

SCIENCE

THE LIFE OF THE UNIVERSE

IF the Universe, as Robert Boyle and Paley thought, be like a clock or watch, made and wound by an Almighty Clockmaker, it is to be expected that this world-machine will ultimately run down and stop:—not even the Cosmos as a whole is to be regarded as a perpetual motion machine. Or if we regard the Universe as a living thing, whose motion is the evidence of its life, we may expect that, like other living things, it must ultimately die. Its substance will remain intact, as the doctrine of the conservation of energy assures us, but its life will have ceased; it will be merely a corpse immune from decay.

Now there is a well established "law" of thermodynamics, discovered by Lord Kelvin in 1852, which bears directly upon these two metaphors that regard the life or activity of the Universe, though not its mere existence, as having had a beginning and as destined to end. The doctrine of the Dissipation of Energy teaches us that whilst energy never disappears it ever tends to become unavailable. For the purposes of the present argument we may regard heat as the common or undifferentiated form of energy, which all the other forms constantly tend to assume. Now heat, like water, must always "seek its own level," and when we suitably arrange any system of which one part is hotter than another, we can make it do work. But when the water has fallen from the height, or the heat has distributed itself, no more work can be got out of it. The energy is still there, but it is no longer available. At present there is a great difference of heat potential between the different parts of the solar system, one consequence of which is the presence of life upon the earth. But in time to come, the heat will have distributed itself so that what corresponds to the solar system of to-day will be all of one temperature, and life will be impossible.

Now if energy, as represented by heat, is ever seeking its own level, the time must come when, if there be no compensatory process, all the energy in the Universe ceases to be available. To state the case broadly, the heat will still

be there—the dead Universe will have a certain temperature—but there will be no difference of potential, and the cosmic life will have run its course. If the law of the dissipation of energy be the whole truth, the Universe is certainly comparable, in this connection, to a watch that is running down. Furthermore, there is within it—if this law be the whole truth—no possibility of being wound up again, for it is a prime character of natural processes, as Lord Kelvin was the first to point out, that they are irreversible. "This remarkable property of all natural processes," as Dr. Merz says, "seems to lead us to the conception of a definite beginning and to shadow forth a possible end—the interval, which contains the life or history of Nature, being occupied with the slow but inevitable running down or degradation of the great store of energy from an active to an inactive or unavailable condition." Recent discoveries, such as that of intra-atomic energy, radio-activity, and the presence of radium in the earth's crust, may show that the watch will run for millions of æons longer than we had thought; but they do not affect the fact that it is running down. The imminent picture suggested by the law of the degradation of energy into heat and its dissipation throughout space, is that of a dead Universe, existent, indeed, but no better than a perdurable corpse.

Now ere we inquire whether there are indications that this is the whole truth we may note how remarkably this, which is the accepted scientific teaching of the time, consorts with various conceptions of the Deity. It is exactly compatible with the idea of God as entertained by Boyle and Paley and Cowper—the Great Artificer. He built the watch, wound it up, and, as Carlyle has it in "Sartor Resartus," is now the absentee God, who has sat idle since the first Sabbath, watching the Universe go. And when it has at last run down, He alone can wind it up. If we pursue the metaphor somewhat further, we may inquire whence the Watchmaker obtained the materials from which the watch is made. And here is an analogy which breeds an insuperable difficulty. For the human watchmaker does not create the steel and rubies and so forth of which his watches are made. They were extant before him. And similarly the doctrine of the Conservation of Energy teaches that the substance of the Cosmos, its corporeal frame, is from everlasting. The scientific teaching thus appears nicely to confirm the ancient conception of an aboriginal Chaos, into which the Deity infused at some definite period, the breath of life—or which he built into a machine, wound up and set going. It is therefore possible to construct a scientific defence for the doctrine of a primæval entity, without form and void, which is presumably "self-existent"—whatever that may mean—and to which a Deity, conceived as independent thereof and having his (or her) habitat beyond the range of any telescope yet constructed, has given form and a finite period of activity. His sole object in constructing it was, as Dr. A. R. Wallace has lately written a book to prove, the production of the human soul. Thereafter the machine will run down, having served its purpose; and will so remain unless its Maker should care to wind it up again.

