Monday, 20th December 1858.

Professor CHRISTISON, V.P., in the Chair.

The following Communications were read :—

1. On the First Properties of Matter—Inertia, Gravitation, Elasticity—referred to a common Law. By John G. Macvicar, D.D. Communicated by Professor Fraser.

The author commences by a vindication of the Scottish philosophy, that he may legitimately build upon *substance* as a reality as well as *phenomenon*. He then shows that just as the idea of substance presents, *a priori*, an alternative, viz., those which are wholly fixed, the subject of law imposed from without only, and those which possess a power of changing their mode of being from within themselves; so, in point of fact, common observation has recognised in all ages two orders of substances or beings characterized by this difference, and filling up in the sphere of reality this alternative given by pure thought; the one being the ground of all natural phenomena, and ordinarily designated *body*; the other the ground of all moral and intellectual phenomena, and designated *spirit*.

Of Body the most characteristic properties are inertia, gravitation, and elasticity; and these are still regarded in science merely as postulates, and that, unrelated to each other except as properties inhering in the same subject; just as heat, electricity, magnetism, and chemical affinity were some years ago. It is the attempt to show the homogeneity of this group of properties, and to account for them, that has given its title to this communication.

For this purpose the author lays hold of *The Law of Assimilation*, already admitted in physiology; he shows that it operates in nature far more extensively than is generally supposed; in fact, he affirms that it is universal, and the only law of nature that needs to be considered by us for the explanation of phenomena. This law, when thus conceived in its utmost generality, he thus expresses:—"Everything *tends* to assimilate itself to itself in successive moments of its existence; and *extends* this action to all things around to unknown distances, assimilating them also more or less to itself, meanwhile being of course more or less assimilated to

them in its turn." And hence, all through nature, at once the permanence and intransmutability of species, whether organized or molecular, and the construction of these species into genera or groups into which the same type enters.

His first application of this law is to show the genesis of inertia. Thus, let any portion or particle of substance considered merely as such be subject to this law alone, it follows, that in its relations both to space and time, that portion or particle must assimilate itself to itself in every successive moment; that is, if it be at rest it must continue at rest, and if it be in motion it must, in every successive moment, accomplish the same element of motion which it accomplished in the first; whence it is obvious that its motion must be uniform and rectilinear, and must continue so till it be changed from without. But this is simply a definition of inertia, whose genesis thus appears.

Similarly he shows, that if the portion or particle of substance be considered, not in reference to its *matter* but its *form*, it must, under the law of assimilation, tend to maintain its true volume and form, and, to restore it when it has been disturbed—it must be resilient and elastic.

Again, let there be two or more particles or masses (each and all of which must thus be inert, and in their last elements elastic also), and let them be placed in different regions of space; it follows, that though as to inertia and elasticity they are identical already, and the law of assimilation has exhausted itself upon them as substances and forms, yet they are not assimilated as to the spaces they occupy. This, therefore, the law of assimilation must tend to effect. Under this law they must tend towards one place. Moreover, in being assimilated as to place, they must also be assimilated as to time. In a word, they must tend to move, and that simultaneously, towards one another, each assimilating the other as to the place which it occupies, or attracting it with a force proportional to itself (its quantity of substance, mass, or inertia). Nor is it merely the fact of mutual attraction that follows from the law of assimilation, but also the law of that attraction. Thus, considered as an attractive apparatus, it must be conceived as investing in a spherical manner the attracting particle. Now, the law of assimilation requires, with respect to such a spherical investiture, that all the successive spherical shells or superficies, of which the entire sphere of attraction may be conceived to consist, must in attractive value be assimilated to each other; that is, they must all be

equal to each other. But in quantity or extent they vary as the squares of their distances from the centre. Estimated, therefore, not as to the entire superficies, but along any line or radius, the attractive force must vary inversely as the square of the distance or radius; which is the well-known law of gravitation. Thus the genesis at once of inertia, elasticity, and gravitation is given. They are shown to be homogeneous in their nature, and not occult properties inhering in matter, but merely uniform phenomena arising from the operation in different circumstances of one and the same law.

The author then proceeds to show, that the law of assimilation also gives a definite conception as to the structure of least parts of matter in the last analysis which nature appears to permit or accomplish. He is thus led to infer the existence of an universal ether or medium of light. And from this, to the molecules of bodies, he thinks that a transition may be made, by regarding the latter as products of the former; the ethereal elements being definitely grouped into molecules; which, under the law of assimilation, must be symmetrical, and permanent or intransmutable (except in long epochs), as also ever bent on union with one another, wherever there is a difference between them; and their union would not occasion too great a degradation of the symmetry which each possessed when existing separately.

2. On the Structure and Functions of the Branchial Sac of the Simple Ascidia. By Andrew Murray, Esq.

The chief portion of this paper is occupied with an inquiry into the truth of Milne Edwards' theory, that the branchial sac of the Ascidians is perforated throughout by apertures, or what he called branchial stigmata.

Some experiments and observations made by Mr Murray last season had induced him to regard this view with doubt. In considering the question, he first examined the evidence that was recorded in support of it. Putting aside those writers who had taken M. Edwards' theory on trust, he could only find four observers who seem to have critically tested it, viz.,—Dr Lister, with whom the idea originated: who, while stating that the walls of the sac appeared to be traversed by open spaces, yet states that at times he thought he saw something like a veil stretching across them, and that the particles in suspension in