THURSDAY, NOVEMBER 2, 1916.

THE SCHOOL OF PYTHAGORAS.

Le Scuole Ionica, Pythagorica ed Eleata (*I Pre-aristotelici, I.*) By Dr. Aldo Mieli. Pp. xvi + 503. (Firenze: Libreria della Voce, 1916.) Price lire 12.

THAT the study of history maketh a man wise was the saying of a great Elizabethan, but it was one of the great Victorians who preferred a copy of the *Times* to "all the writings of Thucydides"; the great days of Elizabeth would not seem so spacious had one or two such sayings as the last come down to us from them! An historic sense was somewhat far to seek in the Victorian age. The nineteenth century had all but forgotten its own past. Lyell and Darwin, Schwann and Virchow, Lister, Faraday and Joule had a way of making their immediate predecessors look old-fashioned, as the post-chaise looked when the railway came. In short, so great a revolution had taken place in things mental as well as in things practical that it seemed (so Judge Stallo said) as though Bacon's demand had at last been thoroughly complied with, *ut opus mentis universum de integro resumatur.*

I never heard a lesson in my school- or college-days on the historical aspect of any science, though some few of our teachers were by no means unacquainted with history. One was on intimate terms with Ray and Willughby, and all the older English naturalists; another got no small part of his large wisdom from Boerhaave and Haller, and even Ambroise Paré. There was yet another who led his pupils (his better pupils) to Newton, while his neighbours were perfectly satisfied with Frost. When one thinks how deep was the reading, how wide the learning, of men like Sharpey and Rolleston, Alfred Newton and Michael Foster, it is all the more striking that even by them the historical method was very seldom employed and the love of history very little instilled. The fact is, we were all dazzled and obsessed, young and old, by "the great press of novelty at hand." Linnæus and Cuvier, even Johannes Müller himself, had read their Aristotle to learn of him, just as they read their Swammerdam and their Réaumur. But we had come to think of the old books as so much bric-à-brac, as material for a hobby but of no more use in the world. The tide has turned since those days, one scarce knows how or why; and a world that is as busy as ever finds more time for the study of history than it did. The long series of Ostwald's "Wissenschaftliche Klassiker" is proof of a widespread desire to consult the sources of knowledge; and Mach's "Science of Mechanics" is perhaps the best but not the only example of the historic method, rigorously and critically applied to the teaching of a science.

Dr. Aldo Mieli, the writer of the book before us, is already known by a number of historical articles in *Scientia,* that admirable journal of our Italian allies; we may welcome him accordingly as a member of the little company of historical students, of which Prof. Gino Loria is the distinguished head. He all but takes our breath away, in his very preface, by the vastness of his conceptions and his projects, while he relates with ingenuous sincerity the recent history of his own mental development. He had a thirst for universal knowledge in his schooldays, and essayed to comprehend, "con l'aiuto di poche premisse, tutti i fenomeni fisici e sociali, artistici e filosofici." He presently sought in mathematics, but sought in vain, for the inner meaning, "la spiegazione," of things. When he failed there, he betook himself in haste to chemistry; "a corpo perduto mi gettai allora (1902) nello studio della chimica!" He was baffled again; he had striven as the old alchemists strove, and his longings, like theirs, were unfulfilled. At last, under the influence of Mach and Ostwald, he turned to history and to philosophy; renouncing the search after a "rational and experimental explanation of the world," he resolved to study the creations of the spirit, and to trace in particular the development of scientific thought.

While charmed by these naïve confessions of the young Italian scholar, the reader is startled to discover that the present bulky book is but the first part of a universal history, on a scale vaster than Gibbon's or Hallam's, of the whole circle of the sciences. It is to be divided into some seven portions, dealing with the great ancient pre-Hellenic empires, next with Hellenic, Arabic, and Far-Eastern science; again, with the Middle Ages and with the Renaissance to Galileo's day; and lastly, with the seventeenth and eighteenth centuries. The story of Hellenic learning will be divided into four parts, of which one must end where Aristotle's work begins; and this pre-Aristotelian treatise will be in three volumes, of which one is the book before us, and the other two will deal in due time with the Atomists and with Plato and the Sophists.

The reader may be a trifle prejudiced, he might be dismayed or even dumfounded, by so vast an ambition. But the fact is that the book is marvellously well done—so far as the present writer is capable of judging. Big as it is, it is compact and full; it leads us smoothly and easily, with but brief and impartial discussion, through the subjects on which we expect and desire to be informed. We hear the legendary history of Pythagoras and his confraternity; we are introduced to the philosophy, the science, and the mystical mathematics of the school. We learn in successive chapters, for instance, of the mystical theory of number; of figurate and other curious numbers, and of the *proportio divina*; of the great Pythagorean theorem, and of the gnomon; of the concepts of application and of excess and defect; of the principles of acoustics and of the musical scale, and of the astronomic and other theories of Archytas and Philolaus and the rest. The subjects are those with which any book or encyclopædia article on Pythagoras is bound to deal, and there is little here but what we can get from others. But here it is, well and clearly ordered and expressed, and abundantly furnished with all sorts of guide-posts for those in quest of still more information or discussion.

The bibliographical lists are astonishingly good, without pretending to "completeness." The one, for instance, which is appended to the first section of our volume is of a general kind, and covers some seventy pages; it pilots the student to the texts of Diels, Mullach, and others; to works on the history of philosophy, Greek and other, from the days of Ritter and Preller to Zeller and Burnet and Diels; and ends with a capital account of the historians of mathematical, astronomical, and physical science, from Bailly, Montucla, and Delambre, to Allman and Zeuthen, and Moritz Cantor and Paul Tannery and Sir Thomas Heath. There may be mistakes, for aught I know, in this learned and compendious book, but I have neither found them nor sought for them. It was one of Pythagoras's sayings (or Dr. Johnson tells us so) that a friend should not be chidden for little faults.

