

development of the English coal-tar colour industry has really been much less than has been supposed. A cause fundamental to those enumerated above, and lying at the basis of many other of our industrial lapses, may be defined as the lack of an appreciation of the importance of science on the part of the public generally. This has rendered the development of many industries quite impossible. It is reputably stated that the Badische Anilin- und Soda-Fabrik spent upwards of one million pounds sterling during a period extending over twenty years in solving the industrial problem of the synthesis of indigo. What English board of directors, even if themselves satisfied to do so, would venture to spend any such sum on apparently unproductive scientific experiments? Public opinion in this country, as reflected in the shareholders, would not allow it, any more than a six or seven years' college science course is considered a paying investment. Nor will satisfactory reform of the patent laws and the excise laws come about until the Government is made to realise, by the pressure of public opinion, that the future of the national industries largely depends upon the proper utilisation of scientific fact and method.

The work under review consists of three parts and an appendix. Part i. comprises a description of the various synthetic dyestuffs and the intermediate products from which they are derived. Part ii. gives methods for preparing typical products on a laboratory scale, but as far as practicable by works processes; and part iii. deals with the analysis and identification of dyes and with the detection of dyestuffs on the fibre. The appendix contains tables giving the specific gravities of various solutions.

The first chapter of the book gives a very short account of coal-tar and the separation and purification of benzene, naphthalene, anthracene, and phenol. A little more space might usefully have been devoted to this section.

Subsequent chapters deal with the nitration and sulphonation products of the hydrocarbons, and the production and properties of amido, hydroxyl, and carboxyl derivatives. The second section of part i. gives in seventeen chapters, occupying about one-third of the book, a systematic description of the various groups of dyes, the classification being, of course, based on the chemical constitution, and not upon the mode of application, of the dyes. The treatment of this section is excellent, the descriptions being very lucid and sufficiently exhaustive without too much detail.

Part ii., which deals with the preparation of colouring matters and intermediate products, is at once the most novel and the most useful feature of the book. It is evidently the outcome of much personal experience on the part of the authors, and the limitations of ordinary college laboratories have very sensibly been kept in view, though at the same time only such materials are employed as would be used in the technical preparation of the several products in the works.

Perhaps the least satisfactory portion of the book is the chapter dealing with the application of the

colouring matters. It is very doubtful whether any useful purpose is served by such a short treatment of the science of dyeing as can be compressed into thirteen pages. Condensation to this extent inevitably results in misleading generalisation, and the authors would probably have been well advised to have referred their readers to some of the well known treatises on dyeing for this part of the subject.

The chapters on the valuation and analysis of dyes are to some extent open to the same criticism. As an example of their deficiencies, the method given for the analysis of indigo may be referred to. The method described would be entirely untrustworthy if applied to the estimation of natural indigos, and such is evidently the intention. In its main and essential sections, however, the book is a noteworthy addition to the literature of specialised organic chemistry, and both authors and publishers are to be congratulated on its production.

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#### SCIENCE AND MYSTICISM.

*Prinzipienfragen in der Naturwissenschaft.* By Max Verworn. Pp. 28. (Jena: Gustav Fischer, 1905.) Price 80 pfg.

PROF. VERWORN detects mystical murmurs in the scientific camp, and is full of apprehension of coming dangers, for "mysticism is the negation of scientific thinking." Naturalists have been working out a monistic interpretation of the world, but there have been symptoms of faint-heartedness lately, especially before two questions, which the author states in the following terms:—Do vital processes depend on the same principles as the processes in inanimate nature? Are psychical processes referable to the same principles as those on which bodily processes depend? Verworn assures us that both these questions may be confidently answered in the affirmative, for the world is one, with the same principles, or rather with one principle throughout. What that "principle" is we have not been able to discover from the lecture, but we are assured that it is not a "mystical principle."

In regard to the first question, Prof. Verworn says that when we sufficiently analyse the criteria of life we find none requiring other principles than those which we require in interpreting the inorganic world. The only feature distinctive of life is the combination of potencies which are seen separately apart from life. Chemical ferments illustrate metabolism without growth; the condensations and polymerisations of chemical compounds illustrate growth without metabolism; the organism combines both. How it does so we are not told, but it is not by any peculiar vital principle. There is no need to assume a secret "organisation" transcending physical and chemical principles; there is no warrant for postulating a persistent protoplasmic architecture, either microscopic or molecular, as the physical basis of life; the form and structure of a cell is just like that of a fountain or a flame; life is a flux; "Πάντα ῥεῖ" is true throughout nature. To suppose, as Driesch, for instance, does, that an Aristotelian "entelechy" resides in

living matter and accounts for its purposive behaviour and development is to resurrect the buried concept of a *nisus formativus*. To do this is quite gratuitous, since Verworn supplies us with a guaranteed modern concept of a "self-steering" metabolism—the "self-steering" quality depending, of course, on the laws which physical chemistry has been revealing during recent years. He also assures us that there are no facts of organic being or becoming which warrant us in losing faith in the sufficiency of the monistic interpretation in terms of chemistry and physics. It is true that the illustrious physiologist has not found time in this lecture to give us any illustration of how any vital phenomenon may be formulated in terms of "the principles of the inorganic world," but he seems to have no doubt that it can be done.