On this position there are two criticisms to be made. The first has reference to the origin of the energy or stuff of which the Universe is composed. Plainly any ultimate answer which leaves out of account or fails to explain the existence of the Universe, apart from its life or activity, cannot be regarded as adequate, or even as true in so far as it goes, for we can scarcely be satisfied with any explanation that does not meet all the facts. Furthermore, we cannot accept as final any explanation which proceeds on the assumption that Time is what, for our daily purposes, we regard it. Few will now dispute the proposition that time is no more than the symbol by which we express our consciousness of change without and within us. Now evolution is simply an assertion of universal and ordered change, so that time is thus merely an expression or symbol of our consciousness of evolution, and cannot be

included in any ultimate explanation of the fact of evolution. Let me make a second attempt to express myself. The foregoing theory states that evolution, change, life, activity—to live is to change, says Newman—had a beginning and therefore a Beginner, and will have an end. But if Time be an expression of our consciousness of change or activity, we cannot introduce this (derived) temporal concept into our explanation of the Cause of that which it symbolises. Judged by any philosophical canon, therefore, the argument for a beginning of the cosmic activity must be regarded as circular and vain. We might, indeed, apply to it, as to any other circular argument, that blessed word "self-existent," with which Professor Haeckel explains the prime fact of Nature's being.

Secondly, we may leave the philosophic and consider the scientific question. Ere we infer from the law of the dissipation of energy that the universal clock is running down, let us ask ourselves what it is that we really know. We shall find that, even when the objective validity of the concept of time is impugned, there still remain some difficulties in our argument. For instance, we know practically nothing as to the destiny of the light-energy and heat-energy which are incessantly being radiated from the solar system. Perhaps they are restoring the balance elsewhere; the energy that is dissipated for us may be marshalled for others. All we have observed are certain facts as to the part of the Universe which we know; but when the doctrine of the dissipation of energy was framed, our Universe was thought to be infinite and the *only* Universe. Yet to-day the astronomers are inclined to think that the stellar Universe—bounded by the Milky Way—may possibly be to the sum of things no more than the solar system is to it. And even if our Universe be running down, there may be that in process elsewhere which shall wind it up again; a speculation in which is implicit, let us mark, the assumption that other Universes, if such there be, and ours, are inter-related. Yet who shall say whether this assumption is gratuitous or no? Indeed the prophecy of universal death is a sorry piece of presumption when we come to inquire into it. Here, in a point of what they call infinite space—not that they can conceive space to be either infinite or finite—is a race of beings, born but yesterday, whom gravitation bloweth where it listeth. They have lately discovered that their prison-home is moving, but are not sure whither. The other day they made a few experiments, which they have interpreted as their reason permits them, and which they infer to imply that *All things* are coming to a standstill. They were not there when the dance began, nor will they see its conclusion. Their total life history can be but a moment in its course, but they are assured that it did begin and will end; for are they not the privileged spectators of "all time and all existence"?

The reader must not say that science points to a conclusion which I dislike and that I am trying to sail away from it on the inflated wings of rhetoric. If science does point to this conclusion, then it must be accepted: but the question is whether so tremendous an inference, involving a whole host of tacit and unexamined assumptions, can legitimately be drawn from the known data. I maintain that it cannot. If it were necessary, I might quote the considerations advanced by Lord Kelvin himself in 1874, to show that certain indications point to the restoration, not of energy, but of its availability: and these considerations might be reinforced by the inquiries of the past thirty years. But I am not prepared to admit that the question of the death of the universe can be solved by any balancing of known or conceivably knowable considerations. If, for instance, there be not other universes than that which perhaps the galaxy bounds, I do not see how their existence could be disproved save by the lapse of infinite time during which no disturbance attributable to them was observed in ours. To say that our macrocosm is to die when it may be no more than an atom in a greater whole, to which it is of no more account than a constituent atom of one of your blood corpuscles is to you—would

surely be madness. Indeed we may venture to say—whilst not forgetting the many instances in which apparently similar assertions have been falsified, as when Comte declared that we could never tell whether gravitation acts amongst the stars, or of what they are composed—that even if the life of the All be finite, we shall never be able to prove it. Radium clocks have been made that will go for a million years; but I believe that the Universe was never made and will go for ever.

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