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THE PHILOSOPHY OF THE INDUCTIVE SCIENCES

[redacted]PON THEIR HISTORY

[redacted]OLUME 2

WILLIAM WHEWELL

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The Philosophy of the Inductive Sciences

Founded Upon their History

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The Philosophy of the Inductive Sciences

First published in 1840, this two-volume treatise by Cambridge polymath William Whewell (1794–1886) remains significant in the philosophy of science. The work was intended as the 'moral' to his three-volume *History of the Inductive Sciences* (1837), which is also reissued in this series. Building on philosophical foundations laid by Immanuel Kant and Francis Bacon, Whewell opens with the aphorism 'Man is the Interpreter of Nature, Science the right interpretation'. Volume 2 contains the final sections of Part 1, addressing namely the philosophy of biology and palaetiology. Part 2, 'Of Knowledge', includes a selective review of opinions on the nature of knowledge and the means of seeking it, beginning with Plato. Whewell's work upholds throughout his belief that the mind was active and not merely a passive receiver of knowledge from the world. A key text in Victorian epistemological debates, notably challenged by John Stuart Mill and his *System of Logic*, Whewell's treatise merits continued study and discussion in the present day.

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THE

PHILOSOPHY

OF THE

INDUCTIVE SCIENCES,

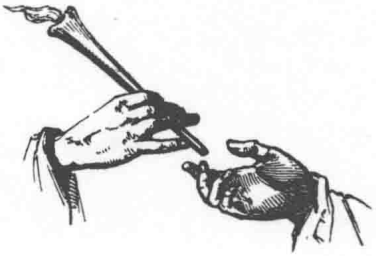
FOUNDED UPON THEIR HISTORY.

BY THE

REV. WILLIAM WHEWELL, B.D.,

FELLOW OF TRINITY COLLEGE, AND PROFESSOR OF MORAL PHILOSOPHY IN THE UNIVERSITY OF CAMBRIDGE, VICE PRESIDENT OF THE GEOLOGICAL SOCIETY OF LONDON.

IN TWO VOLUMES.



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THE PHILOSOPHY OF THE INDUCTIVE SCIENCES.

PART I.

OF IDEAS.

Τῶν καλῶν καὶ τιμίων τὴν εἴδησιν ὑπολαμβάνοντες, μᾶλλον δ' ἑτέραν ἑτέρας ἢ κατ' ἀκρίβειαν ἢ τῷ βελτιόνων τε καὶ θαυμασιωτέρων εἶναι, δι' ἀμφότερα ταῦτα τὴν ΤΗΣ ΨΥΧΗΣ ΙΣΤΟΡΙΑΝ εὐλόγως ἂν ἐν πρώτοις τιθείημεν· δοκεῖ δε καὶ προς ἀλήθειαν ἅπασαν ἡ γνῶτις αὐτῆς μεγάλα συμβάλλεσθαι, μάλιστα δε πρὸς τὴν φυσιν· ἔστι γαρ οἷον ΑΡΧΗ ΤΩΝ ΖΩΩΝ.

Aristot. Πέρι Ψυχῆς. 1.

BOOK IX.

THE PHILOSOPHY OF BIOLOGY.

CHAPTER I.

ANALOGY OF BIOLOGY WITH OTHER SCIENCES.

1. IN the History of the Sciences, after treating of the Sciences of Classification, we proceeded to what are there termed the Organical Sciences, including in this term Physiology and Comparative Anatomy. A peculiar feature in this group of sciences is that they involve the notion of *living* things. The notion of *Life*, however vague and obscure it may be in men's minds, is apprehended as a peculiar Idea, not resolvable into any other Ideas, such, for instance, as Matter and Motion. The separation between living creatures and inert matter, between organized and unorganized beings, is conceived as a positive and insurmountable barrier. The two classes of objects are considered as of a distinct kind, produced and preserved by different forces. Whether the Idea of Life is really thus original and fundamental, and whether, if so, it be one Idea only, or involve several, it must be the province of true philosophy to determine. What we shall here offer may be considered as an attempt to contribute something to the determination of these questions; but we shall perhaps be able to make it appear that science is at present only in the course of its progress towards a complete solution of such problems.

Since the main feature of those sciences of which

we have now to examine the philosophy is, that they involve the idea of life, it would be desirable to have them designated by a name expressive of that circumstance. The word *Physiology*, by which they have most commonly been described, means *the Science of Nature;* and though it would be easy to explain, by reference to history, the train of thought by which the word was latterly restricted to living nature, it is plain that the name is, etymologically speaking, loose and improper. The term *Biology*, which means exactly what we wish to express, *the Science of Life*, has often been used, and has of late become not uncommon among good writers. I shall therefore venture to employ it, in most cases, rather than the word *Physiology*.

2. As I have already intimated, one main inquiry belonging to the Philosophy of Biology, is concerning the Fundamental Idea or Ideas which the science involves. If we look back at the course and the results of our disquisitions respecting other sciences in this work, and assume, as we may philosophically do, that there will be some general analogy between those sciences and this, in their developement and progress, we shall be enabled to anticipate in some measure the nature of the view which we shall now have to take. We have seen that in other subjects the Fundamental Ideas on which science depended, and the Conceptions derived from these, were at first vague, obscure, and confused;—that by gradual steps, by a constant union of thought and observation, these conceptions become more and more clear, more and more definite;—and that when they approached complete distinctness and precision, there were made great positive discoveries into which these conceptions entered, and thus the new precision of thought was fixed and perpetuated in some conspicuous and lasting truths. Thus we have seen how the first confused

mechanical conceptions (Force and the like,) were from time to time growing clearer down to the epoch of Newton; —how true conceptions of Genera and of wider classes, gradually unfolded themselves among the botanists of the sixteenth and seventeenth centuries;—how the idea of Substance became steady enough to govern the theories of chemists only at the epoch of Lavoisier;—how the Idea of Polarity, although often used by physicists and chemists, is even now somewhat vague and indistinct in the minds of the greater part of speculators. In like manner we may expect to find that the Idea of Life, if indeed that be the governing Idea of the science which treats of living things, will be found to have been gradually approaching towards a distinct and definite form among the physiologists of all ages up to the present day. And if this be the case, it may not be considered superfluous, with reference to so interesting a subject, if we employ some space in tracing historically the steps of this progress;—the changes by which the originally loose idea of Life, or of Vital Powers, became more nearly suited to the purposes of science.