Pythagoras is one of the great figures of the world, and many and many a scholar has had a predilection for him. Sir Thomas Browne loved him; Plato was steeped in his doctrine; and whole books of Euclid are ascribed to his teaching. Those who knew least of him could always quote him, as Shakespeare did, and Dr. Johnson, and as Goldsmith quoted Ocellus Lucanus. But the more we read about Pythagoras the less we know of him for sure and certain; and it is just herein that his peculiar fascination lies. For he is one of those shadowy figures who stand on the borderland between history and fable, between fairyland and reality: like King Arthur and Thomas of Ercildoune and King Solomon and Caliph Haroun al Raschid. We know that one of his legs was of gold, that Apollo was his father, that heavenly messengers flew down to him on golden arrows, and that his face shone like the faces of the Shining Ones. In more sober statement he seems to represent the continuity, unbroken but dwindled to a thread (a thin but indispensable thread), between one civilisation and another, between the beginning of Greek thought and the decline of learning in a remote but erudite antiquity. To the student trying to prefigure so strange and so elusive a personality there is a choice of ways. If he keep to sober and critical consideration of the meagre facts at hand, he will probably arrive at the conclusion that there is no evidence for Pythagoras having learned anything worth speaking of upon his travels or having inherited any load of learning from pre-Hellenic science and philosophy. So it is commonly held by many men of the soundest classical learning that no foreign influence can be traced in the school of Pythagoras, and that his "philosophy and institutions contain nothing but what might easily have been developed by a Greek mind exposed to the ordinary influences of the age." Dr. Allman held, with all due caution, that we must be "struck with the Egyptian character of the geometrical work attributed to Pythagoras"; but Prof. Burnet asserts that all the mathematics of the Egyptians consisted of a few rules of thumb by which to measure the area of a field or the height of a pyramid, and denies that Egypt had anything to teach Pythagoras that was worth the learning or the borrowing.

On the other hand, there is ample room for others, of a more imaginative disposition, to grope among the ruins and the misty darkness of pre-Hellenic civilisation, to put two and two together wheresoever they can, and to apply themselves (for a while at least) to the ingenious art of fanciful reconstruction. Dr. Naber's curious book, "Das Theorem des Pythagoras," is of the latter kind. The ground on which he leads us is sometimes dangerous, as when he depends on Piazzi Smyth for his facts as well as his theories of the pyramid; but for all that he weaves a fascinating and instructive story. He brings together a prodigious mass of curious lore about the triangle and the pentagon, and the Sacred Letter, and the Symbol of Health, and Abracadabra, and the sacred lotus and mallow-flower; he touches on a hundred things which the early students of the triangle must (in all likelihood) have observed and discovered by the way; and he suggests with no less ingenuity the lines of tradition along which such knowledge ran, from far-away antiquity even to the artists and cathedral-builders of the Middle Ages.

If we be inclined to see in Pythagorean mathematics not the discoveries of a single lifetime but fragments of the learning of a preceding age, so also in his philosophy may we be inclined to recognise parts of a great edifice the scattered stones of which confront us in unexpected places, built into the fabric of old but less ancient walls. We have often heard that there is a curious link or bond between the Cabbalists and the Pythagoreans; and now again, in a recent *Hibbert Journal*, an article by the Chief Rabbi on "Jewish Mysticism" suggests, though it does not assert, this view. The "opinion of Pythagoras" regarding metempsychosis, wholly absent from Bible and from Talmud, is fundamental to the teaching of the Cabbala. In Cabbalistic as in Pythagorean philosophy the ten numerals, or Sefiroth, contain the possibilities of all things, and, with the help of language, represent the Spirit of God; the mystical number Ten is the material universe, God's kingdom made visible; wisdom and understanding, mercy and justice and harmony are among the concepts which other numbers represent or embody; and the mystical One is the mystery of mysteries, which in the beginning filled all space and was all space. Then "En Sof contracted Himself in order to leave an empty space for creatures"; just as, according to Pythagoras, ἐπεισάγεσθαι δ' ἐκ τοῦ ἀπείρου χρόνον τε καὶ πνόην καὶ τὸ κενόν. The Pythagorean, or Platonic, or Jewish concept of Number is a hard saying to the unpoetic, non-mystical modern and Western world; and many a way is found to show that Plato and Pythagoras meant something prosy and commonplace after all. But to some it is still as plain as ever that Number is the clue to the greatest of earthly mysteries, and that what we call beauty, whether of sound or form, is but its resultant and expression. It was in the very spirit of Pythagorean mysticism and wisdom that that great naturalist, Henri Fabre, wrote his great ode to number; as in a kindred spirit the old carpenter in Verhaeren's poem:

> "Fait des cercles et des carrés,
> Tenacement pour démontrer
> Comment l'âme doit concevoir
> Les lois indubitables et fécondes
> Qui sont la règle et la clarté du monde."

We must never forget that the secrets of the mystic, whether Gnostic, Cabbalist or Pythagorean, lie very deep indeed, and that a twin alternative between esoteric and exoteric statement, or between literal and allegoric interpretation, by no means exhausts the various meanings which the mystical philosopher can wrap up in his words. In the end, as we come slowly to a better, though still a clouded, understanding of what lies within and behind the Golden Verses and all the rest of the husk of Pythagorean tradition, we feel the truth and force of William James's saying (aptly quoted in the article to which I have just referred), that the "mystical classics have neither birthday nor native land; their speech antedates language, and they do not grow old."

D'ARCY W. THOMPSON.

PHYSIOLOGICAL CHEMISTRY.

Physiological Chemistry: A Text-book and Manual for Students. By Prof. A. P. Mathews. Pp. vii+1040. (London: Baillière, Tindall and Cox, 1916.) Price 21s. net.

PROF. MATHEWS is well known as a worker in the field of physiological chemistry, more especially on its physical side. His present volume is one of an ambitious character, and has the merit of being distinctly original. The chapters on the chemistry of the fats, carbohydrates, and proteins are fuller than is usual in such books, and the subject-matter is not only clearly explained, but is fully up to date. Much of it is pure chemistry, but it will not be less valuable for that reason to the biologist. The section on physical chemistry is also treated at considerable length, as might have been anticipated by those who know the author's bent. The whole subject is confessedly treated unequally, for, as the preface puts it: "Of so large a subject one can be personally familiar with but a small part." The portions that strike one as susceptible of more expansion are those dealing with muscle and the ductless glands; for the latter group of organs Prof. Mathews coins yet another name: he dubs them the Cryptorhetic Organs—*i.e.* organs with a hidden flow. One small feature of the book—viz. the explanation and derivation of technical terms—might well be imitated in more elementary manuals than the present. While on the question of words, one may add that the nomenclature adopted for the fats and fat-like substances is one not likely to commend itself to all physiologists.

