If we take the differences between 1 and 4, 2 and 5, 3 and 6, we get the following four sets of values for *a*, *b*, *c*, and *d*.

	P.			Q.
Difference between	*a.*	*b.*	*c.*	*d.*
1 and 4	212	211	210	212
2 and 5	211	211	212	212
3 and 6	211	212	212	212
	634	634	634	636

Mean = 634·5.

$$i = \frac{634{\cdot}5}{6 \times 3} = 35{\cdot}25, \quad \mu = 1{\cdot}733.$$

From the results given above it would appear that the index of refraction of sulphur is very near 1·73.

The method adopted thus seems to be capable of giving accurate results; no large quantity of material is required. The method is also well suited for liquids.

The determination of the indices of other solids and liquids are in progress. I shall give an account of these in a future communication.

II. "Researches on the Structure, Organisation, and Classification of the Fossil Reptilia. Part X. On the complete Skeleton of an Anomodont Reptile (*Aristodesmus Rütimeyeri*, Wiedersheim), from the Bunter Sandstone of Reihen, near Basel, giving new Evidence of the Relation of the Anomodontia to the Monotremata." By H. G. Seeley, F.R.S. Received November 7, 1895.

(Abstract.)

With the co-operation of the Trustees of the University Museum of Basel and Professor Rütimeyer, the author has examined the fossil described by Dr. Robert Wiedersheim in 1878 as *Labyrinthodon Rütimeyeri*. The bones are differently interpreted:—

The reputed humerus is the interclavicle.
The reputed scapula is the humerus.
The reputed supra-scapula is the left coracoid.
The reputed supra-scapula is the right scapula.
The reputed right and left coracoids are the pre-coracoid and coracoid of the right side.
The reputed clavicles are the ribs.

Five digits are identified in place of four in 1878.

These osteological identifications are inconsistent with reference of the type to the Labyrinthodontia. The author also examines the relation of the Labyrinthodont type to existing Amphibia, and regards the Labyrinthodont osteology as demonstrating closer relationship with Ichthyosauria and Anomodontia. The group is therefore regarded as reptilian, forming a branchiate division of the class.

The fossil is referred to a new genus—*Aristodesmus*. It is identified as an Anomodont reptile chiefly on the basis of resemblances to *Procolophon* and *Pareiasaurus*. It is shown not to be a mammal by the large parietal foramen, the composite structure of the lower jaw, and presence of the pre-frontal bone. It, however, differs from known Anomodonts in making a somewhat closer approximation to Monotreme mammals than has hitherto been evident, and this correspondence extends to successive segments of both the fore and hind limbs.

The teeth are in sockets placed obliquely, with conical crowns compressed to sharp lateral margins, and curved inward. The proportions of the vertebral column are those of *Echidna*, though the transverse processes are longer, as in *Pareiasaurus*. The ribs are like those of a Monotreme, though the sacral ribs are longer. The shoulder girdle resembles that of *Procolophon*, and differs from all other Anomodonts in the constituent bones being unanchylosed, and in the precoracoid having a large anterior extension in advance of the scapula. The sternum appears to have been unossified as in Crocodilia. The humerus is widely expanded at both extremities and twisted, but does not show the peculiar lateral curvature seen in Monotremes. The ulna gives no evidence of an olecranon process; it is larger than the radius, and appears to articulate with the humerus. The pelvic bones are without acetabular or obturator perforations, are not anchylosed together, and the ilium is not expanded transversely. The hind limb is no larger than the fore limb. The femur is more slender than the bone in *Echidna*. The fibula is prolonged proximally beyond the stout tibia, round which it may rotate. The proximal row of the tarsus is one large bone, formed of the blended astragalus and os calcis.

In conclusion, the author argues that the points of structure are so few in which Monotreme mammals make a closer approximation to the higher mammals than is seen in this fossil and other Anomodontia, that the Monotreme resemblances to fossil reptiles become increased in importance. He believes that a group *Theropsida* might be made to include Monotremata and Anomodontia, the principal differences (other than those of the skull) being that monotremes preserve the marsupial bones, the atlas vertebra, and certain cranial sutures. *Ornithorhynchus* shows pre-frontal and post-frontal bones, and has the malar arch formed as in Anomodonts.

Aristodesmus, which suggests this link, is at present placed in the Procolophonia, a group separated from its recent association with *Pareiasaurus* and restored to its original independence, because it has two occipital condyles, with the occipital plate vertical, and without lateral vacuities, and has the shoulder girdle distinct from Pareiasauria in the separate pre-coracoid extending in advance of the scapula.

III. "Octonions." By ALEX. MCAULAY, M.A., Lecturer in Mathematics and Physics, University of Tasmania. Communicated by Rev. N. M. FERRERS, D.D., F.R.S. Received November 28, 1895.

(Abstract.)

Octonions is a name adopted for various reasons in place of Clifford's *Bi-quaternions*.

Formal quaternions are symbols which *formally* obey all the laws of the quaternion *symbols*, q (quaternion), x (scalar), ρ (vector) ϕ (linear function in both its ordinary meanings), ϕ' (conjugate of ϕ), i, j, k, ζ, Kq, Sq, Tq, Uq, Vq. Octonions are in this sense formal quaternions. Each octonion symbol, however, requires for its specification just double the number of scalars required for the corresponding quaternion symbol. Thus, of every quaternion formula involving the above symbols there is a geometrical interpretation more general than the ordinary quaternion one, an octonion interpretation. The new interpretation, like the old, treats space impartially, *i.e.*, it has no special reference to an arbitrarily chosen origin or system of axes.

If Q is an octonion and q a quaternion, the symbols, which in octonions correspond to Kq, Sq, Tq, Uq, Vq in quaternions, are denoted by KQ, SQ, TQ, UQ, MQ. KQ is called the conjugate of Q, SQ the scalar octonion part, TQ the augmenter, UQ the twister, and MQ the motor part.

If A is a "motor" whose axis intersects the axis of Q perpendicularly, QA is also a motor intersecting Q perpendicularly. UQ.A is obtained from A by a combined translation along and rotation about the axis of Q; *i.e.*, by a "twist" about the axis of Q. TQ.A is obtained from A by increasing the "rotor" part of A in a definite *ratio*, and by increasing the "pitch" of A by a definite *addition*. $UQ = U_1Q\ U_2Q$, where when Q is thus regarded as an operator, U_1Q is a "versor," *i.e.*, it effects the rotation mentioned; and U_2Q is a "translator," *i.e.*, it effects the translation mentioned. Similarly, $TQ = T_1Q . T_2Q$ where T_1Q is a "tensor," *i.e.*, it effects the ratio