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John Frederick William Herschel

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PRELIMINARY DISCOURSE
ON
THE STUDY
OF
NATURAL PHILOSOPHY.

PART I.

OF THE GENERAL NATURE AND ADVANTAGES OF
THE STUDY OF THE PHYSICAL SCIENCES.

CHAPTER I.

OF MAN REGARDED AS A CREATURE OF INSTINCT, OF
REASON, AND SPECULATION.—GENERAL INFLUENCE OF
SCIENTIFIC PURSUITS ON THE MIND.

(1.) **T**HE situation of man on the globe he inhabits, and over which he has obtained the control, is in many respects exceedingly remarkable. Compared with its other denizens, he seems, if we regard only his physical constitution, in almost every respect their inferior, and equally unprovided for the supply of his natural wants and his defence against the innumerable enemies which surround him. No other animal passes so large a portion of its existence in a

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state of absolute helplessness, or falls in old age into such protracted and lamentable imbecility. To no other warm-blooded animal has nature denied that indispensable covering without which the vicissitudes of a temperate and the rigours of a cold climate are equally insupportable; and to scarcely any has she been so sparing in external weapons, whether for attack or defence. Destitute alike of speed to avoid and of arms to repel the aggressions of his voracious foes; tenderly susceptible of atmospheric influences; and unfitted for the coarse aliments which the earth affords spontaneously during at least two thirds of the year, even in temperate climates, — man, if abandoned to mere instinct, would be of all creatures the most destitute and miserable. Distracted by terror and goaded by famine; driven to the most abject expedients for concealment from his enemies, and to the most cowardly devices for the seizure and destruction of his nobler prey, his existence would be one continued subterfuge or stratagem; — his dwelling would be in dens of the earth, in clefts of rocks, or in the hollows of trees; his food worms, and the lower reptiles, or such few and crude productions of the soil as his organs could be brought to assimilate, varied with occasional relics, mangled by more powerful beasts of prey, or contemned by their more pampered choice. Remarkable only for the absence of those powers and qualities which obtain for other animals a degree of security and respect, he would be disregarded by some, and hunted down by others, till after a few generations his species would become altogether extinct, or, at best, would be restricted to a few islands in tropical

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regions, where the warmth of the climate, the paucity of enemies, and the abundance of vegetable food, might permit it to linger.

(2.) Yet man is the undisputed lord of the creation. The strongest and fiercest of his fellow-creatures, — the whale, the elephant, the eagle, and the tiger,—are slaughtered by him to supply his most capricious wants, or tamed to do him service, or imprisoned to make him sport. The spoils of all nature are in daily requisition for his most common uses, yielded with more or less readiness, or wrested with reluctance, from the mine, the forest, the ocean, and the air. Such are the first fruits of reason. Were they the only or the principal ones, were the mere acquisition of power over the materials, and the less gifted animals which surround us, and the consequent increase of our external comforts, and our means of preservation and sensual enjoyment, the sum of the privileges which the possession of this faculty conferred, we should after all have little to plume ourselves upon. But this is so far from being the case, that every one who passes his life in tolerable ease and comfort, or rather whose whole time is not anxiously consumed in providing the absolute necessities of existence, is conscious of wants and cravings in which the senses have no part, of a series of pains and pleasures totally distinct in kind from any which the infliction of bodily misery or the gratification of bodily appetites has ever afforded him; and if he has experienced these pleasures and these pains in any degree of intensity, he will readily admit them to hold a much higher rank, and to deserve much more attention, than the former class. Independent of

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the pleasures of fancy and imagination, and social converse, man is constituted a speculative being ; he contemplates the world, and the objects around him, not with a passive, indifferent gaze, as a set of phenomena in which he has no further interest than as they affect his immediate situation, and can be rendered subservient to his comfort, but as a system disposed with order and design. He approves and feels the highest admiration for the harmony of its parts, the skill and efficiency of its contrivances. Some of these which he can best trace and understand he attempts to imitate, and finds that to a certain extent, though rudely and imperfectly, he can succeed, — in others, that although he can comprehend the nature of the contrivance, he is totally destitute of all means of imitation ; — while in others, again, and those evidently the most important, though he sees the effect produced, yet the means by which it is done are alike beyond his knowledge and his control. Thus he is led to the conception of a Power and an Intelligence superior to his own, and adequate to the production and maintenance of all that he sees in nature, — a Power and Intelligence to which he may well apply the term infinite, since he not only sees no actual limit to the instances in which they are manifested, but finds, on the contrary, that the farther he enquires, and the wider his sphere of observation extends, they continually open upon him in increasing abundance ; and that as the study of one prepares him to understand and appreciate another, refinement follows on refinement, wonder on wonder, till his faculties become bewildered in admiration, and his intellect