Each chapter is followed by a short selected list of papers bearing on the subject dealt with in that chapter. There is no attempt at a complete bibliography, but the selections appear to have been judiciously made, though in the present state of the political atmosphere German writers figure rather too largely for English taste. The papers mentioned for reading and study are mostly recent ones, because they approach the subject from the modern point of view, and in them the older literature is cited. The choice does not imply that the author does not value the work of the early pioneers; indeed, he presents evidence that he takes the opposite point of view, and the full consideration which he gives to their work forms one of the most interesting features of his book. He, for instance, gives a very extensive account of the researches of Lavoisier, whom he perhaps rightly regards as the founder of bio-chemistry, of Beaumont, of Claude Bernard, and many others.

Prof. Mathews, who is here the exponent of a vast but nevertheless comparatively young branch of science which every day is becoming more and more exact, is not devoid of a sense of imagination, the most valuable asset of both a teacher and a researcher. His excursions into the regions of speculation will be read with keen interest, even although, like so many hypotheses in the past, they may ultimately be forgotten. Such theories as those which he advances in his comparison of the animal body to a magnet, or in his conception of the "conservation of psychism," or in his attempts to explain memory on a chemical basis, will certainly stimulate thought and future investigation. To quote once more from the preface: "It is hoped that this book will raise in the mind of those who read it more questions than it answers."

The last 160 pages of the book are devoted to a description of the laboratory work in physiological chemistry as carried out in the University of Chicago, and practical teachers will obtain many useful wrinkles by studying these. W. D. H.

OUR BOOKSHELF.

Cambridge Geological Series. Agricultural Geology. By R. H. Rastall. Pp. ix+331. (Cambridge: At the University Press, 1916.) Price 10s. 6d. net.

MR. RASTALL'S well-written and excellently printed book is a treatise on geology for agricultural students rather than on agricultural geology. To say this is no disparagement, since it is obviously intended for the stage in an agricultural curriculum when natural history subjects are predominant, and not for the later years when preliminary scientific conceptions are applied to the study of the soil. A knowledge of chemistry and elementary mineralogy is presupposed, but unnecessary technical terms are carefully excluded. The final chapter, on "The Geological History of the Domestic Animals," will appeal especially to those whose work is on the farm. The history of life on the globe is, indeed, far more appreciated by agricultural scholars than our text-books would commonly lead us to suppose. The details of British strata, such as the Ashgill Shale and the inevitable Oldhaven Beds, are still reverenced by examining boards, but are far less important than a philosophic outlook on the great romance leading up to man, the tiller of the soil. Mr. Rastall, however, makes good use of his opportunity, and gives us attractive descriptions of the types of country met with on various strata throughout England.

The chapter on soils, occupying twenty-eight pages, is a good example of the author's method. It contains a large amount of information without any appearance of compression; the details given fit into a continuous and pleasing essay. We unfortunately get no conception of the variations in the "fine earth" of soils, on which their fundamental characters depend, such matters being left (p. 144) to more purely agricultural teaching. Phosphatic deposits (p. 100), however, come within the geologist's province, and here we think that more analyses might have been inserted and a description given of materials, such as the beds of Florida and Gafsa, which are being worked commercially at the present day.

G. A. J. C.

British Rainfall, 1915. By Dr. H. R. Mill and Carle Salter. The fifty-fifth annual volume. Pp. 288. (London: Edward Stanford, Ltd., 1916.) Price 10*s*.

DR. MILL has been able, with the assistance of Mr. Carle Salter and Mr. R. C. Mossman, to prepare his annual account of British rainfall with almost the usual pre-war promptitude. The special feature of the volume lies in an account of the method of construction of a rainfall map, which is illustrated by a map of the Forth Valley above Queensferry, including an area of almost 1000 square miles. The fundamental rainfall facts are closely related to the elevation of the land and to the prevailing winds, and this relationship makes it possible to draw isohyets across districts where rain gauges are infrequent, with the result that as the years go by these rainfall lines approximate more and more closely to the final form which they will eventually take.

In May–June, 1915, practically the whole of Great Britain experienced absolute drought for twenty days. This was an unusual occurrence for Scotland. On the other hand, the west coast of Ireland and the north-west corner of Scotland had a rain spell which lasted from sixty to more than 100 "rain-days" consecutively. Remarkable rain splashes occurred at Abergavenny on July 4, when 2·2 in. fell in thirty minutes, and at Mildenhall, Suffolk, on June 30, when 2·63 in. fell in fifty minutes. The heavy thunderstorm of May 6 over the centre of London is specially mapped. On the whole, 1915 was a year of mean rainfall, since the areas of both heavy and light rains are smaller than usual; this circumstance is related to the fact that the dry east was wetter, and the wet west was drier, than on the average.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Germans and Scientific Discovery.

A GOOD deal is being written on the terms of peace and on our attitude towards the Germans after the war in the spheres of pure science, applied science, and industry generally. While these and similar topics are in the melting-pot of controversy, this might be the suitable time to bring up the subject of the attitude of Germans towards the history of science in general, and towards the part played in scientific discoveries by English-speaking people in particular.

Those familiar with German utterances during the last twenty years or so know well that German men of science, in giving the historical *résumé* of a subject, scarcely ever mention the names of British workers in that field. There is virtually a conspiracy of silence, especially as regards recent and contemporary workers. One would think, to read some German accounts of a subject, that it had been begun, continued, and ended in Germany.

To make our enemies realise to what an extent they are indebted to British thinkers would be one most excellent result of this dreadful war. Of course they know it; but they systematically conceal it; it should be a valuable part of their chastisement to be made now to confess it. They have concealed the successful part played in scientific discovery by English-speaking people as systematically as they have concealed the successes of the Allies in the present international conflict. They should be cast down from their self-assumed pride of place in the matter of scientific discovery, and made to confess who were the real pioneers in the painful fields of scientific work. It is well known that many truly epoch-making discoveries, things of the very first magnitude, were made by Britons, and that afterwards the Germans came in and adopted and utilised these discoveries in the interests, for the most part, of the expansion of their trade.

