



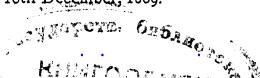
Presidential Address to the Liverpool Physical Society.*

BY PROFESSOR OLIVER LODGE, D.SC., LL.D., F.R.S.

WE meet here as a working society of members, all alike interested in physical science and willing to study seriously the enormous groups of phenomena which that term covers. Our subject is a most enticing one, but it is alarmingly huge. No man can pretend to be equally familiar with all parts of it, and with all its border sciences. Yet, to be a complete physicist, that is what is demanded. As the German proverb says, *Ein Physiker muss Alles kennen*, and the hopeless impossibility of satisfying such a demand ought to brace us to fresh effort rather than to unnerve us with slackened energies. Such a demand, moreover, has the happy equalising effect of the theological doctrine of original sin and free grace: it makes us all alike incompetent and unworthy; and since no man is able to proclaim himself a complete *Physicist*, every man who takes up and works at one corner of it may hope for some result from his labours, if he pursues them in a patient and candid and undogmatic spirit.

With those persons—paradoxers, as De Morgan called them—who, on the strength of a few ill-considered notions, propose to reconstruct the universe, and to flout their conceited ignorance in the face of the great searchers after truth of all eras: with them, I was going to say, we have no patience. But patience one does have with them nevertheless, for they are frequently unhappy and misguided men, not without a certain ability, possessors often of a very enviable energy; men who, if rightly self-directed, might have accomplished something, but who, by reason of some trivial crank, continue all their lives to batter themselves fruitlessly against the hard wall of opposing fact, flattering themselves that they are attacking a malicious combination of unprincipled scientists, banded together in league against them.

* Delivered at the Inaugural Meeting held at University College, Liverpool, on 16th December, 1889.



Such are the men who say that the earth is flat, that electricity and heat are identical, that water is a form of energy, that the circumference of a circle is commensurably related to the diameter, and so on. Men, again, who assert that they have discovered a new force, and that the nature of electricity has revealed itself to them, after reading some 3s. 6d. text-book on the subject.

Such persons should be informed that what they have found in an elementary text book is but the A B C of the subject, and for them to presume to have a first-hand opinion on it is as absurd as if a person who had read nothing but a few pages of English Grammar, should propound opinions on English literature, and write an essay on the works of (say) Mr. Browning.

Not such, however, are the men who ever advance science. The unprofessional workers are patient humble men, who grope their way, occasionally by means of mathematics, more often by means of experiment; searching diligently and recording their results, guided by instinct often more than by knowledge, knowing indeed it may be very little, and making many mistakes, but perseveringly amending their methods and devising fresh ingenuities of attack. To some of these it is occasionally given to discover secrets hidden from the wise and prudent.

A trained mechanician, for instance, has immense advantages in the command of tools and weapons of investigation. Such workers have often a deftess of hand, a keenness of eye, and a delicacy of touch, which those who have had more time and opportunity for study have good cause to envy. And their very lack of a wide outlook, by leaving them leisure and will to concentrate attention on one small corner of the field, may result in their detecting treasure unsuspected by the man of broader view.

Continually it has to be noticed that the most novel and surprising facts are discovered, not by the man of learning, who is apt to be over-weighted by his stores of information and to move rather cumbrously in unexplored territory, but by the light skirmisher or adventurous explorer, who penetrates with apparently inadequate equipment into wilds and thickets regarded as scarcely penetrable by the more completely panoplied general of modern science.

In the region of the known there is no comparison. On civilised soil the batallions of von Moltke would sweep away a few hardy volunteers; but in the wilds of South Africa, or the upper stretches of the Nile, advantage not infrequently lies with the Zulu or Arab enthusiast.

Such guerilla warriors it is, I imagine, the business of this society to gradually discover and bring together, so as to aid each other as far as may be by mutual encouragement and occasional timely advice.

How many there may be of such workers, *in esse* or *in posse*, in and round Liverpool I have as yet no means of knowing.

Of microscopists, and astronomers, and workers in biology and its allied sciences, there is a fair supply ; the workers in physics at present known to me are few. The interest shewn in the formation of this society, however, and the rapidity with which members have joined, are very encouraging facts, and I hope that we shall soon settle down to quiet and useful co-operation in physics, as well as in the other sciences so effectively represented by societies in this city.

As a beginning I propose, first of all, to bring forward a Classification of the Sciences with which I was rather pleased when it occurred to me some time back while walking down Prince's Road. I doubt not that it is very open to criticism, but there are some useful points in it as indicating the bearing of the main sciences on each other.

The idea running down the main trunk is that of "explanation." What do we mean when we say that a fact or phenomenon is "explained?" We never mean *ultimately* explained. To ultimately and completely explain the most seeming-trivial fact demands, I expect, omniscience. No, we only mean carried one step from the more unknown to the less unknown. The derivation suggests carried one step from the rugged to the smooth—flattened out, as it were; more precisely expressed, carried one step from the unfamiliar to the familiar. If we can relegate a puzzling fact to a category we have grown accustomed to we think we know something about it, and we say "it is explained."

Thus, for instance, Physics is explained by Mechanics. The aim of the Physicist is to reduce an obscure physical fact to simple mechanics, and when he has done this the fact is considered to be understood. So, also, the Chemist deals with phenomena which he seeks to explain by heat, electricity, dissociation, and the like. Any explanation of the force of chemical affinity, for instance, must be through Physics and Mechanics, hence we may say that Chemistry tends to be reduced to Physics as it becomes better known. Likewise, the science which I have called Physiology, but which might equally well be called Biology, except that the latter term is too wide, and embrace the whole upper group, as the old term Natural Philosophy embraced the whole lower group. This science of Physiology seeks to explain itself by help of Chemistry, and if the processes going on in brain and muscle and nerve in alimentation and secretion can be expressed in exact chemical language, they are, so far as physiology is concerned, explained. Lastly, the science of mind, or Psychology, whether the operations of thought are capable of being expressed in terms of brain processes, *i.e.*, of being reduced to Physiology, which is, at all events the present aim of Psychologists. The attempt may end in failure or in success, but the only way to find out how far anything can be done in that direction is to make the attempt ; to experiment physiologically, to localise the functions of the brain, and to have all the hidden connexion between definite physiological changes and the corresponding mental operations.