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falls back on itself in utter hopelessness of arriving at an end.

(3.) When from external objects he turns his view upon himself, on his own vital and intellectual faculties, he finds that he possesses a power of examining and analysing his own nature to a certain extent, but no farther. In his corporeal frame he is sensible of a power to communicate a certain moderate amount of motion to himself and other objects; that this power depends on his will, and that its exertion can be suspended or increased at pleasure within certain limits; but *how* his will acts on his limbs he has no consciousness: and whence he derives the power he thus exercises, there is nothing to assure him, however he may long to know. His senses, too, inform him of a multitude of particulars respecting the external world, and he perceives an apparatus by which impressions from without may be transmitted, as a sort of signals to the interior of his person, and ultimately to his brain, wherein he is obscurely sensible that the thinking, feeling, reasoning being he calls *himself*, more especially resides; but by what means he becomes conscious of these impressions, and what is the nature of the immediate communication between that inward sentient being, and that machinery, his outward man, he has not the slightest conception.

(4.) Again, when he contemplates still more attentively the thoughts, acts, and passions of this his sentient intelligent self, he finds, indeed, that he can remember, and by the aid of memory can compare and discriminate, can judge and resolve, and, above all, that he is irresistibly impelled, from

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the perception of any phenomenon without or within him, to infer the existence of something prior which stands to it in the relation of a *cause*, without which it would not be, and that this knowledge of causes and their consequences is what, in almost every instance, determines his choice and will, in cases where he is nevertheless conscious of perfect freedom to act or not to act. He finds, too, that it is in his power to acquire more or less knowledge of causes and effects according to the degree of attention he bestows upon them, which attention is again in great measure a voluntary act; and often when his choice has been decided on imperfect knowledge or insufficient attention, he finds reason to correct his judgment, though perhaps too late to influence his decision by after consideration. A world within him is thus opened to his intellectual view, abounding with phenomena and relations, and of the highest immediate interest. But while he cannot help perceiving that the insight he is enabled to obtain into this internal sphere of thought and feeling is in reality the source of all his power, the very fountain of his predominance over external nature, he yet feels himself capable of entering only very imperfectly into these recesses of his own bosom, and analysing the operations of his mind,—in this as in all other things, in short, “*a being darkly wise;*” seeing that all the longest life and most vigorous intellect can give him power to discover by his own research, or time to know by availing himself of that of others, serves only to place him on the very frontier of knowledge, and afford a distant glimpse of boundless realms beyond, where no human thought has penetrated, but which yet he is sure

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must be no less familiarly known to that Intelligence which he traces throughout creation than the most obvious truths which he himself daily applies to his most trifling purposes. Is it wonderful that a being so constituted should first encourage a hope, and by degrees acknowledge an assurance, that his intellectual existence will not terminate with the dissolution of his corporeal frame, but rather that in a future state of being, disencumbered of a thousand obstructions which his present situation throws in his way, endowed with acuter senses, and higher faculties, he shall drink deep at that fountain of beneficent wisdom for which the slight taste obtained on earth has given him so keen a relish?