3. But we may safely carry this analogy between Biology and other sciences somewhat further. We have seen, in other sciences, that while men in their speculations were thus tending towards a certain peculiar Idea, but before they as yet saw it clearly to be peculiar and independent, they naturally and inevitably clothed their speculations in conceptions borrowed from some other extraneous idea. And the unsatisfactoriness of all such attempts, and the necessary consequence of this, a constant alteration and succession of such inappropriate hypotheses, were indications and aids of the progress which was going on towards a more genuine form of the science. For instance, we have seen that in chemistry, so long as men refused to recognise a peculiar and distinct kind of power

in the *Affinity* which binds together the elements of bodies, they framed to themselves a series of hypotheses, each constructed according to the prevalent ideas of the time, by which they tried to represent the relation of the compound to the ingredients:—first supposing that the elements bestowed upon the whole qualities *resembling* their own:—then giving up this supposition, and imagining that the properties of the body depended upon the *shape* of the component particles;—then, as their view expanded, assuming that it was not the shape, but the mechanical *forces* of the particles which gave the body its attributes;—and finally acquiescing in, or rather reluctantly admitting, the idea of *Affinity*, conceived as a peculiar power, different not only from material contact, but from any mechanical or dynamical attraction.

Now we cannot but think it very natural to find that the history of Biology offers a series of occurrences of the same nature. The notions of Life in general, or of any Vital Functions or Vital Forces in particular, are obviously very loose and vague as they exist in the minds of most men. The discrepancies and controversies respecting the definitions of all such terms, which are found in all works on physiology, afford us abundant evidence that these notions are not, at least not generally, apprehended with complete clearness and steadiness. We shall therefore find approaches and advances, intermediate steps, gradually leading up to the greatest degree of distinctness which has yet been attained. And in those stages of imperfect apprehension in which the notions of life and of vital powers are still too loose and unformed to be applied independently, we may expect to find them supported and embodied by means of hypotheses borrowed from other subjects, and thus made so distinct and substantial as to supply at least a temporary possibility of scientific reasoning upon the laws of life.

4. For example, if we suppose that men begin to speculate upon the properties of living things without acknowledging a peculiar Vital Power, but making use successively of the knowledge supplied by the study of other subjects, we may easily imagine a series of hypotheses along which they would pass.

They would probably, first, in this as in other sciences, have their thoughts occupied by vague and *mystical* notions in which material and spiritual agency, natural and supernatural events, were mixed together without discrimination, and without any clear notion at all. But as they acquired a more genuine perception of the nature of knowledge, they would naturally try to explain vital motions and processes by means of such forces as they had learnt the existence of from other sciences. They might first have a *mechanical* hypothesis, in which the mechanical forces of the solids and fluids which compose organized bodies should be referred to, as the most important influences in the process of life. They might then attend to the actions which the fluids exercise in virtue of their affinity, and might thus form a *chemical* theory. When they had proved the insufficience of these hypotheses, borrowed from the powers which matter exhibits in other cases, they might think themselves authorized to assume some peculiar power or agency, still material, and thus they would have the hypothesis of a *vital fluid*. And if they were driven to reject this, they might think that there was no resource but to assume an immaterial principle of life, and thus they would arrive at the doctrine of an animal *soul*.

Now, through the cycle of hypotheses which we have thus supposed, physiology has actually passed. The conclusions to which the most philosophical minds have been led by a survey of this progress is, that by the failure of all these theories, men have exhausted this path of inquiry,

and shown that scientific truth is to be sought in some other manner. But before I proceed further to illustrate this result, it will be proper, as I have already stated, to exhibit historically the various hypotheses which I have described. In doing this I shall principally follow the *History of Medicine* of Sprengel. It is only by taking for my guide a physiologist of acknowledged science and judgment, that I can hope, on such a subject, to avoid errors of detail. I proceed now to give in succession an account of the Mystical, the Iatrochemical, the Iatromathematical, and the Vital-Fluid Schools; and finally of the Psychical School who hold the Vital Powers to be derived from the Soul (*Psychè*).

Chapter II.

SUCCESSIVE BIOLOGICAL HYPOTHESES.

Sect. I. *Mystical School.*—In order to abbreviate as much as can conveniently be done the historical view which I have now to take, I shall altogether pass over the physiological speculations of the ancients, and begin my survey with the general revival of science in modern times.

We need not dwell long on the fantastical and unsubstantial doctrines concerning physiology which prevailed in the sixteenth century, and which flowed in a great measure from the fertile but ill-regulated imaginations of the cultivators of Alchemy and Magic. One of the prominent doctors of this school is the celebrated Paracelsus, whose doctrines contained a combination of biblical interpretations, visionary religious notions, fanciful analogies, and bold experiments in practical medicine. The opinion of a close but mystical resemblance of parts between the universe and the human body, the *Macrocosm*