scientific facts and hypotheses each in its own way; each new victory of scientific "law" was regarded as a triumph not only of science but also of the "scientific view of life", and each alleged proof of "miracle" or of "divine intervention" was considered as a triumph of religion. This shows that the antagonists fought their battle on a common ground and that they had more affinity than they were conscious of themselves.

IV. The *biblical view* (which is not always the view of religious orthodoxy) does not accept the alternative put by the contending parties mentioned above; it does not regard wonder and law as mutually exclusive. A miracle is not considered as an *intervention* in a world that otherwise runs its own course; rule and exception to the rule are equally wonderful to religious contemplation. God cares even for the sparrow on the roof; His activity is behind *every* thing, however unimportant it may seem. The scientist, even when he is a believer, tries to reduce miracles as much as possible; the believer, even when he is a scientist, discovers miracle in the most familiar things.

Now it has often been said that such a "spiritual" view is the last refuge for a religious belief which sees its elastic front break down before the progress of science. However, this charge appears historically unjustified. From Nicole Oresme in the fourteenth century, to Isaac Beekman and Pascal in the seventeenth century and Asa Gray and Charles Kingsley in the nineteenth century this view has been upheld by people who as scientific thinkers belonged to the vanguard of their time. It was the nominalist Oresme who proclaimed God's absolute power and recognized miracle where scholastic rationalism was blind to it, but it was also Oresme who dismissed many of the marvels his contemporaries believed in as perfectly "natural" phenomena or as deceit of priests or magicians (cf. Hooykaas, op. cit.). And the nominalist Jean Buridan propounded a geological theory not less uniformitarian than that of Hutton. Beekman pointed out that the more we understand God's reign in nature, the more wonderful it is (cf. R. Hooykaas, "Science and religion in the seventeenth century," *Free Un. Q.*, 1, pp. 169-183). Yet, he was one of the founders of the "mechanical philosophy", which lies at the basis of the modern scientific world picture. But he recognized that "science proceeds from wonder to non-wonder, whereas religion should go from non-wonder to wonder".

According to the American botanist Asa Gray (1810-1888), Darwin's biological theory of evolution was neither theistic nor non-theistic; he maintained that the birth and development of a species is as natural as that of an individual, but evidently he deemed them also equally wonderful. So far as the argument of design in nature is concerned "it makes no difference whether there be evolution or not, or whether the change be paroxysmal or uniform" (A. Gray, *Evolution in Theology*, 1874). It seems strange, says Gray, that a convinced theist should be so prone "to

associate design only with miracle ” and then he understands miracle as a suspension of natural laws.

C. Kingsley’s interpretation of Darwin’s theory did not tend to discard God more and more from nature but, on the contrary, he saw in the effects of natural selection special “ providences of Him without whom not a sparrow falls to the ground, and whose greatness, wisdom, and perpetual care I never understood as I have since I became a convert to Darwin’s views ” (*C. Kingsley’s Letters*, 7th abridged ed. [1880], II, p. 155). Below all natural phenomena he recognized “ a miraculous ground ”. This generalization of miracle could be an evading of the biblical miracles. However, Kingsley’s uniformitarianism did not in any way weaken his Christian conception of miracle, for it was precisely this conception that was behind it. “ After the crowning miracle of the Incarnation all miracles are possible. ” The biblical miracles which, if necessary, we would have once more, are “ not arbitrary infractions, but the highest development of that will of God, whose lowest manifestations we call the Laws of Nature, though really they are no Laws of Nature, but merely customs of God, which He can alter as and when He will ” (op. cit., II, p. 85). This is the truly biblical conception, which makes no division between nature and supernature and regards “ miracle ” as another aspect of everything that presents natural law at its face value.