As one of the conditions of their being granted peace by those who shall conquer them on their own selected arena of brute force backed by perverted machinery and prostituted chemistry, they should be made publicly to acknowledge the enormous benefits to science made initially, not by themselves, but by those whom they forced to become their enemies, the Italians, the British, and the French.

It would be a salutary humbling of their scientific pride to be made to confess that it was the Englishman, Newton, who discovered the law of universal gravitation; the Englishman, William Harvey, who discovered the circulation of the blood; the Englishman, Priestley, who first isolated oxygen; the Scotsman, Joseph Black, who discovered the chemical relations of carbon dioxide; and the Scotsman, Rutherford, who discovered nitrogen gas. They must be made to know that the Englishman, Stephen Hales, was the first to perceive the necessity of a mechanical system of ventilation, to estimate the magnitude of the blood pressure *in vivo* by an instrument which he had devised for estimating the pressure of sap in plants, and that he was the first to invent an apparatus for artificial respiration. Chemistry as a science was created by the Englishman, Dalton. They should be made to confess that the steam-engine was a British invention, as was also the steamboat; that the electric telegraph, the telephone, and the phonograph were all inventions of English-speaking people. The bicycle and the aeroplane were devised on the soil of Britain.

It was Faraday, they should be made to confess, who laid the basis of electromagnetics, and therefore the foundations of that amazing industrial application of electricity as a mode of motion. It was Davy who showed the elemental character of the alkaline metals —a discovery of the greatest moment. They must be made to realise that Boyle, Cavendish, Watt, Stephenson, Leslie, Hutton, and Lyell, as well as John Hunter, Jenner, Simpson, and Lister, were Britons who made discoveries of the first importance. They must be forced to confess the supreme character of the work of Napier, the Herschels, Adams, Clerk-Maxwell, and Kelvin. We, on our part, always acknowledge the indebtedness of science to such Germans as Mayer, Helmholtz, and Ehrlich; whereas our enemies systematically conceal their immense indebtedness for the enunciation of first principles to men of the English-speaking race.

In regard to the splendid contributions to science of every kind made by the Italians and the French, the representatives of those nations must draw up their own lists, and they will not be short ones. The names they must contain suggest cardinal discoveries in every field of natural knowledge. It would be tedious to revert to the Italian Renaissance, because the names of the men of that epoch have become well known to anyone who knows anything at all of the story of the progress of science.

Eustachius, Malpighius, Borelli, Spallanzani, Galvani, Volta, and Avogadro in Italy; Lavoisier, Laplace, Lagrange, Montgolfier, Cuvier, Lamarck, Claude Bernard, Chevreul, and Pasteur in France, are names writ large in letters of gold across the azure of the firmament of European science. Not one of the following is German: Vesalius, Van't Hoff, Arrhenius, Helmont, Boerhaave, Mendeléeff, the Curies, Metchnikoff, and Pavlova.

Are the Germans grateful to us for what we have done in science? Do they realise, when they use railroads and steamers, dynamos and telephones, that they are all of British origination? They realise nothing of the kind. Not only are they not grateful for the benefits conferred on them by British science, but they have entered into a conspiracy of silence with regard to them.

Let us never forget that it was a German professor of physics who deliberately declared that German aircraft must destroy the tombs of Newton and of Faraday. He also included the tomb of Shakespeare, which was highly inconsistent with the widespread academic delusion that our and the world's greatest poet was a German.

D. FRASER HARRIS.

Halifax, Nova Scotia, September 30.

The Spectrum of Hydrogen.

THE writer has examined the four-line spectrum of hydrogen as produced in Geissler tubes with a 1 mm. capillary by alternating current of 15 milliamperes without inductance or capacity. The light was analysed by a glass prism monochromator, and the intensities measured by a photo-electric cell of quartz containing rubidium in an atmosphere of helium. The cell was calibrated in absolute units by a carbon filament lamp the energy distribution of which in different wave-lengths is that of a grey body in the visible spectrum.

The energy ratios of H_α, H_β, H_γ, H_δ were found to remain constant when the pressure exceeded three or four millimetres of mercury. At lower pressures the relative intensities of the lines of shorter wave-lengths increased. The effect is visually obvious in water-vapour which suppresses the many-line spectrum; this spectrum masks the effect when pure dry hydrogen is used.

The results lead to the conclusions that the four-line spectrum is due to the recombination of a +H ion with an electron; that the method of ionisation of the H atom has no effect on the distribution of intensities, but that the mean free path of the luminous atom and the nature of the atoms with which it collides give a sufficient explanation of the intensity changes observed.

According to Bohr's theory, the mean free path of a luminous hydrogen atom should be shorter as the emitted wave-length decreases. The distance travelled by the atom while luminous may be called the length of the luminous streak, and at high pressures this exceeds the mean free path of the luminous atom for all wave-lengths, so that a change in pressure affects all lines in the same proportion. As the pressure is lowered, however, the mean free path will eventually exceed the length of the luminous streak for H_α, while remaining less for H_β, and so the ratio $H_\beta \div H_\alpha$ may be expected to increase, as is actually observed. At still lower pressures the intensity ratios should approach a constant value when all the mean free paths are greater than the corresponding luminous streaks.

Observation of such ratios will give the relative energies in different wave-lengths emitted by the hydrogen atom when undisturbed by collisions, and experiments of this kind are in progress.

A full account of this work will be published shortly.

R. T. BEATTY.

Queen's University, Belfast, October 18.

Origin of the Word "Blizzard."

THERE have been a number of communications on the earliest use of the word "blizzard," but thus far there has been no suggestion as to its origin. At first sight perhaps it might seem unlikely that the name of some objectionable person was adopted to describe the extremely disagreeable features of the north-westerly snowstorm of the States. We have, however, "boycott" and other words added to our vocabulary with just as much justification as the old settlers in the West would have had for introducing "blizzard."

