semi-Kymric dialect.' Mr. Nicholson, on the other hand, claims to have shown that *Pean* is ' a Goidelic borrowing from the Latin *penna* or *pinna.*' "

The astonishing allusion here to the *western* termination of the wall of Severus might seem at first sight to be a mere misprint for *eastern*; but, on looking at the original, it turns out to be something more, something calculated to create serious uneasiness as to other statements which one has not had time to verify in this volume. Bede's words, as given in Plummer's edition, I. xii. (p. 26), run thus :—

" Incipit autem duorum ferme milium spatio a monasterio Aebbercurnig ad occidentem in loco, qui sermone Pictorum Peanfahel, lingua autem Anglorum Penneltun appellatur; et tendens contra occidentem terminatur juxta urbem Alcluith."

Dr. Holmes rightly acquiesces in the view that *fahel* is an old form of the Irish genitive *fáil* matching a nominative *fál*, " a hedge, a wall "; but this does not, to say the least of it, help the theory that Pictish phonetics were like those of Welsh rather than of Gaelic. As to Bede's *pean* from Latin *pinna,* the author proceeds to show how absurd it is to think that this word " could beget a geographical name." In any circumstances whatsoever, that sort of statement must be hard to prove, so the argument comes dangerously near mere quibbling, and the appeal to Cæsar should have been an appeal to the German Diez, who derives from Latin *pinna* (" Zinne der mauer ") the Italian *penna,* " the top, height, or peak of a hill or mountain," and the Spanish *peña,* " a rock, a cliff," instances of which Diez finds in the oldest Spanish records as Latin *penna.* This is not all; a passage in the second volume of Stokes and Strachan's " Thesaurus Palæohibernicus," from a famous Irish MS. written in the early years of the ninth century, has the words *a pinna montis Berbicis usque ad montem Mis.* The latter height was probably Slemish Mountain, in co. Antrim; the Top of the Mountain of the Wether (*vervex*) remains to be identified. But its name in the Book of Armagh shows that *pinna* was current in Irish Latinity, and was capable of forming part of a place-name. From Latin it passed into the Goidelic language, whence Bede's *Pean-fahel,* which is accordingly neither Kymric nor even semi-Kymric. One of the case forms of a feminine *pinna* in modern Irish would be *pinn,* and it was known to O'Reilly, who gives it in his dictionary as a feminine meaning " the summit of a hill or headland."

The foregoing instances will serve to show that the author has not been quite happy in his treatment of the philologists; whether he has been happier with the geologists and astronomers, the ethnologists and archæologists, they could best tell. We regret to be unable for want of space to pass under review the rest of the second part of the work: we have drawn on the excursus treating of the ethnology of ancient Britain. There are others, however, on such attractive subjects as the Cassiterides, the configuration of the coast of Kent in the time of Cæsar, Portus Itius, the place of Cæsar's landing in Britain, and many minor themes. The Clarendon Press has done

its part with its wonted success, and the reader has the aid of useful maps, together with good illustrations. As to the work as a whole, one may say that, in spite of certain grave defects and a uniform lack of originality, it is a great monument to the author's industry.

LINEAR ALGEBRA.

Synopsis of Linear Associative Algebra. By J. B. Shaw. Pp. 146. (Washington : Carnegie Institution, 1907.)

THIS work serves three purposes : it gives a bibliography of the subject; a synopsis of the various algebras considered, in a fairly uniform notation, with a classification into families and types; and, in the introduction and § xiii. especially, some general remarks on algebra and its development. Part iii. (pp. 113–134) deals with applications.

Prof. Shaw points out that there are two views of complex algebra :—

" the one regards a number in such an algebra as in reality a duplex, triplex, or multiplex of arithmetical numbers or expressions; . . . the other regards the number in a linear algebra as a single entity, and multiplex only in that an equality between two such numbers implies *n* equalities between certain coordinates or functions of the numbers."

On this it may be remarked that both views are equally legitimate, and equally useful, but in different ways. The formulæ of a special algebra which are most characteristic and most powerful are those which most naturally associate themselves with the second point of view; an example is afforded by the quaternion formula $V(aV\beta\gamma)=\gamma Sa\beta-\beta Sa\gamma$. On the other hand, the place of quaternion algebra among its fellows is most clearly shown when we consider a quaternion as a complex (a, b, c, d) of four ordinary numbers, with rules for the addition and multiplication of two such tetrads.

The general impression produced by reading the synopsis is that, after Grassmann and Hamilton, the most remarkable work has been done by Benjamin Pierce. By developing his methods it has been possible to make a classification of linear associative algebras which, so far as it goes, is really exhaustive, and may be said, also, to be a natural classification. Of recent papers, those of Cartan, Frobenius, and Poincaré deserve particular mention; they tend to show that the characters of special algebras can be included in the all-embracing theory of groups.

A few lines (p. 18) are given to a definition of complex numbers by Mr. Bertrand Russell, in terms of logical constants. This is certainly interesting from a philosophical point of view, but it illustrates a tendency on the part of what may be called the Peano school to over-refine their definitions, and become verbose if not tautological. When the theory of real numbers has been logically established, it is sufficient to define a complex algebra in arithmetical terms, without bringing in logical notions *already* used in defining number and arithmetical operations. Why not make use of a symbolism which has been fully

justified, and which immensely abbreviates the statement of new definitions? After all, Mr. Russell's definition, as here given, does not differ essentially from the " umbral " definition (the first of the two previously referred to).

