

THE SCIENTIFIC OUTLOOK.

It is impossible to disguise the fact, that the final results, towards which scientific discovery seems to point, are viewed with more or less serious apprehension by many minds. These results, whether they should excite uneasiness or not, cannot be avoided by timidly shutting our eyes to their perpetual advance. There is nothing for us, in fact, but to take a brave outlook into the future of science, and set our mental house in order, to meet any result which may be disclosed.

The future of science can be surmised only by an inference from the course which it has followed in the past. Now, it is a commonplace remark, that the aim and the result of science have been to reveal the universal order, the invariable law,—in a word, the absolute uniformity which prevails throughout Nature. It would not be difficult for the philosophical thinker to show that this feature of scientific progress is no mere accident of the course which science has happened to take. The direction of scientific effort is not accidental, it is determined by the very nature of science. For science is simply the intellect of man striving to comprehend the universe as an intelligible system; and this end can be attained only by reducing the perplexing multiplicity and variety of phenomena to some sort of unity and order. The inherent unity of Nature, therefore, forms an indispensable article in the creed of the scientific student; were this faith abandoned, the progress of science would be at once arrested.

The career of science, in its quest of the universal harmonies, has been fraught with high inspiration; and the minds of men may well be flushed with ardent anticipation of the sublime prospect which is opened up. It is especially in the very days in which we live that the achievements of science have raised the expectations of men to the intensest eagerness; the marvels of recent scientific appliance have won the interest even of those who feel little attraction in science for its own sake. It is true, that we must not, in the pride of our own progress, forget the work of the long line of predecessors by whom our success has been prepared. The fact is, that not a few of the most brilliant discoveries of modern date had been conjectured long ago, in some cases by thinkers of the ancient world. We may recognize, in all its fulness, our obligation to the genius that was able to rise to an intuitive anticipation of discoveries which it could not establish by the processes of logic; such a recognition does not detract from the value of the intellectual labor, by which the intuitions of ancient wisdom have been brought down from the airy region of mere conjecture to the solid ground of verified fact.

There are two aspects which Nature presents, which may perhaps, with sufficient accuracy, be described as the statical and the dynamical, the former referring to the existing relation of natural forces, the latter to their development in time. In both these aspects of Nature a fascinating study is offered in the history of the scientific researches, by which unsuspected resemblances have been brought to light, where the first view detected nothing but an apparently irreconcilable diversity. In the former aspect the phenomena of Nature have long been ranged under three great divisions, which are still familiarly distinguished as the animal, the vegetable, and the mineral kingdoms. All scientific researches have assumed that there must be some

identity underlying all the differences that separate these groups of natural products. The very earliest efforts of European thought with which we are acquainted attempted to explain all things as modifications of a single form of matter, like water or air; but it was reserved for modern chemistry to trace, by unerring analysis, the precise quantities of the elementary materials that enter into the composition of all things, through the various combinations and separations by which they build up mineral, vegetable, and animal forms alike. It has long seemed as if we were thus forced, in the last analysis, to recognize a considerable number of ultimate units of matter or force—those units which are commonly called the chemical elements. But it has also been long conjectured, that this is not really the last analysis that science can effect; and now the chemistry of our day, in its latest researches, seems fairly on the way to vindicate the soundness of this conjecture,—to show that the so-called elements are merely different combinations or modifications of some primitive substance or force.

But the process, through which this primitive material has been transformed into the elements of the chemist, leads us to that other aspect of Nature, in which it is regarded, not as a stationary condition, but as a development that has been going on unceasingly through all the ages. The faith in the essential unity of Nature must assume, that the agencies at work in the present are substantially identical with those of the past and the future. Accordingly, the uniformity of Nature has always, even among the oldest thinkers, been supposed to extend over the period of time embraced within the records of human experience; but a bolder career has been opened for scientific research by the speculations of modern astronomy and geology. When in last century Kant, and in the present century Laplace, suggested that the formation of planetary systems might be explained by the gradual cooling down of vast spaces of gaseous matter; when, fifty years ago, Sir Charles Lyell's *Principles of Geology* established the assumption, upon which alone geological science is possible, that the agencies which have produced the crust of the earth are identical with those which we find operating on its surface at the present day; then the conception of the uniformity pervading all Nature's operations began to expand through the inconceivable periods of the past. But the living generation has witnessed the most startling application of uniformitarianism to a new sphere of objects. Long ago, even among the early thinkers of Greece, the idea had been broached, that the original production of organic forms was due to existing agencies of Nature; the idea had also been developed in modern times by Lamarck and by the author of the *Vestiges of Creation*, but it is not yet a quarter of a century since Darwin and Wallace gave to this idea a shape which has made it almost universally accepted among the naturalists of our time. Whether the Darwinian theory has succeeded in formulating completely the agencies by which the innumerable varieties of organic being have been produced, certain it is that the world can never recede from the step which has thus been taken towards the recognition of a unifying thought evolving the manifold diversities amid identity, the manifold identities amid diversity, that are discoverable in all the realms of Nature alike, throughout every region of space and throughout every period of time.