In Amersham churchyard there is a tomb (now collapsing into the grave) of the Blizard family (Otto Bajer), and to this day, at the neighbouring village of Chalfont St. Giles, there resides a Blizard family. We are here in the heart of the Penn country, the Home of America. It seems highly probable that one or more members of the Blizard family of Buckinghamshire emigrated with the earliest settlers, and it needs no great stretch of the imagination to realise how the name could have been adopted in the slightly altered form "blizzard." I offer the suggestion to the world-wide readers of NATURE.

HY. HARRIES.

Meteorological Office, South Kensington, October 24.

"PREPAREDNESS": THE AMERICAN WAY.

THE problem of organising a nation for war has had to be faced and partially solved by this country during the act of war. The war has led the Americans to tackle the same problem, with the advantage that they are at peace and at leisure to study it scientifically, with all our mistakes and their own difficulties in the supply of munitions before their eyes. It should be instructive to see what conclusions have been reached by a people with a genius for reducing everything to machinery, from the production of motor-cars to education.

The first step, in a democracy, was to bring home to every citizen the importance of the problem. Some of us may have smiled at the picture of the President of the United States, clad in a straw hat, a navy-blue jacket, and cream-coloured duck trousers, marching at the head of a great "Preparedness" procession, and waving a flag with the best of them. But Mr. Wilson knew what he was about. The Americans are incomparable advertisers. No other device could have so instantly focussed the attention of the whole mass of heterogeneous populations between the two coasts. This having been effected, the plan evolved by the Naval Consulting Board's Committee on "Preparedness" was set out in a series of articles written by leading Government officials and business experts, and introduced by an open letter from the President himself. Which of the great political journals was entrusted with this weighty national publication? The shocking truth cannot be concealed that it was not to the editor of anything analogous to our *Times* that the President wrote his letter with full confidence that it would reach the people. It was to the *Scientific American*—as it might be our own *Engineering*—and there the articles appeared during the late spring of the present year.

They start with what seems to them an axiom, though it is still so difficult for many of our fire-eaters to realise it: "The one great lesson of the European conflict is that defence is not obtained to-day by fighting *men* alone, but by fighting *industries*. Behind every man in the firing line in Europe, from three to five persons are employed to supply him with food, ammunition, and other needs." Their experience of the first year of the war convinced them that the people will never reach the right point of view till they realise "what a mess we have made of our attempts to supply munitions to the Allies." So an article is devoted to the initial difficulties. A large firm in the West is instanced, which cheerfully took on a contract for 250,000 3-in. high-explosive shells.

It seemed a simple and profitable job. But the firm soon realised that by turning their plant—a first-class machine shop—on to it they might hope to accomplish it in eight months, and then it would only be one day's supply for *one* of the Allies. But so many difficulties intervened that after eighteen months they had only 130,000 shells accepted, which still had to be fitted with fuses and loaded and put through other processes. None had yet reached the battlefield.

Before production can be started an enormous number of measuring tools and gauges must be provided. The three famous firms engaged in this manufacture—the Brown and Sharp, the Pratt and Whitney, and the Greenfield concerns—found, on comparing estimates, that to produce 200,000 shells a day, the amount under contract for the Allies, would require in gauges and measuring tools alone an investment of from seventeen to twenty million dollars. Many of the best-known firms in the U.S. had been at work a year on the provision of this preliminary outfit without turning out sufficient finished product to be worth inspection. They have "made up their minds that if they are ever to be called on for the service of the nation they have to learn a great deal more about this business of making munitions, or in the event of war they would prove to be liabilities to the nation and not assets."

The plan worked out by the Naval Consulting Board is then expounded. It involves three steps:—

The first step consists in the taking of a complete census of the producing resources of the country, to be tabulated on a card index. This is to include an inventory of industrial manufacturing establishments which, it is thought, will cover eighty thousand firms.

The index will show the ground area, floor space, number of stories, housing accommodation, and possibility of increase in emergency; sources of heat, light, water, power; tool equipment idle in slack season; limits of precision in machine work, principal materials used and where purchased, and principal products manufactured; number of men, skilled and unskilled, number of toolmakers, of women, and of men who could be replaced by women; percentage of employees who are not American citizens; means of transport, trucking distance, and quality of street service to shipping point, trucks owned and hired, and shipping facilities by water.

The census is to cover the resources of the country in minerals and materials, with special stress on petroleum supplies and the utilisation of water-powers. To prepare it President Wilson invoked the aid of the five great engineering societies—civil, mechanical, mining, electrical, and chemical. In every State a member of each of the five societies has given his services gratuitously to form a board of five directors for the State, and under the supervision of these boards the 30,000 members of the societies have been at work. The Chambers of Commerce have given their aid, private firms have provided offices and furniture free of cost, and the newspapers have given advertisements and articles to boom the movement. It was expected that the bulk of the work would be completed by the end of May, 1916.

The second stage of the plan will consist in placing small educational orders for munitions with large numbers of selected firms annually in time of peace.

It is felt that while the Government must have its own factories distributed throughout the country to act as educational centres and clearing-houses, they would in any important war have to rely on privately owned plants. Everything connected with these orders will be done exactly as it would be were the order a war order of one hundred times the magnitude. The work will be educational. The purchasing department of the company will learn where to buy materials; the manufacturing department how to handle them and make the necessary jigs and tools; the inspection department will become familiar with Governmental inspection; the engineering department with Government blue-prints and specifications; the firm with Governmental methods of business; and the shipping department will know how to crate and ship the finished article.

The terms on which these contracts are to be made are significant. They are to be on a basis of cost plus a reasonable profit, or at a fixed dividend. There are to be no excess profits for anybody arising out of the national need, but the stockholders are to have a living wage, "since it is economically undesirable that the stockholders cease to have any dividend from their investment"! In this way will be prevented any suggestion of a profit-interest in war, of a munition lobby, of a section of the community having an interest in forcing the nation into war. If there is a war every person in the nation must accept his share of the national sacrifice and turn in and work in whatever place his ability can be best applied.

The third and final step in the programme is the enrolment of skilled labour in an "Industrial Reserve" in time of peace. Skilled mechanics in all lines of production must be kept from enrolment in the Army. Rather must bankers, clerks, shopkeepers, and professional men be sent. The skilled workers must be badged, and the only restriction imposed on them by the badge will be prevention of enlistment. Enrolment in the Industrial Reserve will be considered to carry with it honours equal to enrolment in the fighting forces.