The synopsis is so condensed that it appeals rather to specialists than to general readers. The latter, if interested in the subject, will find it easier to read the more important papers referred to on pp. 5–7, and then gain a comparative view by studying the synopsis.

Prof. Shaw himself has made various contributions to the subject, some of which are contained in the present volume. His summary will doubtless do much to further the study and comprehension of algebra in general.　　　　　　　　　　　　　　　G. B. M.

MEDICAL PHYSICS.

Lehrbuch der medizinischen Phyzik.　By Prof. H. Boruttau. Pp. viii + 282. (Leipzig : Johann Ambrosius Barth, 1908.)　Price 8 marks.

THIS book is intended for medical students who have completed a course of general physics, and is therefore limited to the study of the physical properties of tissues, the physical changes that take place in the tissues, and physical instruments of importance in physiology and pathology. In view of the slight equipment of most medical students in mathematics in Germany, as in this country, the treatment of the subject is not mathematical, diagrams and simple equations alone being used. Considering the variety of the subjects treated, the book is of very modest size. This result has been attained by keeping theoretical discussions within the narrowest limits, avoiding detail in descriptions of practical methods and apparatus, and by the use of small but excellent diagrams.

According to the author, no similar book to this has been published since that of Adolf Fick, the last edition of which appeared more than twenty years ago. As the scope of the book is therefore unusual, a brief account of its contents may be useful.

Chapter i. is introductory. Chapters ii. and iii. are devoted to the general properties of tissues, which are divided into fluids and solids, and include sections on velocity, energy and its transformations, density and elasticity of the different tissues, contraction of muscle, the levers of the body, locomotion, deformities, blood pressure, pulse, blood flow, surface tension, viscosity, osmotic pressure, and the secretion of urine. Chapter iv. deals with gases in relation to blood and respiration; chapter v. sound, including wave motion, the analysis of sounds, hearing, speech, percussion, and the sounds of respiration and the heart; chapter vi. heat production and temperature, and their relation to food, work and surface of the animal, conductivity of clothing materials, and the laws of thermodynamics; chapter vii. magnetism and electricity : therapeutic use of electricity, the electric properties of muscle and nerve, Röntgen rays, radioactivity, N-rays; chapter viii. optics : photometry, mirrors, lenses, the eye, optical measurements, cor-

rection of optical defects, the microscope, immersion lenses, polarimetry, spectroscopy, calorimetry. References to original papers are given.

A feature of the book is the inclusion of many tables of physical quantities, *e.g.* comparative velocities, densities and elasticities of tissues, specific rotations, conductivities of clothing materials.

That the book contains much useful information not usually found in medical students' text-books is undeniable, the section on blood pressure and pulse, and that on the respiratory murmurs, for example, but it is doubtful whether measurements of elasticity of tissues, to which considerable space is devoted, are of much value, owing to the fact that these tissues show great variations according to their nutrition, and that no tissue except bone is a true solid.

In conclusion, it may be doubted whether a book of this kind, dealing mainly with physiological subjects from a physical point of view with a physical classification, is entirely desirable. Physiologists, after a large number of careful researches on the physical phenomena of living tissues, have had to confess that they are no nearer to the discovery of a physical basis of life. The student should, therefore, arrive at a truer view of the present position of the science from books, which deal with the properties of the living organism as a whole, or as an association of different organs, than from a book with an essentially physical treatment such as this.
　　　　　　　　　　　　　　　　　　　　J. H. R.

OUR BOOK SHELF.

Musée ostéologique; Étude de la Faune Quaternaire, Ostéométrie des Mammifères. By E. Hue. Two vols. Pp. xix + 50 + 186 plates. (Paris : Schleicher Frères, 1907.) Price 24 francs.

To persons interested in cavern-research and cavernanimals, and having no means of access to a museum, these volumes—which are a monument to the industry and perseverance of their author—will no doubt be welcome, and afford adequate means of identifying their " finds " with comparative ease. In this country, however—apart from what may be the case on the Continent—the number of such persons must, we should surmise, be extremely small, and the sale of the work consequently limited. On the other hand, it may possibly be found of use to students of comparative osteology generally, without reference to cavern-research.

The plan adopted by the author is to take the skeletons of all the species of mammals the remains of which are commonly found in caverns, and to arrange their component elements in corresponding series, so that all the skulls, all the humeri, &c., are brought together in associated plates. Each bone (except, of course, those of the skull) and each tooth is figured separately to scale, the scale in the case of each plate being as large as circumstances permit. By means of these figures to scale and measurements, Mr. Hue is of opinion that it will be practicable for anyone to identify such cave-bones—even when imperfect—as may come under his observation.

For this purpose a series of measurements for each bone in the skeleton is recommended, the lines along which these measurements should be taken being indicated in a series of preliminary figures. By the aid of a rule and pair of compasses, such measurements