The most general conceivable thermo-electric relations of a crystalline solid, or body possessing, inductively or structurally, different physical properties in different directions, are next examined. It is shown how a metallic structure may be actually made up of pieces of different non-crystalline metals, which, taken on a large scale compared with the dimensions of the heterogeneous elements of which it is composed, will be found to exhibit the most general type of thermo-electric directional relations indicated by the abstract investigation; and it is inferred that it would be wrong to limit the general expressions by any particular assumption, even if we only discover simpler types of thermo-electric relations in natural crystals.

The general equations determining the thermo-electric currents in any naturally, inductively, or structurally crystalline solid; resulting either from a completely specified distribution of temperature through it; or from given external appliances of heat, on which, and on the thermo-electric currents themselves, the distribution of heat through the interior will depend; are investigated.

Certain particular applications of the general equations are also made; and the thermo-electric properties of metallic structures (laid before the Society as solids actually possessing the properties referred to), are investigated.

The paper in which this extension of the theory is described, includes a more developed account of the theory of thermo-electric currents in non-crystalline conductors, formerly communicated, than has been hitherto printed; with a simplification in the fundamental equations introduced without hypothesis, by the adoption of a thermometric assumption proposed as the foundation of an absolute scale of temperature, in consequence of thermo-dynamic experiments on air recently made by Mr Joule and the author. It also includes a brief outline of some experimental investigations undertaken to answer questions proposed in the former theoretical communication, and suggested by various considerations which occurred in the course of the research, and by the new part of the theory now communicated to the Royal Society.

7. On the Structure of Diatomacea. By E. W. Dallas, Esq.

The author directed attention to the following list of species, which, although imperfect, exhibits great variety in the forms, shewing the Medway to be very fertile in these organisms:

Epithemia Musculus.	Nitzschia sigmoidea.
Campylodiscus cribrus.	„ dubia.
Surirella striatula.	„ reversa.
„ linearis.	And an undetermined species.
Tryblionella marginata.	Navicula elliptica.
Tryblionella Scutellum.	Navicula convexa.
„ punctata.	„ Westii (?)
„ gracilis.	„ didyma,
„ acuminata.	„ pusilla.
Cymatopleura elliptica.	„ punctulata.
Triceratium Favus.	„ palpebralis.
„ striolatum.	Pinnularia divergens.
„ undulatum.	Stauroneis pulchella.
Cyclotella Kutzingiana.	Cocconeis parvum.
„ operculata.	Pleurosigma balticum.
And three species undetermined.	„ Hippocampus.
Actinocyclus undulatus.	„ angulatum.
Actinoptychus senarius.	„ acuminatum.
„ septenarius.	„ distortum.
„ octonarius.	Doryphora Amphicerus, vars.
„ nonarius.	„ Boeckii.
Eupodiscus Argus, 2 vars.	Achnanthes brevipes.
„ radiatus.	Grammatophora marina (?)
„ maculatus.	Biddulphia aurita.
Coccinodiscus radiatus.	Zygoceros rhombus.
„ minor.	Denticella sp.
„ eccentricus.	Orthoseira sp.
„ Thwaitesii.	Dictyocha.
And an undetermined species.	Bacteriastrum furcatum (?)
Cocconeis Pediculus.	„ curvatum (?)
„ Scutellum.	

Some of the species in this list have been described as new to Britain by Mr Roper, in a late paper published in the Microscopical Journal. The *Coccinodiscus*, not named, seems from the description to be the same with that found at the mouth of the Thames, and is an exceedingly beautiful disc. The four species of *Actinoptychus* are those described by Ehrenberg, and are new British species. They exhibit the strong siliceous cellular tissue underneath the moniliform structure of the surface, as in *Actinocyclus*. The examples of *Triceratium striolatum*, and also *Zygoceros rhombus*, differed somewhat from the figures and descriptions given of them, being provided with spines along the side, and with two spines placed close to the projecting terminations or angles of the valve, and which were always present in the examples that had come under observation. The surfaces of the valves were also seen to be dotted over with small nodules, giving them a very remarkable appearance, and which might be seen to project from the surface when the valve was suitably placed; these appearances might be attributable to a more mature developing of the siliceous structure.

Among the remarkable forms found, although not considered to belong to the Diatomaceæ, are the two varieties of *Bacteriastrum*, the discs of which, it may be observed, were three or four times the diameter of those described by Mr Shadbolt, from Port Natal, and the radiations more numerous.

