sense of knowledge of the more precise, exact, and exquisite order, has claims to public recognition and support on the ground of benefits conferred on the nation in the shape both of honour and profit; that it shares with righteousness the prerogative of exalting a nation (for the love of truth, which causes men to seek after knowledge and the patient industry and self-denial which are the first conditions of the search, are among the manly virtues that give strength and solidity to a people); that it must be preferred before learning, as being more practical, and coming into more direct contact with the realities of life; before art, as less apt to be turned to unworthy uses, more sure not to become an agent of effeminacy and luxury.

Of the good gifts which Science showers upon mankind, we may find grand and convincing examples in the works of the hygienic heroes of the last century—Sir George Baker and his masterly demonstration of the cause of the Devonshire colic, Captain Cook and his successful prevention of scurvy, John Howard and his prison work, ending in the destruction of the Jail Fever, and Jenner, with his discovery of vaccination. We fully sympathise with the concluding words of this part of our author's paper:—"By what figures of arithmetic shall I attempt to measure the greatness of these four gifts of science, freely bestowed upon us, and upon all men everywhere, in the short space of a single generation? I believe it to be no exaggeration to affirm that the great war of the French Revolution was brought to a successful issue as much through the lives thus saved as by the valour of our soldiers and sailors. Such have been the triumphs, such the precious gifts, of this one science of hygiène." Other illustrations of the same class, that is to say, showing direct profit to the nation, may be drawn from the Science of Chemistry, of which the whole history, from first to last, is one unbroken series of purely scientific discoveries made for love of truth, without thought or hope of reward, but, sooner or later, turning to profit in the hands of our manufacturers.

We might cite examples from the discoveries of Davy and Daniell, and the arts of electrotyping and photography, discoveries appealing to universal experience of the manifold obligations under which science and scientific men have laid mankind for all the arts which make our civilised existence to differ from the rude life of the savage. The Penny Post, with its world-wide benefits, is the result of a scientific demonstration belonging to the methods and domain of Social Science.

We conclude with the following statement of the special claims of the Statistical Society and its associates in the culture of Social Science:—"The scientific labours of our members, inspired by a mere love of truth, looking to no pecuniary reward, and bearing directly on the very questions which come under discussion in the Legislature, are in many cases a direct saving of expense to the nation. An important (perhaps a very costly) return is made to Parliament. It abounds in tables and columns of figures. The work of analysis, which must be undertaken if the return is not to become so much waste paper, if Parliament and the public are to profit by the expense incurred—this work of analysis is done by some member of the society seized with a wholesome curiosity to know the truth. He bestows upon it time, and thought, and the skill acquired by practice; he submits his work to the criticism of the Society, his paper is published in its *Journal*, at its proper cost; and thus the public and the Government save money and become possessed of wholesome and fruitful truths." These are claims which, we think, the Government will feel bound to recognise, and we wish the cultivators of the Social Societies every success when they come to represent them in the proper quarter.

THE SOURCES OF PHOSPHATIC MANURES

"PRACTICE with Science" is the title of a volume of essays (the second of a series), issuing from the Royal Agricultural College, Cirencester, and containing contributions from the members of the staff of that institution. Amongst other papers is an interesting account by Prof. Thiselton Dyer of the geological distribution of Tricalcic Phosphate; that is to say, a sketch of the chief sources of mineral phosphate of lime, whether as apatite, osteolite, phosphatite, coprolite, or guano. Mr. Dyer points out the abundance of phosphate of lime in igneous rocks, but hesitates about tracing its origin in such beds either to direct chemical combination, or to the inclusion of organically-formed phosphate in the rocks in question. He does not, in short, discuss the possibility of the combination of phosphoric acid and lime in the primæval state of the globe without the intervention of life, which one distinguished geologist at least denies. Mr. Dyer traces the occurrence of tricalcic phosphate in the various sedimentary deposits with great care, having obviously taken much trouble to render his statement an exhaustive one. He considers the many structureless masses of phosphatic deposits which occur "as residuary evidence of formerly existing life, of which they are to some extent the measure," as graphite is in other cases. A greater influence in the production of these masses is attributed to animal than to vegetal life, though marine plants are stated to be especially rich in phosphate of lime, and have undoubtedly played their part in its introduction into sedimentary strata. Mr. Dyer mentions that the recent Brachiopod Lingula has 86 per cent. of phosphate of lime in the mineral ingredients of its shell; and the occurrence of large quantities of phosphate of lime in the great Laurentian and Silurian formations is noticed by him in detail, as well as its occurrence in Devonian and Carboniferous limestones. In emerging to the group of mesozoic strata, we leave behind almost entirely those veins and beds of "phosphate" which occur in the older and more changed rocks, where the segregation of the phosphate of lime has been more completely effected, owing to the greater age of the beds. In mesozoic and tertiary strata we find those nodules which have so erroneously been confused with "coprolites"—the droppings of fish, which are not unfrequently preserved in the fine sediment of the Liassic and the Rhætic beds of the chalk—though beds of flaggy phosphate also occur in some deposits of this age.

