

seasons. All these phenomena are found to be of four very distinguishable kinds or classes which have been called

Physical or Mechanical,
Chemical,
Vital or Biological, and
Mental or Psychological.

The simple phrases which describe the resemblances among them are called *General Truths, or Laws of Nature*. and as a body of knowledge, they constitute what is called *Science or Philosophy* in contradistinction to *Natural History*, already described. Now, as man cannot, independently of a supernatural revelation, learn anything but what respects either the momentary states, past or present, of himself and the objects around him, or the manner in which the states have changed. *Natural History and Science*, in the senses now explained, make up the sum of his knowledge of nature.

10. As an example of a general truth, or law of nature, we may take the physical law of *gravitation or attraction*, which declares that every particle of matter in the universe attracts and is attracted by every particle with a certain force varying in a certain manner with the distance.

1st. It may be observed that bodies in general, if raised from the earth and left unsupported, fall towards it with force called their weight. It has long been thought that flame, smoke, and certain vapors which, when free, ascend in the air, had positive *levity* as a property, the contrary of weight; but, after a time, it was discovered that these things were also substances having weight, but were immersed in an unseen atmospheric air which was *heavier* than they, and which, therefore, lifted them up as water lifts cork or oil. Thus a *resemblance* was detected where a *difference* had long been believed to exist. 2d. It is found that any contiguous, hanging bodies are drawn towards each other so as not to hang quite perpendicular, and that a plummet suspended near a hill is drawn towards the hill with force less than that with which it is drawn towards the earth, but in exact accordance with what should follow from the different sizes of the hill and earth, and the difference of distance of the plummet from the respective centres of the two. It is thus proved that weight itself is only an instance of a mutual attraction operating among all the constituent elements of the globe, and which explains, moreover, the fact of the rotundity of the globe, all the parts being drawn to a common centre, as also the form of dew-drops, rain-drops, globules of mercury and of many other such things. 3d. It is observed that all the heavenly bodies are round, as if formed of material obeying the same law. And, lastly, that these bodies, however distant, attract each other, for the tides of our ocean rise in obedience to the attraction of the moon, and become *high or spring-tides* when the moon and sun operate in the same direction. Thus the sublime truth has become evident, of which the sufficient proofs were first detected and arranged by the genius of the immortal Newton, that there is a power of attraction, called weight while acting on earth, and there maintaining a stable order among things generally, but which connects together also the distant bodies of this solar system, and probably as limited only by the bounds of the universe.

11. The process of comparing the facts or phenomena learned by observation and experiment, so as to extract from them the general circumstances in which they resemble, is called the method of reasoning by *induction*, because numerous single facts are brought together for examination and comparison; and the expression for such circumstances discovered with respect to them all,

is termed the truth, or scientific principle under which they are to be classed. Lord Bacon very clearly described the process. Progress in this kind of knowledge has been slow, owing to the great complexity of many ordinary phenomena, arising from several laws acting together and with great variety of combination. All the reasonings proceed on the assumption, early suggested, and afterwards confirmed by universal experience, that the *course of nature* remains uniform, and that what has happened once under given circumstances. The knowledge of these so-called laws enables an instructed man, when he witnesses some facts forming part of a known series, to announce what the state of things will be at any future time, and what it must have been in times past. Thus, by understanding the movements of the heavenly bodies, he foretells their positions at any future time so accurately that he publishes in the almanacs, without fear of errors, his prediction of the very moment of any coming eclipse. Even the wind and the rain, which in common speech are referred to as types of uncertainty and change, obey laws as fixed as those of the sun and moon; and already as regards many parts of the earth, man can foretell them with certainty; he plans his voyages to suit the coming monsoons, and he prepares against the floods of the rainy seasons. He can similarly judge of other future events belonging to the other departments of nature.

12. The *phenomena or changes* of nature when thus reviewed by the human mind, according to their resemblances, fall as naturally into the four scientific classes named above as the *things* of nature fall into the classes of natural history; and it will not further appear that the mind, to acquire complete acquaintance with phenomena, must study the classes in a certain order, which is that both of their mutual dependence and of their simplicity in relation to man's power of apprehension.

13. (2.) *Physics* (called also *Natural or Mechanical Philosophy*). The numerous changes among things which would first attract common notice and become objects of study, are those in which motions very evident to the senses occur. Such are the motions of all bodies falling directly or rolling down slopes; of currents of water and air, and of bodies carried by such currents; of bodies thrown or projected by any force; of machines, as water-mills, wind-mills; of carriages on railways; of the heavenly bodies, and so forth. All these are called *physical or mechanical motions*. Now, all these are explained by a very few general expressions or laws called since Newton's time, the laws of motion, and which are fully elucidated under the four words, *atom or material, particle, attraction, repulsion, and inertia*. It gives a striking idea of the nature and value of methodical science, to be told that a person who understands aright these words—viz: how the imperishable particles of matter, by mutual *attraction*, approach and cling together to form masses which are solid, liquid, or æreiform, according to the quantity or strength of the *repulsion*, of heat remaining among them, owing to their *vis inertie* acquire and lose motion in exact proportion to the force of attraction or repulsion acting on them—understands a great proportion of the phenomena of nature; but such is the fact. *Solid* bodies, existing in conformity with these truths exhibit all the phenomena of *mechanics*; liquids exhibit those of *hydrostatics* and *hydraulics*; airs, those of *pneumatics*, and so forth.

14. (2.) *Chemistry*—Another set of changes or phenomena, more tranquil in their nature, soon attract attention, such as the rusting of iron exposed to the weather,