It is claimed that this plan is a most democratic and American way of doing the job. It is cheap; it lays the ghost of a munitions trust, with its dangerous interest in provoking war; it safeguards labour from exploitation for excess profits; it educates the manufacturers; and it is not only an insurance against war, but it has great advantages in peace.

Direct organisation for peaceful competition is dealt with in another series of articles. The survey of national resources and their conservation includes significantly "our 22,000,000 children." These must be trained, not only in the schools, but in the vital years between fourteen and eighteen, the waste of which has recently been pointed out by Mr. Galsworthy in the Press and Lord Haldane in the House of Lords. The methods of intensive industrial efficiency which were coming into notice before the war must be continued and developed.

Other articles deal with the disposal of the finished products—the careful preparation of the ground in foreign markets by personal inquiries; by correspondence with consular agencies, chambers of commerce, and universities; by improved methods of packing and dispatch; and by cultivating the "human side of salesmanship." Some of the devices described under this last head would not commend themselves to British ideas, and are not perhaps very seriously urged. There is a thoroughgoing materialism in some of the utterances quoted which we could not accept. "Real immorality," says Prof. Carver, of the Economics Department of Harvard University, in a paper on the Conservation of Human Energy, "is nothing in the world except waste or dissipation of human energy. Real morality is nothing in the world except the economy and utilisation of human energy. The reason why it is better to tell the truth than to lie is because a community in which truth prevails will waste less energy than a community where lying prevails. . . . Honesty is one of the greatest labour-saving inventions ever devised. This may be said of any other form of morality which is genuine and not merely conventional."

There are things in our British life which we should not sell for all the markets in the world. But the treasuring of these ideals is not inconsistent with sane preparation to meet the tremendous competition we shall have to encounter in the material sphere at the conclusion of the war. What this preparation should be, in the opinion of President Wilson, is indicated in the letter addressed by him to the editor of the *Scientific American*, directing attention to the articles which have since appeared in that journal. We think it worth quoting in full:—

It will be a signal service to our country to arouse it to a knowledge of the great possibilities that are open to it in the markets of the world. The door of opportunity swings wide before us. Through it we may, if we will, enter into rich fields of endeavour and success. In order to do this we must show an effectiveness in industrial practice which measures up to our best standards. We must avail ourselves of all that *science* can tell us in aid of industry, and must use all that *education* can contribute to train the artisan in the principles and practice of his work. Our industries must be self-reliant and courageous, because based upon certain knowledge of their task, and because supported by the efforts of citizens in the mills. If scientific research and the educated worker go hand in hand with *broad vision in finance* and with that keen *self-criticism* which is the manufacturer's first duty to himself, the fields will be few indeed in which American commerce may not hold, if it chooses, a primary place.

The significant thing about this letter is that there is in it no allusion to Protection. The President is for open operations by an industry relying on its own efficiency, not for trench warfare behind tariffs. Science, education, broad vision in finance, self-criticism—that is the programme. A nation which has imagination, courage, and honesty enough to depend on these can look forward without fear to whatever the future may have in store for it.

J. C.

RHODODENDRONS AND LIME.

IN a note in NATURE of February 17, 1916 (vol. xcvi., p. 684), reference was made to Mr. Forrest's discovery of rhododendrons growing on limestone rocks in N.W. Yunnan. In this connection Lady Wheeler-Cuffe, writing from Maymyo, Upper Burma, informs the Editor that she found "a beautiful blush-white rhododendron growing actually wedged into a bare limestone crag on the very summit of Sindaung (6022 ft.), in the southern Shan States, a few years ago." Mr.

Forrest also states definitely that he found rhododendrons with their roots actually spreading in the crevices of the limestone rock.

From the evidence of Mr. Forrest and Lady Wheeler-Cuffe it would appear that these particular rhododendrons must come in contact with a large quantity of lime, but, unfortunately, we have no definite information as to the particular character of the limestone rocks on which they have been found.

In the European Alps the two endemic species of rhododendron, *R. ferrugineum* and *R. hirsutum*, are recognised as being chalk-avoiding and chalk-loving respectively. *R. ferrugineum* is found in damp, deep-layered soil rich in humus, and it will only grow in a limestone region when there is an overlying layer of humus. *R. hirsutum*, on the other hand, is a limestone rock plant, found in dry, open situations, and when the two species are found in the same locality, *R. hirsutum* grows only on the rocks, while *R. ferrugineum* occurs in the pockets of humus. The hybrids which have been raised in gardens with *R. hirsutum* as one of the parents are also lime-loving, like that species.

Several of the new Chinese rhododendrons which were collected on limestone are now being experimentally cultivated in this country on various lime-containing soils. Some of the species (see Grove in *Gardeners' Chronicle*, January 29, 1916, p. 65) appear to thrive under these conditions very well, while to others the lime has proved fatal, but the experiments have not been in progress for a sufficiently long time for a definite verdict as to the behaviour of these limestone rhododendrons under cultivation to be given.

The abhorrence of lime by the humus-loving rhododendrons appears to be intimately connected with the mycorrhiza, the symbiotic fungus which lives in association with the roots of the rhododendron and heath family (Ericaceæ), and performs the functions of the root-hairs in absorbing water from the soil; and it may be that the mycorrhizal fungi associated with the humus-loving forms of rhododendron are physiologically, if not specifically, distinct from those of the lime-loving species.

It has recently been shown by Rayner, Jones, and Tayleur (*New Phytologist*, vol. x., 1911, pp. 227–240) that the common ling, *Calluna vulgaris*, though it is sometimes found on chalk downs, is really growing in pockets of loamy soil rich in mineral constituents but poor in lime. It is also worthy of note that in the "limestone pavement" district of Westmorland ling grows vigorously in the very thin layers of earth which lie directly on the limestone rock. An analysis of the surface soil, however, reveals an almost complete absence of lime, and so lime-free is this layer that it is actually necessary to add lime thereto in the course of ordinary agricultural operations.

Cultures made by C. A. Weber and Graebner (see Graebner, "Lehrbuch der Allgemeinen Pflanzenphysiographie," 1910, p. 236) have shown that the lime-avoiding Ericaceæ and other plants they examined suffer from lime only when this is associated with a large amount of soluble salts, and that root-formation fails when nutritive salts are in abundance in the presence of lime. Rhododendrons, however, do not appear to have been among the plants examined.

