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Peter Mark Roget  
Excerpt  
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# ANIMAL AND VEGETABLE PHYSIOLOGY.

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## INTRODUCTION.

### CHAPTER I.

#### *Final Causes.*

To investigate the relations which connect Man with his Creator is the noblest exercise of human reason. The Being who bestowed on him this faculty cannot but have intended that he should so exercise it, and that he should acquire, through its means, some insight, however limited, into the order and arrangements of creation; some knowledge, however imperfect, of the divine attributes; and a distinct, though faint, perception of the transcendent glory with which those attributes are encompassed. To Man have been revealed the POWER, the WISDOM, and the GOODNESS of GOD, through the medium

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of the Book of Nature, in the varied pages of which they are inscribed in indelible characters. On Man has been conferred the high privilege of interpreting these characters, and of deriving from their contemplation those ideas of grandeur and sublimity, and those emotions of admiration and of gratitude, which elevate and refine the soul, and transport it into regions of a purer and more exalted being.

A study which embraces so extensive a range of objects, and which involves questions of such momentous interest to mankind, must necessarily be arduous, and requires for its successful prosecution the strenuous exertions of the human intellect, and the combined labours of different classes of philosophers, during many ages. The magnitude of the task is increased by the very success of those previous efforts: for the difficulties augment as the objects multiply, and the eminence on which the accumulated knowledge of centuries has placed us only discloses a wider horizon, and the prospect of more fertile regions of inquiry; till at length the mind, conscious of the inadequacy of its own powers to the comprehension of even a small part of the system of the universe, is appalled by the overwhelming consideration of the infinity that surrounds us. The reflection continually presents itself that the portion of creation we are here permitted to behold is as nothing when compared with the

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immensity of space, which, on every side, spreads far beyond the sphere of our vision, and indeed far beyond the powers of human imagination. Of the planetary system, which includes this earth, our knowledge is almost entirely limited to the mathematical laws that regulate the motions of the bodies which compose it, and to the celestial mechanism which patient investigation has at length discovered to be that most admirably calculated to preserve their harmony and maintain their stability. Still less have we the means of penetrating into the remoter regions of the heavens, where the result of our investigations respecting the myriads of luminous bodies they contain amounts to little more than the knowledge of their existence, of their countless numbers, and of the immeasurable distances at which they are dispersed throughout the boundless realms of space.

Measured on the vast scale of the universe, the globe we inhabit appears but as an atom; and yet, within the compass of this atom, what an inexhaustible variety of objects is contained: what an endless diversity of phenomena is presented; what wonderful changes are occurring in rapid and perpetual succession! Throughout the whole series of terrestrial beings, what studied arrangements, what preconcerted adaptations, what multiplied evidences of intention, what signal proofs of beneficent design exist to

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attract our notice, to excite our curiosity, and to animate our inquiries. Splendid as are the monuments of divine power and wisdom displayed throughout the firmament, in objects fitted by their stupendous magnitude to impress the imagination and overpower us by their awful grandeur, not less impressive, nor less replete with wonder, are the manifestations of those attributes in the minuter portions of nature, which are more on a level with our senses, and more within the reach of our comprehension. The modern improvements of optical science, which have expanded our prospects into the more distant regions of the universe, have likewise brought within our range of vision the more diminutive objects of creation, and have revealed to us many of the secrets of their structure and arrangement. But, farther, our reason tells us that, from the infinite divisibility of space, there still exist worlds far removed from the cognizance of every human sense, however assisted by the utmost refinements of art; worlds occupied by the elementary corpuscles of matter, composing, by their various configurations, systems upon systems, and comprising endless diversities of motions, of complicated changes, and of widely extended series of causes and effects, destined for ever to remain invisible to human eyes, and inscrutable to human science.

Thus, in whatever field we pursue our in-

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quiries, we are sure to arrive at boundaries within which our powers are circumscribed. Infinity meets us in every direction, whether in the ascending or descending scale of magnitude; and we feel the impotence of our utmost efforts to fathom the depths of creation, or to form any adequate conception of that supreme and Dominant Intelligence, which comprehends the whole chain of being extending from that which is infinitely small to that which is infinitely great.

It is incumbent on us, before engaging in a study of such vast importance, and extending over so wide a field as that which lies before us, to examine with attention the nature of those processes of reasoning, by which we are conducted to the knowledge of the peculiar class of truths we are seeking. Such a preliminary inquiry is the more necessary, inasmuch as the investigation of these truths is beset with many formidable difficulties and liable to various sources of fallacy, which are not met with in the study of other departments of philosophy.