Attention was directed to the structure of the Diatomaceæ as affording some of the most beautiful examples of geometric arrangement with which we are acquainted. It was pointed out that there are only three of the regular polygons that can be employed alone to fill up the space about a point in a plane surface, namely, the equilateral triangle, the square, and the hexagon; these forms and their angles are accordingly found to prevail in the structure of the tissues. By constructing the polygons, it was shewn that they arranged themselves in straight lines, determined by the shorter axis of the figures, the quadrilaterals having two directions in which the lines run, and the hexagons three. With the hexagonal structure, when one set of the lines passing through the axis is referred to a centre, the cells then appear to radiate in straight lines from the centre, while the other two directions in which they appear to run will be spiral lines, having a definite character according to the size of the cells. Much of the character of the tissue depends on the position of the axis of the polygon with respect to an axis of the valve,—that is, whether the longer or shorter axis is parallel to it. Mr Smith in his Synopsis has noticed this peculiarity, and in accordance with it has divided his genus *Pleurosigma* into two sections.

The above arrangements will be found to prevail in the structures of the tissues of the valves, and the influence of the living principle might generally be seen in the repetition of like spaces about a centre in each species, and always in the same numerical relations in each individual of the species, multiples of the numbers 2, 3, and 5, and also 7, seeming to prevail.

These divisions are seen very conspicuously in *Actinocyclus* and *Actinoptychus*. In the large species of *Coscinodiscus*, the number of sectors appeared to be twelve, from the groups of rows at the centre, and in it was shewn the very beautiful arrangement of the cells in radiating and intersecting spiral lines. *Eupodiscus Ralfsii* was referred to as affording an example of the division of the circle into sectors, within which the lines of cells are arranged symmetrically on each side of a single radiating row, to which the rest are

all parallel. In *Eupodiscus maculatus*, the disc is divided into ten, but the rows of cells do not converge towards the centre, except one at the side of each sector, to which the others are parallel. From this may be derived the very beautiful and peculiar construction of the *Coscinodiscus eccentricus*, in which the disc is divided into seven sectors, the rows of cells extending across the valve from each sector to meet similar rows from the second sector beyond.

The following Donations to the Library were announced :—

Archives du Muséum d'Histoire Naturelle. Publiées par les Professeurs de cet établissement. Tome VII., Liv. 1 & 2. 4to.
—*From the Museum.*

Actuarial Tables ; Carlisle Three-per-Cent. Single Lives and Single Deaths. With Auxiliary Tables. By William Thomas Thomson, F.R.S.E., F.I.A. 4to.—*From the Author.*

On the application of Cast and Wrought Iron for Building Purposes. By William Fairbairn, C.E. 8vo.—*From the Author.*

Jahrbuch der Kaiserlich Königlich Geologischen Reichsanstalt. 1853. IV. Jahrgang. 8vo.—*From the Institute.*

Denkschriften der Kaiserlichen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe. Band VI. 4to.

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe. Band XI. 8vo.
—*From the Academy.*

Mémoires de l'Académie des Sciences de l'Institut de France. Tome XXIV. 4to.—*From the Academy.*

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Memoirs of the Geological Survey of Great Britain, and of the Museum of Practical Geology in London. Vol. II. Pts. 1 & 2. 8vo.

Museum of Practical Geology and Geological Survey. Records of the School of Mines and of Science applied to the Arts. Parts 1, 2, 3, 4. 8vo. (With various Maps and Pamphlets.)
—*From H. M. Government.*

Journal of the Geological Society of Dublin. Vol. VI., Part 1. 8vo.—*From the Society.*

The Assurance Magazine, and Journal of the Institute of Actuaries. Vol. IV., Part 3. 8vo.—*From the Institute.*

- The American Journal of Science and Arts. Vol. XVII., No. 50.
8vo.—*From the Editors.*
- Comptes Rendus hebdomadaires des Séances de l'Académie des
Sciences. Mai 1853–Mai 1854. 4to.—*From the Academy.*
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XIII. 4to.—*From the Academy.*
- Bulletins de la Société de Géographie. Tome V. 8vo.—*From the
Society.*
- Annales de l'Agriculture et de l'Industrie de Lyon. Tome III.
8vo.—*From the Society.*
- Annales de l'Observatoire Physique Central de Russie. 1851. 2
Tomes, 4to.—*From the Observatory.*
- Journal of the Horticultural Society of London. Vol. VIII., Part
4. 8vo.—*From the Society.*