

conversely that every possible free motion about its centre of gravity of every such solid admits of being so represented.

To revert for an instant to the general question of the representative rolling ellipsoid, I think it must be admitted that the addition of the time element to the theory and the substitution of a second fixed plane in lieu of a fixed centre, considerably enhance the value and give an unexpected roundness and completeness to Poinso's image of the free motion of rotation of a rigid body, of which so much and not altogether undeservedly has been made. From an idea or shadow Poinso's representation has now become a corporeal fact and reality, as if, so to say, Ixion's cloud, in the moment of fruition, had substantiated into a living Juno. I heard the late Professor Donkin, of revered and ever-to-be-cherished memory, state that when as a referee of the Royal Society he first took in hand my paper on rotation, he did so with a conviction that all had already been said that could be said on the subject, and that it was a closed question; but that when he laid down the memoir he saw reason to change his opinion. I owe my thanks to M. Radau and the editors of the *Annals of the Ecole Normale Supérieure* for having been at the pains to disinterment the little-known conclusions therein contained from their honourable place of sepulture in the *Philosophical Transactions*.

J. J. SYLVESTER

K House, Woolwich Common, April 2

The Principle of the Conservation of Force and Mr. Mill's System of Logic

WILL you permit me briefly to point out, what has not, as far as I am aware, been yet noticed—the very important modifications of the logical theory of induction resulting from the consideration in reference thereto of the physical theory of the correlation of forces?

As I believe the subject is now more ripe for discussion than it was when, some dozen years ago, I first began to work out the bearings of the higher results of physical research on the general theory of causation, logical, and metaphysical; the following questions which, in the course of a correspondence on this subject, I submitted to Mr. Mill so long ago as 1863, may, perhaps, contain suggestions of thought not unwelcome to some students of NATURE.

"How then," I wrote, "do our new views of force affect the established theory of causation? Now I would rather, if you will allow me, submit the whole subject interrogatively to you, than give dogmatically my own thoughts. And, more particularly, allow me to submit to you these two questions—1st, Whether the physical theory of transformation (and identity) does not necessitate all such logical changes of expression, at least, as may be implied in the abolition of the conceptions of 'permanent causes,' and of 'kinds,' as real and absolute existences? And, 2ndly, whether—'if, as I have endeavoured to show, the inductive facts on which are based the principles of conservation and correlation lead to such a more general principle as may be thus expressed, *every existence has a determined and determining co-existence*—whether, I say, 'we are not justified in enunciating such a principle as the complement of that fundamental axiom of our present logic, 'every effect has a cause'?"

I believe I am at liberty to say that, though affirmative answers to these questions would necessitate very important changes in the "system of logic, inductive and ratiocinative," Mr. Mill, as to the first, admitted the necessity of certain changes of expression, at least, and generously encouraged me in the prosecution of the researches indicated by the second question.

Of the results of these researches I shall here only say that, as the axiom, "every effect has a cause," is the foundation of a logic which must be distinguished as a *logic of sequence*, the new axiom above stated may be shown to be the basis of a *logic of co-existence*, of which *Geometry* appears as an example. But as to this, as to the conception of force implied in this idea of co-existence, and as to the bearing of this new conception of force on the speculations with regard to space of a fourth dimension, perhaps I may have another opportunity of addressing you.

J. S. STUART GLENNIE

Athenæum Club, March 30

Dust and Germs of Life

PROF. TYNDALL'S exceedingly interesting article in No. 20 of NATURE seems to me to leave unexplained a fact very

familiar to naturalists. It is well known that collections of natural history, say a Herbarium or an Entomological cabinet, will, if left undisturbed for a number of years, and unpoisoned, become infested with animal life, chiefly Acari and larvæ of Coleoptera; and that the surest way of preventing such attacks is thorough ventilation. Now if the floating matter in the air settles so readily after only a few days' stillness, as Prof. Tyndall's experiments seem to indicate, and does not even enter into an uncorked flask, it is out of the question that it can penetrate through the keyholes or chinks of our cabinets. Setting aside the theory of spontaneous generation, we are then forced to the conclusion that this life must arise from germs already existing in the specimens when they are preserved, or in the very limited amount of atmosphere originally confined in the cabinet. Is either of these explanations tenable? A strong argument against the former alternative seems presented by the fact that, as far as I am aware, the same species of *Acarus* infests plants in a Herbarium brought from the most widely diverse localities, an inland meadow or the seashore, the plains of England or the Alps of Switzerland. Can any of your physiological readers throw light on this subject?

F. L. S.

Catkins of the Hazel

WHILE looking at some hazel bushes to-day, I noticed that where the red tuft of stigmas was protruded, the male catkins adjacent on the same twig were immature; while, on the other hand the stigmas had fallen, and the fruit was already swelling, where the scales of the male flowers were open to show the stamens.

A week or two back (in another locality) I could not find a single female catkin which had not lost its stigmas; while nearly all the male catkins had opened, and many had shed their pollen.

Is this always the case with the hazel? If so, it would be a striking illustration of Darwin's aphorism, "Nature abhors perpetual self-fertilisation."

I ought to add, that my observations are not confirmed by the illustrations in the books to which I have access, namely, Balfour's "Class Book," Lindley's "School Botany," and Lemaout and Decaisnes' "Traité de Botanique." In all these, a female catkin with its tuft of stigmas is represented on the same twig as a bunch of fully developed male catkins.

Will some one of greater experience inform me if I am in error as to the above facts?

MARCUS M. HARTOG

University College, London, March 24

ANCIENT BRITISH LONG BARROWS

II.

THE chambered long barrows of North Wilts, Somerset, and Gloucestershire differ, as a rule, but slightly in external form from the simple or unchambered long barrows of South Wilts and Dorset. They are, however, generally of somewhat smaller dimensions, being from about 120 to 200 feet in length and from 30 to 60 feet in breadth. The side ditches characteristic of the unchambered barrows are seldom to be met with, but the margin of the grave-mound is, or rather was, usually defined by a low wall, built of loose tile-shaped fragments of oolitic stone. In some cases, as at West Kennet (see fig. 1), there is good evidence that the mound was originally surrounded by a series of obelisks of sarsen stone, the intervals being filled up with the usual dry walling just described. Sometimes, too, large monoliths or triliths are found at the broad end of the tumulus. As regards orientation, or position in reference to the points of the compass, the direction of east and west commonly observed in the simple barrows prevails in four out of five cases with the chambered barrows; and as in the former class of monument the interments were at the eastern end, which is also the higher and broader, so likewise do we find that the stone chambers or cists occupy the same position in the chambered barrows.

In internal structure the chambered barrows exhibit many varieties, but three principal types are recognised by Dr. Thurnam, viz.—(1) those in which the chamber