(5.) Nothing, then, can be more unfounded than the objection which has been taken, *in limine*, by persons, well meaning perhaps, certainly narrow-minded, against the study of natural philosophy, and indeed against all science, — that it fosters in its cultivators an undue and overweening self-conceit, leads them to doubt the immortality of the soul, and to scoff at revealed religion. Its natural effect, we may confidently assert, on every well constituted mind is and must be the direct contrary. No doubt, the testimony of natural reason, on whatever exercised, must of necessity stop short of those truths which it is the object of revelation to make known; but, while it places the existence and principal attributes of a Deity on such grounds as to render doubt absurd and atheism ridiculous, it unquestionably opposes no natural or necessary obstacle to further progress: on the contrary, by cherishing as a vital principle an unbounded spirit of enquiry, and ardency of

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expectation, it unfetters the mind from prejudices of every kind, and leaves it open and free to every impression of a higher nature which it is susceptible of receiving, guarding only against enthusiasm and self-deception by a habit of strict investigation, but encouraging, rather than suppressing, every thing that can offer a prospect or a hope beyond the present obscure and unsatisfactory state. The character of the true philosopher is to hope all things not impossible, and to believe all things not unreasonable. He who has seen obscurities which appeared impenetrable in physical and mathematical science suddenly dispelled, and the most barren and unpromising fields of enquiry converted, as if by inspiration, into rich and inexhaustible springs of knowledge and power on a simple change of our point of view, or by merely bringing to bear on them some principle which it never occurred before to try, will surely be the very last to acquiesce in any dispiriting prospects of either the present or future destinies of mankind; while, on the other hand, the boundless views of intellectual and moral as well as material relations which open on him on all hands in the course of these pursuits, the knowledge of the trivial place he occupies in the scale of creation, and the sense continually pressed upon him of his own weakness and incapacity to suspend or modify the slightest movement of the vast machinery he sees in action around him, must effectually convince him that humility of pretension, no less than confidence of hope, is what best becomes his character.

(6.) But while we thus vindicate the study of natural philosophy from a charge at one time for-

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midable from the pertinacity and acrimony with which it was urged, and still occasionally brought forward to the distress and disgust of every well constituted mind, we must take care that the testimony afforded by science to religion, be its extent or value what it may, shall be at least independent, unbiassed, and spontaneous. We do not here allude to such reasoners as would make all nature bend to their narrow interpretations of obscure and difficult passages in the sacred writings : such a course might well become the persecutors of Galileo and the other bigots of the fifteenth and sixteenth centuries, but can only be adopted by dreamers in the present age. But, without going these lengths, it is no uncommon thing to find persons, earnestly attached to science and anxious for its promotion, who yet manifest a morbid sensibility on points of this kind, — who exult and applaud when any fact starts up explanatory (as they suppose) of some scriptural allusion, and who feel pained and disappointed when the general course of discovery in any department of science runs wide of the notions with which particular passages in the Bible may have impressed themselves. To persons of such a frame of mind it ought to suffice to remark, on the one hand, that truth can never be opposed to truth, and, on the other, that error is only to be effectually confounded by searching deep and tracing it to its source. Nevertheless, it were much to be wished that such persons, estimable and excellent as they for the most part are, before they throw the weight of their applause or discredit into the scale of scientific opinion on such grounds, would reflect, first, that the credit and respect-

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ability of *any* evidence may be destroyed by tampering with its *honesty*; and, secondly, that this very disposition of mind implies a lurking mistrust in its own principles, since the grand and indeed only character of truth is its capability of enduring the test of universal experience, and coming unchanged out of every possible form of *fair* discussion.

(7.) But if science may be vilified by representing it as opposed to religion, or trammelled by mistaken notions of the danger of free enquiry, there is yet another mode by which it may be degraded from its native dignity, and that is by placing it in the light of a mere appendage to and caterer for our pampered appetites. The question "*cui bono*" to what practical end and advantage do your researches tend? is one which the speculative philosopher who loves knowledge for its own sake, and enjoys, as a rational being should enjoy, the mere contemplation of harmonious and mutually dependent truths, can seldom hear without a sense of humiliation. He feels that there is a lofty and disinterested pleasure in his speculations which ought to exempt them from such questioning; communicating as they do to his own mind the purest happiness (after the exercise of the benevolent and moral feelings) of which human nature is susceptible, and tending to the injury of no one, he might surely allege *this* as a sufficient and direct reply to those who, having themselves little capacity, and less relish for intellectual pursuits, are constantly repeating upon him this enquiry. But if he can bring himself to descend from this high but fair ground, and justify