As to the second question, before which so many have fallen away from monism—the question of psychical life as distinct from bodily life—Verworn finds satisfaction in boldly denying that any dualism exists. The dualistic idea was born out of ignorance fathered by desire, and it has been nurtured and refined by philosophy. The material ghost that escaped in *articulo mortis* has become a spiritual soul, but both are fallacious abstractions. It is pathetic to think of all the wrestlings with the problem of dualism since Descartes's day, for dualism is but one of man's many inventions with which he makes himself miserable. Just as the organism is a mere bundle of metabolisms, so the "ego" is but a changeful bundle of sensations, and perceptions, thoughts, and feelings derived from these—a complex the components of which are not continuously or simultaneously held in combination, though certain components, e.g. sensations of our body, occur so frequently and uniformly that the illusion of a persistent personality is produced. The material for the up-building of the "ego" is the external world or corporeal world—the world of sensations; the "make-up" of the "ego" is the same as the "make-up" of the world; the antithesis of soul and body is "a fossil idea." "Either everything is body in the world or everything is soul: however I like to put it, the main fact is that there is only one kind of thing." How a flux of sensations can give origin to that unified outlook and inlook which is called monism remains somewhat mysterious, but to think of any mystical principle being involved is "a negation of scientific thinking." But which is mysticism and which scientific thinking?

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#### THE PLANT KINGDOM.

*Das Pflanzenreich. Regni vegetabilis conspectus.*

Edited by Prof. A. Engler. (Leipzig: W. Engelmann; London: Williams and Norgate.)

AN account of the inception of this work was given in NATURE, October 30, 1902 (p. 657), with a list of the earliest parts. Twenty-one volumes have now been published, of which ten are devoted to monocotyledonous orders. The late Dr. K. Schumann has contributed, in addition to the Musaceæ, two memoirs on the Marantaceæ and the Zingiberaceæ respectively. In both these orders there is

a large increase in numbers and a considerable amount of change as compared with the account given by Pedersen in the "Pflanzenfamilien." This is explained by the fact that an enormous number of new species have been made out of copious material received from Indo-Malaya and tropical Africa. The new species of Zingiberaceæ described for Malaya alone exceed a hundred. Dr. Schumann formulates very definite arguments in favour of the changes which he proposes in reviewing the history of the orders, and also presents a comprehensive discussion on the flower and on the relationships of the four orders which compose the series Scitamineæ.

Many of the orders are obviously too large to admit of their being treated in a single volume. The Orchidaceæ, as in the case of the "Pflanzenfamilien," have been entrusted to Prof. Pfitzer, and the first instalment contains the section Pleonandraceæ—formerly called Diandraceæ—which consists mainly of the Cypripediums as generally understood. A special feature of this volume is the list of hybrids, both natural and artificial. Similarly, the Araceæ require several parts, and Dr. Engler, who undertakes this order, begins with the tribe Pothoideæ. Dr. Engler gives a full description of the branching, and distinguishes nearly 500 species of Anthurium. A short volume includes the orders Scheuchzeriaceæ, Alismataceæ, and Butomaceæ, which are all worked out by Prof. Fr. Buchenau. Dr. W. Ruhland is responsible for the Eriocaulaceæ, and gives a detailed account of the geographical distribution, taking up the origin, evolution, and dispersal of the order. Owing to a large influx of new specimens from Brazil, the number of species of Eriocaulon now exceeds two hundred, and the genus Pæpalanthus, after being shorn of many species that form three new genera, still shows a slight increase.

The first volume dealing with a group of the gymnosperms, that on the Taxaceæ, has been written by Dr. R. Pilger. The Taxaceæ are profoundly interesting on account of the primitive forms which characterise some of the genera, but, as is usually the case with such genera, the number of species is small, and no great increase may be expected, although some new species may be looked for from the unexplored areas of China and eastern Asia.

Of dicotyledonous orders, the Tropæolaceæ, by Prof. Fr. Buchenau, appeared in 1902, and the Cistaceæ, by Dr. W. Grosser, and the Theophrastaceæ, by Prof. C. Mez, were issued in 1903. Since that time a larger volume on the Lythraceæ has been contributed by Dr. E. Koehne, who has gone very fully—in fact, more fully than seems necessary—into the varieties and forms of the more variable species. The genus Cuphea is amplified to 200 species, and the genus Rotala is extended to include some species previously assigned to Ammannia. A list of plant collectors and their contributions is added. One of the most complete and interesting memoirs is that by Prof. H. Winkler on the Betulaceæ. The general sketch contains sections on the geographical distribution and the history of the order. The fossil forms, which are numerous, are enumerated without comment, but with references,