Mr. Dyer accepts the history of the origin of these nodules which I have advocated (Geol. Magazine, vol. v.), in describing those which occur below the Suffolk Crags. Clay has a remarkable power of detaching phosphate of lime from its solution in carbonated water; and the phosphatic

nodules are bits of clay which have become imbedded with great quantities of bones, and in some cases, very probably—as suggested by Mr. Seeley, of Cambridge, with regard to the Cambridge nodules—with sea-weed too; whence, by the intervention of gas-charged water, they have extracted the phosphate: hence all beds of phosphatic nodules occur near to argillaceous strata of special character. Much of this process, no doubt, went on whilst the bones and clay-lumps lay on the ancient shores, and were daily washed and infiltrated by the sea-water, or lay entirely submerged in masses: but Mr. Dyer thinks that the process of transference would continue after the beds had been left high and dry, and may be now going on; though I think it is clear that the phosphate of lime in the nodules came from bones which have been destroyed and lost in the process, having been very different in mineral condition to the fragments which now remain amongst the nodules of these valuable "bone-beds." Mr. Dyer notices Rhætic, Jurassic, Cretaceous, and Tertiary accumulations of phosphatic nodules. There is one which has not been hitherto recorded, and which is not alluded to in this paper, but is interesting, and in a well-known locality; it occurs in the Wealden series, near Brook, in the Isle of Wight, and is in parts five or six feet thick. The nodules are light-coloured, and aggregated into masses so as to form a solid bed, and not a pebbly conglomerate, as is usual.

The distribution and origin of Guano is briefly given. True guano is simply the dung of sea-fowl, and can only accumulate in rainless districts. Guano rock is the result of the action of water on this matter and subjacent calcareous coral rocks; the celebrated Sombrerite is of this nature. It is very possible that much of the palæozoic phosphatic rock may have been produced in this way, in those beds, at any rate, which we may believe to have been formed subsequently to the evolution of terrestrial vertebrate forms of life.

The other essays in this volume treat of more strictly agricultural subjects, and are accordingly of more limited interest.

E. RAY LANKESTER

SCIENTIFIC YEAR BOOKS

The Year-Book of Facts in Science and Art. By John Timbs. Pp. 288. (London: Lockwood and Co., 1870.)

Annual of Scientific Discovery, or Year-Book of Facts in Science and Art for 1870. Edited by John Trowbridge, aided by Samuel Kneeland, M.D., and W. R. Nichols. Pp. xxii. and 354. (Boston: Gould and Lincoln; London: Trübner and Co., 1870.)

L'Année Scientifique et Industrielle. Par Louis Figuier. Quatorzième Année (1869), pp. 606. (Paris: Hachette; London: Williams and Norgate, 1870.)

Causeries Scientifiques. Neuvième Année (1869). Par Henri de Parville. Pp. 363. (Paris: Rothschild; London: Williams and Norgate, 1870.)

Annuaire Scientifique. Par P. P. Dehérain. Neuvième Année (1869), pp. 387. (Paris: Masson; London: Williams and Norgate, 1870.)

Jahrbuch der Erfindungen. Herausgegeben von H. Hirzel, und H. Greschel. Fünfter Jahrgang, pp. 416. Leipzig: Quant; London: Williams and Norgate, 1869.)

GROUPING these volumes according to the languages in which they are written, we may dismiss the first two with a very few remarks. Mr. Timbs literally gives his readers nothing whatever but a collection of cuttings from the most miscellaneous sources, including the *Pall Mall Gazette*, *Times*, *Spectator*, *Illustrated News*, *Liverpool Albion*, &c.; while Mr. Trowbridge and his coadjutors (who have a respectable scientific status) present us with a much more perfect, although still an incomplete, picture of the leading discoveries of the year. The introductory notes by the Editor constitute the most valuable portion of the American book, which treats of the progress of science, under the respective heads of (1) Mechanics and Useful Arts, occupying 135 pages; (2) Natural Philosophy, to which 64 pages are devoted; (3) Chemistry, (4) Geology, (5) Biology, (6) Astronomy and Meteorology, and (7) Geography and Antiquities. This volume, like that of Mr. Timbs, exhibits a too free use of the scissors, but the extracts are almost invariably taken from periodicals of good scientific repute.

If our readers require any specific evidence of the English editor's unfitness for his office, we would refer them to the article headed "Singular Plant," in p. 200 of the "Year-Book of Facts." It is obvious from the most cursory perusal of the history of this "singular plant," that it is merely a fine specimen of coral, and the absurdity of the story was exposed in a number of the *Gardener's Chronicle* subsequent to that in which it originally appeared. The correction was, however, overlooked by the learned editor.

The French Year-Books differ materially from one another in their modes of arrangement. In this respect we prefer that of M. Figuier to the others. It includes a large number of subjects arranged in the following order:—Astronomy, Mechanics, Physics, Meteorology, Chemistry, Civil Engineering, Voyages and Travels, Natural History, Public Health, Physiology and Medicine, Agriculture, and the Industrial Arts.

The science-gossips of M. de Parville are a collection of papers such as a physicist might contribute to a popular journal. The matter in this volume is more digested, and is in a far less crude and fragmentary state than in the other books we have noticed, and the individual facts are dovetailed together so as to make the style agreeable and the reading continuous. It includes in its range—Astronomy, Physics, Mechanics, Chemistry, Physiology and Medicine, Natural History, Engineering, and unplaceable topics.

In some respects M. Dehérain's volume is the best of the three. Although less comprehensive in its scope than that of M. Figuier, or even than that of De Parville, it is more perfect so far as it goes. It is divided into two parts, treating respectively of the pure and of the applied sciences. Under the pure sciences he places Astronomy, Physics, Chemistry, Meteorology, Botany, Physiology, and Anthropology; while the applied sciences include Civil Engineering, Applied Chemistry, Medicine, and *Exploitation des Animaux*, for which we have no exact English equivalent. It is, we think, doubtful whether this sub-division of the sciences will bear criticism, but it is needless at present to discuss that subject. Instead of flying from flower to flower like the busy bee of our early days, M. Dehérain confines himself to one or two of the most important subjects in each department, and these he treats with far more fulness than the preceding writers. For example, under Chemistry we have an article on Explosive Compounds, containing a review of the works of Nobel, Abel, Berthelot, and Saint-Claire Deville, by the