In connection with their behaviour towards lime-containing soils, plants may be roughly divided into two groups: of those which avoid lime, the heath family affords one of the most striking examples, but, contrary to expectation, certain members of the family, as, for instance, *R. hirsutum*, are characteristic plants of limestone districts.

It seems probable from the evidence now before us that some of Forrest's newly discovered Chinese rhododendrons, as also the one found by Lady Wheeler-Cuffe, must be reckoned as lime-loving species, but in all these cases the interesting question as to the quantity of lime absorbed by the plants growing on limestone rock still awaits an answer. Under natural conditions these lime-loving rhododendrons are flourishing on what we should consider a very sterile medium, and it may be that the poor growth which such plants exhibit when grown in lime-containing soil in our gardens is due to the superabundance of soluble nutritive salts, which may cause the lime to react unfavourably on the mycorrhiza of the roots, and that, under certain chemical conditions, the lime may have a definitely toxic influence. A. W. H.

NOTES.

AT a meeting of the council of the National Museum of Wales held at Cardiff on October 28, it was announced that a sum of 10,000*l.* had been received in War Loan Scrip from Capt. W. R. Smith, senior partner of the firm of W. R. Smith and Son, Cardiff, and Mrs. Smith towards the building fund of the new museum. The generous donors had made this gift in the belief that the National Museum would be one of the first educational influences in the Principality. There were other donors, who wished to remain anonymous for the present, and it is expected that when the present contract has been paid there will be a balance of about 16,000*l.* towards the 50,000*l.* which is needed to complete the furnishing and equipment of the portion of the building at present in course of erection.

DEALING with the fine collection of statues of eminent Welshmen at Cardiff unveiled by Mr. Lloyd George, a correspondent, writing in the *Western Mail*, points out with regret that no man of science figures in the series. He says that Robert Record, of Tenby, who flourished in the first half of the sixteenth century, might well have been included. Record was a man of cyclopædic knowledge, and was most eminent in his time, though little known to modern Welshmen. The use of the sign = to denote equality was introduced by him in 1557. He was "the first mathematician who wrote on arithmetic in English; the first who wrote on geometry in English; the first who introduced algebra into England; the first who wrote on astronomy and the doctrine of the sphere in English; and, finally, the first Briton (in all probability) who adopted the system of Copernicus." As a statue or two are still to be added, perhaps science may yet be represented in the Welsh Valhalla.

LORD RAYLEIGH presided at a meeting held at University College, London, on Tuesday, October 31, to take steps to establish a memorial to the late Sir William Ramsay. Mr. J. A. Pease, M.P., Postmaster-General, in moving that a memorial fund should be raised, to be utilised in promoting chemical teaching and research, under a scheme to be approved hereafter, said he was glad on behalf of the Government to pay a tribute to the memory of Sir William Ramsay and to take part in the great object of the meeting. The memorial should be not merely national, but international. Sir J. J. Thomson seconded the motion, which was supported by the Belgian Minister, who wished to convey the respectful homage of Brussels University, and by Mr. W. H. Buckler, who testified to the interest of the American Ambassador and his countrymen in the movement. The resolution was carried. It was also agreed that the meeting should resolve itself into a general committee, with Lord Rayleigh as chairman, to raise the necessary fund, and an executive committee was appointed to circulate an appeal.

A NEW departure in the study of Indian phonetics and linguistics is marked by the presentation before the Royal Asiatic Society, by Sir G. Grierson, head of the Linguistic Survey of India, of a series of gramophone records of four languages of the Munda group, prepared under the orders of the Government of Behar and Orissa. These comprise the Kharia, Mundari, Ho, and Santali, and one of the Dravidian group, Kurukk. In each case a version of the tale of "The Prodigal Son" has been reproduced, with some marriage songs and items of folklore. The work is important because the Munda tongues are a widespread group, extending through India proper to Assam, Burma, thence to Indo-China and the Malay Peninsula, and eastward to Easter Island. A copy of these records will be deposited at the India Office Library, a second in the British Museum, and a third in the rooms of the Asiatic Society. It is significant that this new record of phonetics is produced just as the first director of the School of Oriental Studies has been appointed. It may be hoped that similar records for other Indian languages may be prepared, and the scheme might be extended to other languages taught in our schools.

THE Chinese Government is becoming alive to the need for a proper geological investigation of the mineral resources of the country, and the lead in this task has been entrusted to Swedes. As the head of the survey, Dr. J. G. Andersson, formerly chief of the Swedish Geological Survey, has been appointed, and with him already are Dr. Tegengren and Prof. U. Nyström. We now learn that Dr. T. G. Halle, assistant in the palæobotanical department of the Riksmuseum at Stockholm, is to travel in China for one year, mainly in the interests of his own department, for which he will collect Palæozoic plants, but partly for the Chinese Government, to which he will report on the age and character of the coal-seams inspected, and for which a duplicate series of fossils will be provided after their determination. A young Chinese geologist will accompany Dr. Halle, and will be trained by him as a palæobotanist. The spring and summer will be devoted to the northern provinces, especially Shansi, with its enormous deposits of anthracite and ordinary coal. The coal-field of greatest scientific interest lies round and south of the Yangtse river, but how far this can be visited must depend on political conditions, now considerably disturbed. The expenses are borne by friends of the Swedish museum, but naturally every assistance will be given by the Central Government at Pekin.