The proper objects of all human knowledge are the relations that exist among the phenomena of which the mind has cognizance. The phenomena of the universe may be viewed as connected with one another either by the relation of *cause* and *effect*, or by that of *means* and *end*; and accordingly these two classes of relations give

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rise to different kinds of knowledge, each of which requires to be investigated in a peculiar mode and by a different process of reasoning. The foundation of both these kinds of knowledge is, indeed, the same; namely, the constant uniformity which takes place in the succession of events, and which, when traced in particular classes of phenomena, constitutes what we metaphorically call the *Laws of Nature*. It is the province of philosophy, strictly so called, to discover the circumstances or laws which regulate this uniformity, and to arrange the observed changes according to their invariable antecedents, or *causes*: the unknown links by which these causes are connected with their respective consequents, or *effects*, being denominated the *powers of Nature*. With reference to phenomena which are purely mechanical, that is, to changes which consist in the sensible motions of material bodies, these powers are denominated *forces*; and the intensities, the operations, and the characters of these forces admit of exact definition, according to the qualities of the corresponding effects they produce. It is by pursuing the method of philosophical induction, so well explained by Bacon, that the physical sciences, which the misdirected efforts of former ages had failed to advance, have, within the last two centuries, been carried to a height of perfection

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which affords just grounds for exultation in the achievements of the human intellect.

In the investigation of the powers which are concerned in the phenomena of living beings we meet with difficulties incomparably greater than those that attend the discovery of the physical forces by which the parts of inanimate matter are actuated. The elements of the inorganic world are few and simple; the combinations they present are in most cases easily unravelled; and the powers which actuate their motions, or effect their union and their changes, are reducible to a small number of general laws, of which the results may, for the most part, be anticipated, and exactly determined by calculation. What law, for instance, can be more simple than that of gravitation, to which all material bodies, whatever be their size, figure, or other properties, and whatever be their relative positions, are equally subjected; and of which the observations of modern astronomers have rendered it probable that the influence extends to the remotest regions of space? The most undeviating regularity is exhibited in the motions of those stupendous planetary masses, which continually roll onwards in the orbits prescribed by this all-pervading force. Even the slightest perturbations occasioned by their mutual influence are but direct results of the same general

law, and are necessarily restrained within certain limits, which they never can exceed, and by which the permanence of the system is effectually secured. All the terrestrial changes dependent on these motions partake of the same constancy. The same periodic order governs the succession of day and night, the rise and fall of the tides, and the return of the seasons: which order, as far as we can perceive, is incapable of being disturbed by any existing cause.

Equally definite are the operations of the forces of cohesion, of elasticity, or of whatever other mechanical powers of attraction or repulsion there may be, which actuate, at insensible distances, the particles of matter. We see liquids, in obedience to these forces, collecting in spheroidal masses, or assuming, at their contact with solids, certain curvilinear forms, which are susceptible of precise mathematical determination. In different circumstances, again, we behold these particles suddenly changing their places, marshalling themselves in symmetric order, and constructing by their union solid crystals of determinate figure, having all their angles and facets shaped with mathematical exactness.

The forces by which dissimilar particles are united into a chemical compound have been termed *Chemical Affinities*; and the operation of these peculiar forces is as definite and determinable as the former. They are now known to be

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regulated by the law of definite proportions; a law, the discovery of which has conferred on Chemistry the same character of precision which appertains to the exact sciences, and which it had never before attained. The phenomena of Light, of Heat, of Electricity, and of Magnetism have been, in like manner, reduced to laws of sufficient simplicity to admit of the application of mathematical reasoning, and to furnish the accurate results derived from such application.

Thus to whatever department of physical science our researches have extended, we every where meet with the same regularity in the phenomena, the same simplicity in the laws, and the same uniformity in the results. All is strictly defined, and subjected to rigid rule: all is subordinate to one pervading principle of order. The great Creator of the universe has exercised in its construction the severest and most refined geometry, has traced with unerring precision the boundaries of all its parts, and has prescribed to each element and each power its respective sphere and limit.

Far different is the aspect of living Nature. The spectacle here offered to our view is every where characterised by boundless variety, by inscrutable complexity, by perpetual mutation. Our attention is solicited to a vast multiplicity of objects, curious and intricate in their mechanism,

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exhibiting peculiar movements, actuated by new and unknown powers, and gifted with high and refined endowments. In place of the simple combinations of elements, and the simple properties of mineral bodies, all organic structures, even the most minute, present exceedingly complicated arrangements, and a prolonged succession of phenomena, so varied and so anomalous, as to be utterly irreducible to the known laws which govern inanimate matter. Let us hasten, with fresh ardour, to explore this new world that here opens to our view.

Turning, then, from the examination of the passive objects of the material world, we now direct our attention to the busy theatre of animated existence, where scenes of wonder and enchantment are displayed in endless variety around us; where life in its ever-changing forms meets the eye in every region to which our researches can extend; and where every element and every clime is peopled by multitudinous races of sensitive beings, who have received from the bounteous hand of their Creator the gift of existence and the means of enjoyment. Our curiosity is powerfully excited by phenomena in which our own welfare is so intimately concerned, as are all those that relate to animal life; and we cannot but take a lively and sympathetic interest in the history of beings in many respects so analogous to ourselves like us possessing powers