It should be stressed that Kingsley, who shared the English prejudice against Calvin, unwittingly repeated Calvin’s view. Small wonder: Calvin’s teaching contains little “ Calvinism ”, as it is one of the most scholarly and successful attempts to build a theology on Scripture alone without falling into the error of biblicism. In his *Institutes* Calvin did not make any *essential* distinction between ordinary events, belonging to the order of Nature (the rising and setting of the sun), extraordinary events (great drought) and miraculous events. The term “ supernatural ” is not used; there are regular, less regular, and even unique manifestations of God’s will. The idea that only “ special ” events require divine intervention is rejected; God is present in the most insignificant things (references to Ps. 104: 27; Acts 17: 28; Matthew 10: 30), and all deviations from natural order are the best proof that God is also active in all other things (*Inst.*, Bk. I, c. XVI, §§ 4, 5, 7).

This conception may be found with “ creationists ”, progressionists as well as evolutionists. Among the progressionists Hugh Miller, the well-known defender of the cause of the Free Kirk, sometimes talked about natural theology in the way of Buckland, but much more than with the Bucklands there will be found with him a continuity by which general revelation in nature and special revelation in Christ are blended into one exalted view of the destiny of the cosmos, in which the “ adorable Monarch of all the future ” is the crown of the progression that started with the creation of matter (H. Miller, *The Testimony of the Rocks* [1857], pp. 155–156; cf. pp. 243–245). Consequently, Miller deemed a belief in

the existence of God, evoked by natural science, but dissociated from a belief in the Mediator and Redeemer, of as little ethical value as a belief in the existence of the great sea serpent.

The biblical miracles are intended as "signs" (cf. A. M. Stibbs, "Miracles as Signs," *Christian Graduate*, 9 [1956], pp. 2-5), and as such it does not matter so very much whether such a sign is wrought in a "natural" way or seems quite "supernatural". The "prescribed order of nature" as well as events outside the regular course of nature are signs of God's power (Calvin, op. cit., §§ 5 and 7). In order to recognize these signs for what they are, one ought to have eyes "anointed with eyesalve": many "scientific" people do not see evidence of God's design and presence in the works of nature and many "religious" people will, just as the scientists, escape from miracle by seeking for a "natural" explanation. Darwin could not imagine that the creator of countless worlds should have made myriads of worms by individual acts of His will (cf. *The Foundation of the Origin of Species*, Two Essays written in 1842 and 1844, ed. by F. Darwin, 1909; Essay of 1842, p. 51), whereas to Kingsley the generation of lower polyps as well as the general law of gravitation show "absolute Divine miracle at the bottom of all". Darwin was well aware of the unbridgeable gap existing between him and Asa Gray, whom he regarded, from the point of view of biology, as a "tower of strength" to his cause.

It is perhaps an unconscious semi-deism which since the eighteenth century prompted so many Christians eagerly to seek for signs of divine intervention. There is the possibility that not only religious zeal but also the little faith of a generation which might be ranked with those of whom it was said, "Except ye see signs and wonders ye will not believe", played a certain part (cf. A. Gray, *Darwiniana* [1878], p. 389). The scientist, even when he is a Christian, will as a scientist try to be as actualistic as possible, and at the same time recognize the merely methodological character of the principle of uniformity. Accordingly, as a *scientist* he will adjust his interpretation of the principle of uniformity to the data of observation and experiment, even when this might imply the admittance of the seemingly marvellous.

Those who praise themselves as "progressive" thinkers and, perhaps because of their dislike of Christianity, tenaciously cling to rigorous uniformity, should remember that strict actualism and conservative theology often converged: orthodox people like Buridan in the fourteenth century and the Rev. John Fleming (Professor of Geology at the Free Church College) were rigorously uniformitarian.

The scientist as a *Christian* will not be eager for divine interventions and breaches of uniformity; because, from the religious point of view, it makes no difference whether geological changes be paroxysmal or uniform, and also because, though God glorify Himself sometimes in doing a miracle, "yet there is in every miracle, a silent chiding of the world, and a tacite reprehension of them, who require, or who need miracles" (John Donne; *Sermon* on March 25th, 1627).