our scientific terms. In the expression actinism and radiant heat, the cause has been mixed up with the effect. To be consistent, given one class of bodies the rays falling on it should be called actinic rays; whilst, given another, they should be called heat rays.

In 1840 Dr. F. W. Draper, of New York, clearly pointed out the identity in quality (if I may so call it) of the light, heat, and actinic rays, and that identity, I hold, has been confirmed more than once by recent investigators. I speak, perhaps, somewhat strongly on this point as no one knows better than myself the immeasurable mischief which a wrong definition causes in the progress of a scientific education. Men matured in science can afford to use any definition since they can carefully guard it by mental reservations as to what they really understand by it; but I hold it as a misfortune of no mean order that definitions, which are not so exact as our present state of knowledge can make them, should be given to the uninitiated whose reasoning powers must at the outset be feeble. A definition containing but half a truth must of necessity lead a student of science to a wrong conclusion at some time or another. If our writers of text-books could but be persuaded to write as they believe in this matter, and as some have written (for instance, Clerk Maxwell), we should have fewer mistakes made in explaining the ordinary phenomena met with in daily life.

I think I have now explained what I meant when the answer was given, "There are no such things as heat rays:" a source of energy may be darkly hot as was the kettle, some of the energy radiating from it was expended in heating bodies round it, but that portion which radiated through the holes perforated in the card and which struck the plate was, at all events, partially expended in converting the silver bromide into the sub-bromide.

In the course of these lectures, which I now finish, it has been my endeavour to show you the principles on which experiment in the infra-red region has been carried out, and also to point out the necessity for further work of no light kind in this part of the spectrum. The preceding lectures will also have shown you that work is required to investigate the visible part of the spectrum, and also in the observation of the various phenomena presenting themselves on the solar surface which must of necessity react upon our earth. It has been ignorantly said that the study of solar physics will be exhausted in ten or twelve years, but from what you have heard my colleagues tell you it will surely last our lifetime. If I live till the exhaustion takes place, my allotted threescore and ten years will, I should say, be greatly overstepped. I prophesy, though it can hardly with decency be called a prophecy, that many generations will pass away before all is known of the exact relationship between solar and terrestrial phenomena. What we do know already is hardly the alphabet of the language in which the sun addresses us, and until that alphabet is mastered the whole story that he would tell us must remain undeciphered.

MORPHOLOGY OF THE TEMNOPLEURIDÆ

THE following is an abstract of a communication read before the Linnean Society, Dec. 15, 1881:—The Temnopleuridæ, a sub-family of oligopores, are remarkable for their sutural grooves and depressions at the angles of the plates. The author examined the grooves and depressions or pits in *Salmacis sulcata*, Agass, and found that these last are continued into the test as flask shaped cavities sometimes continuous at their bases which are close to the inside of the test, but do not perforate. This is the case in the median vertical sutures of the interradium and ambulacrum. Between the interradium and the poriferous plates of the ambulacra are numerous pits in vertical series which are the ends of cylinders closed and often curved within. Altogether the undermining is considerable. The grooves over the sutural margins are losses to the thickness of the test. The edges of the contiguous plates are sutured together, by a multitude of knobs and sockets $\frac{1}{300}$ of an inch in diameter visible with a hand lens. In the vertical sutures there is an alternate development of knobs and sockets on each plate corresponding to a similar development on the opposed plates. Between the horizontal plate edges are sutures remarkable in their distinctness and position. The apical edges of the interradial plates have multitudes of sockets and the actinal edges, knobs: whilst the apical edges of the ambulacral plates have knobs and the actinal have sockets. The ambulacra, on their interradial edge have nothing but knobs and the interradial plates corresponding sockets, so that a great series of knobs and socket "dowelling" prevails. *Temnopleurus torematicus*, Agass., gave similar results modified by the great development of the grooves and the young form was shown to differ from the adult, and to have rows of knobs and sockets, and barely penetrating pits. The arrangement in *Salmacis bicolor* and *Amblypneustes ovum* was considered. The pits have an importance for they increase the superficies of the derm and near the peristome, as indicated by Lovén, they contain *Sphæridia*.

The paucity of knowledge respecting the union of the plates of the Echinoidea was noticed and the nature of the suturing of Echinus and *Diadema* was explained, the first resembling part of that of a young *Temnopleurus*, but it was without knobs and sockets. The author concluded by separating the Temnopleuridæ into two divisions, those with pits and those with grooves without pits. The last are the oldest in time and resemble young modern forms which subsequently develop pits. He reduced the number of genera considerably.

P. M. DUNCAN

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

WE are glad to learn that the number of students who have entered the Chemical Laboratory of Firth College, Sheffield, this session, has been so great, that the present accommodation has been quite insufficient. The Council, therefore, decided at their last meeting to erect working benches for sixteen more students. The University of Edinburgh have recently recognised Dr. Carnelly, Professor of Chemistry in Firth College, as a Teacher of Medicine in Sheffield, whose lectures on Chemistry, and course of instruction in Practical Chemistry shall qualify for graduates in Medicine in that University. The lectures on Chemistry and Laboratory Practice at Firth College have also been recognised by the Royal College of Surgeons and the Royal College of Physicians.

SCIENTIFIC SERIALS

American Journal of Science, October, 1881.—Cause of the arid climate of the western portion of the United States, by C. E. Dutton.—Embryonic forms of trilobites from the primordial rocks of Troy, N.Y., by S. W. Ford.—Observations of comet *b*, 1881, by E. S. Holden.—Thickness of the ice sheet at any latitude, by W. J. McGee.—Notes on earthquakes, by C. G. Rockwood. Marine fauna occupying the outer banks off the southern coast of New England, by A. E. Verrill.—Note on the tail of comet *b* 1881, by L. Boss.—Geological relations of the limestone belts of Westchester Co. New York, by J. D. Dana.

November, 1881.—Jurassic birds and their allies, by O. C. Marsh.—The remarkable aurora of September 12–13, 1881, by J. M. Schæberle.—The stereoscope and vision by optic divergence, by W. L. Stevens.—The electrical resistance and the coefficient of expansion of incandescent platinum, by E. L. Nichols.—Local subsidence produced by an ice-sheet, by W. J. McGee.—Notes on the Laramie group of Southern New Mexico, by J. J. Stevenson.—Polariscopic observations of comet *c* 1881, by A. W. Wright.—The relative accuracy of different methods of determining the solar parallax, by W. Harkness.—The nature of Cyathophycus, by C. D. Walcott.

Journal of the Franklin Institute, December, 1881.—Report of the committee on the precautions to be taken to obviate the dangers that may arise from electric lighting.—Report of committee on fire-escapes and elevators.—Chemical methods for analysing rail steel, by M. Troilius.—Notes on the properties of dynamo-electric machines, by E. Thomson.—Blast-furnace hearths and linings, by J. Birkinbine.—Sand-filtration at Berlin, by W. R. Nichols.—Report of committee on Griscom's electric motor.—Weighing the sun by a soap-bubble, by P. E. Chase.

Bulletin de l'Académie Royale des Sciences de Belgique, Nos. 9 and 10.—*Apropos* of determination of latitude, by M. Folie.—On the origin of Devonian limestones of Belgium, by M. Dupont.—Application of accidental images (second note), by M. Plateau.—A means of measuring the flexure of telescopes, by M. Rouzean.—On the micaceous substance of veins of Nil St. Vincent, by M. Renard.—Reports, &c.

Archives des Sciences Physiques et Naturelles, December, 1881.—International Geological Congress of Bologna, September and