

the trouble of examining the chain of reasoning by which they have been obtained ; but, in order to do this, something beyond the mere elements of abstract science is required. Waving, however, such instances as these, which, after all, are rather calculated to surprise and astound, than for any other purpose, it must be observed that it is not possible to satisfy ourselves completely that we *have* arrived at a true statement of any law of nature, until, setting out from such statement, and making it a foundation of reasoning, we can show, by strict argument, that the facts observed must follow from it as necessary logical consequences, and *this* not vaguely and generally, but with all possible precision in time, place, weight, and measure.

(20.) To do this, however, as we shall presently see, requires, in many cases, a degree of knowledge of mathematics and geometry altogether unattainable by the generality of mankind, who have not the leisure, even if they all had the capacity, to enter into such inquiries, some of which are, indeed, of that degree of difficulty that they can be only successfully prosecuted by persons who devote to them their whole attention, and make them the serious business of their lives. But there is scarcely any person, of good ordinary understanding, however little exercised in abstract inquiries, who may not be readily made to comprehend at least the general train of reasoning by which any of the great truths of physics are deduced, and the essential bearings and connections of the several parts of natural philosophy. There are whole branches, too, and very extensive and important ones, to which mathematical reasoning has never been at all applied ; such as chemistry, geology, and natural history in general, and many others, in which it plays a very subordinate part, and of which the essential principles, and the grounds of application to useful purposes, may be perfectly well understood by a student who possesses no more mathematical knowledge than the rules of arithmetic ; so that no one need be deterred from the acquisition of knowledge, or even from active original research in such subjects, by a want of mathematical