moving particles of matter or ions. At the end of the 19th century these ideas were extended, chiefly by the labours of J. J. Thomson, to elucidate also the conduction of electricity through gases. In 1897 Thomson discovered that, in certain cases, the moving particles which carried the electric current were of much smaller mass than the smallest chemical atom, that of hydrogen, and that these minute particles, to which he gave the name of corpuscles, were identical from whatever substance they were obtained. They enter into the structure of all matter, and form a common constituent of all chemical atoms. The only known properties of these corpuscles are their mass and their electric charge. Now, a charged body when set in motion spreads electromagnetic energy into the surrounding medium. Thus, more force is needed to produce a given acceleration than if the body were uncharged. The body acts as though its mass were greater than when it is uncharged. Now there is reason to believe that the whole apparent mass of the minute corpuscles to which we have referred is an effect of their electric charge. The idea of a material particle thus disappears with that of material mass, and the corpuscle becomes an isolated unit of electricity— an electron. It is impossible to resist making the speculation that the whole of an atom is made up of electrons, and that mass is to be explained in terms of electricity, though it must be pointed out that there is no conclusive evidence in favour of this hypothesis.

Another train of reasoning, starting from a different point, reinforces this result. The phenomena of the interference of beams of light in certain circumstances, to produce darkness or colour, indicate that light is some form of wave motion, and, to carry these waves, a hypothetical luminiferous aether was invented. The theoretical work of J. Clerk Maxwell (1831-1879) and the experiments of H. R. Hertz (1857-1894) showed that the properties and velocity of propagation of light and of electro- magnetic waves were identical and that their other properties differed only in degree. Thus light became an electromagnetic phenomenon. But light is started by some form of atomic vibra­tion, and to start an electromagnetic wave requires a moving electric charge. Thus electric charges must exist within the atom, and we are led again to the theory of electrons by the road opened up by H. A. Lorentz and Joseph Larmor. Such a theory suggests the occasional instability of the atom, and the phenomena of radioactivity, shown in a remarkable form by the substance radium, discovered by M. and Mme. Curie, have been explained satisfactorily by the theory of E. Rutherford and F. Soddy, who regard the energy liberated as due to the disintegration of the atom. The evolutionary view of nature, established in the biological and sociological sciences, is thus extended to physical science, not only in the development of planets and suns, but even in the chemical atoms, hitherto believed indestructible and eternal.

As we have seen, Francis Bacon described a new method of discovery in which exclusive attention was paid to the collection and tabulation of facts, with a view to the detection of relations between them, and the consequent reference of “ effects ” to their proper “ causes.” Impressed by the barrenness of the a priori methods of the Schoolmen,

Bacon in his philosophy went to the other extreme. The use of the Baconian method in its purity would be too laborious for success. Some guide is necessary in the collection of facts at an early stage of our investigations. Here the scientific imagination is brought into play, and some hypothesis is framed to explain the phenomena under investigation. The hypothesis may be suggested by the theories which are accepted at the time in cognate branches of knowledge, or it may be suggested by the few isolated facts already known or just discovered in the phenomena to be considered. From this new hypothesis, consequences are deduced by processes of logical reasoning—consequences which may be put to the test by comparison with the results of observation or experiment. If agreement is found, the hypo­thesis is, so far, confirmed, and gains in authority with every fresh concordance discovered. If the deductions from the hypothesis do not agree with the accepted interpretation of facts, the

hypothesis may need modification, it may have to be abandoned altogether, or the want of concordance may point to some erroror inconsistency in the fundamental concepts on which the hypothesis is based—the whole framework of that branch of science may need revision, as the idea of heat as a caloric sub­stance had to be abandoned under the pressure of the experiments of Joule on the equivalence between work done and heat developed. But the ultimate test of the validity of our know­ledge can only be the consistency with each other of the parts of the whole scheme. If the received interpretation of one set of phenomena is not consistent with that of another, one or other or both of the interpretations must be wrong if we make the assumption necessary for all knowledge, namely, that the universe is intelligible to a mind capable of dealing with its complexity.

In early times, when the knowledge of nature was small, little attempt was made to divide science into parts, and men of science did not specialize. Aristotle was a master of all science known in his day, and wrote indifferently treatises on physics or animals. As increasing knowledge made it impossible for any one man to grasp all scientific subjects, lines of division were drawn for convenience of study and of teaching. Besides the broad distinction into physical and biological science, minute subdivisions arose, and, at a certain stage of development, much attention was given to methods of classification, and much emphasis laid on the results, which were thought to have a significance beyond that of the mere convenience of mankind.

But we have reached the stage when the different streams of knowledge, followed by the different sciences, are coalescing, and the artificial barriers raised by calling those sciences by different names are breaking down. Geology uses the methods and data of physics, chemistry and biology; no one can say whether the science of radioactivity is to be classed as chemistry or physics, or whether sociology is properly grouped with biology or economics. Indeed, it is often just where this coalescence of two subjects occurs, when some connecting channel between them is opened suddenly, that the most striking advances in knowledge take place. The accumulated experience of one de­partment of science, and the special methods which have been developed to deal with its problems, become suddenly available in the domain of another department, and many questions insoluble before may find answers in the new light cast upon them. Such considerations show us that science is in reality one, though we may agree to look on it now from one side and now from another as we approach it from the standpoint of physics, physiology or psychology.

Having traced the development of the most important of the fundamental conceptions of science, and followed the subdivision of natural knowledge into the various sections which for convenience mankind has made, let us now examine the meaning of the knowledge thus acquired, and its relation to other branches of learning.

By the slow and laborious methods of observation, hypothesis, deduction, and experimental verification, a scheme has been constructed which for the most part is consistent with itself, and bears the test of the comparison of one part with another. As a chart is drawn by the explorer of unknown seas to represent his discoveries in a conventional manner, so the scientific in- vestigator constructs a mental model of the phenomena he observes, and tests its consistency with itself and its concordance with the results of further experiment. The chart does not give a lifelike picture of the coast as does a painting, but it represents one aspect of it conventionally in a manner best adapted for the immediate purpose. So the conceptions of one branch of science- mechanics let us say—represent the phenomena of nature in the conventional aspect best suited for one particular line of inquiry. It does not follow necessarily that “ nature ’’in reality resembles the particular mental chart which mechanical science enables us to construct. It docs not even follow that there is any “ reality ” underlying phenomena and corresponding with any of our con- ceptions. The whole problem which mankind has to face