A PAPER on food economics, by Prof. G. Lusk, in the Journal of the Washington Academy of Sciences for June 19, is worthy of study by everyone, and especially by those sending parcels of foodstuffs to prisoners in Germany. Prof. Lusk describes briefly how Germany tackled the all-important question of foodstuffs at the outbreak of the war. In order to maintain the protein portion of the nation's food the committee of investigation recommended that considerable increase should be made in the bean crop in Germany. Modifications were put forward in connection with the production of cereals, cheese, and skim milk, and it was finally concluded that the German people, through the co-operation of millions of inhabitants, would be able to obtain a ration of 3000 calories per adult per day, and so escape suffering from lack of food. A prisoner of war, doing moderate work, could get along on a ration of 2500 calories, composed as follows:—Proteins, 100 grams; carbohydrates, 400 grams; fats, 50 grams. On the assumption that a gram (roughly $15\frac{1}{2}$ grains) of protein yields 4·1 calories, and that the corresponding values for carbohydrates and fats are 4·1 and 9·3 respectively, it is obvious that the total caloric value of this ration is about 2500. Prof. Lusk points out that true food reform demands the sale of food by calories and not by pounds, and he gives an instructive table of various articles of food, showing the weight and price of each necessary to produce 2500 calories. The following are some of the foodstuffs mentioned, and their costs in New York:—Oatmeal, 1 lb. $5\frac{1}{2}$ oz., $2\frac{3}{4}$*d.*; wheat flour, 1 lb. 8 oz., 3*d.*; sugar, 1 lb. $5\frac{1}{2}$ oz., $3\frac{1}{2}$*d.*; rice, 1 lb. $8\frac{1}{2}$ oz., $3\frac{3}{4}$*d.*; bread, 2 lb. 1 oz., 4*d.*; lard, $9\frac{1}{2}$ oz., $4\frac{1}{4}$*d.*; potatoes, 8 lb. 1 oz., 8*d.*; raisins, 1 lb. 12 oz., $10\frac{1}{2}$*d.*; cheese, 1 lb. 3 oz., $11\frac{3}{4}$*d.*; butter, 11 oz., 12*d.*; cocoa, 1 lb. 1 oz., $14\frac{1}{2}$*d.*; lentils (dried), 1 lb. 8 oz., 15*d.*; salt cod, 6 lb., 45*d.*

OFFICERS of the Royal Artillery and the Royal Engineers, besides a large circle of friends in the teaching profession, will learn with deep regret of the sudden death, on October 18, of Mr. C. S. Jackson, Instructor of Mathematics and Mechanics at the Royal Military Academy, Woolwich. Before entering as a scholar of Trinity College, Cambridge, Mr. Jackson was head of Bedford School. He was eighth Wrangler in 1889, in the following year took the premier place in Part II. of the Law Tripos, and was called to the Bar shortly afterwards. In 1891 he joined the staff of the R.M. Academy, and for the past twenty-five years worked there with rare distinction and single-hearted devotion. He was a member of the council of the Mathematical Association, and took a prominent part on the various committees of that body, the reports of which have done so much to improve the mathematical teaching of our schools. He was also the first president of the London branch of this association. His great knowledge of the educational requirements of the country was recognised by the Board of Education when, in connection with the International Congress of Mathematicians, which met at Cambridge in 1912, it was determined to issue a series of reports dealing with the teaching of mathematics in secondary schools. The organisation of the work in connection with these reports was put into the hands of Mr. Jackson, and they form a lasting tribute to his far-sighted outlook on mathematical education. His work at Woolwich brought him into contact with the applications of mathematics to the problems of gunnery and military engineering. Working on these lines, he became a pioneer in breaking down the barrier that so long existed between so-called rational mechanics, as taught in our schools, and mechanics as applied to the problems of civil and military engineering.

THE *Nieuwe Courant* reports the death, at sixty-three years of age, of Prof. A. Torp, of the University of Christiania, the most famous of Norwegian philologists.

ACCORDING to the *Chemisch Weekblad,* the Bakhuis Roozeboom medal has been awarded to Prof. Schreinemakers, professor of inorganic and physical chemistry in the University of Leyden.

WE notice with much regret, in the *Times* of October 30, the announcement of the death, at seventy-seven years of age, of Prof. Cleveland Abbe, the well-known meteorologist of the U.S. Weather Bureau, Washington, D.C

THE Horace Dobell lecture of the Royal College of Physicians of London will be delivered by Dr. H. R. Dean on November 7. The subject will be "The Mechanism of the Serum Reactions." On November 14 and 16 Dr. W. H. R. Rivers will give the Fitz-Patrick lectures on "Medicine, Magic, and Religion" (part 2).

DR. E. D. VAN OORT's report on the activities of the State Museum of Natural History at Leyden for the year ended September 1, 1916, records the transference of the collections to the new building in the Van der Werf Park, but laments that even now the collections are totally inaccessible to the public at large, owing to the lack of any exhibition galleries. The retirement, after forty-five years' service, of Dr. C. Ritsema Czn, keeper of the entomological collections, is a great loss to the museum. He is succeeded by R. van Eecke.

OWING to the pressure of his duties at Columbia University, Prof. M. H. Whitaker has resigned the editorship of the *Journal of Industrial and Engineering Chemistry,* one of the official organs of the American Chemical Society. He will be succeeded in that post by the president of the society, Prof. C. H. Herty, who will relinquish at the end of the year his duties as head of the department of chemistry at the University of North Carolina in order to devote his whole time to editorial work.

THE death is announced, in his seventy-fifth year, of Dr. Albert J. Cook, professor of zoology and entomology at the Michigan Agricultural College from 1866 to 1893, and afterwards professor of biology at Pomona College, California. From 1894 to 1905 he superintended, the university extension work in agriculture in connection with the University of California. Prof. Cook is said to have been the first to make kerosene emulsion (in 1877), and to demonstrate and advocate the use of the arsenites as a specific against the codling moth (in 1880). He was the author of a manual of the apiary, and also of publications on "Injurious Insects of Michigan," "Silo and Silage," "Maple Sugar and the Sugar Bush," and "Birds of Michigan."

CAPT. J. O. WAKELIN BARRATT, who is serving with the British Expeditionary Force in France, writes:— "On October 17, at 9 p.m., an exceptionally fine lunar rainbow was visible in the west at Etaples (the moon had risen in the east). The width of the rainbow was fully equal to that of a solar rainbow, but no colour was recognisable, the rainbow being of a uniform light grey appearance." Full moon was on October 11—six days earlier—so that the atmospheric conditions must have been very favourable for a lunar rainbow to be distinctly visible. Such rainbows are usually faint, and their colours are not easily distinguished on this account. They generally have the appearance of a whitish or yellowish arch, except when the moon is full and other conditions are good, in which case colours may be seen, as in a solar rainbow.

THE sixth war course of Chadwick public lectures began on October 27 with a lecture on the physiological basis of fatigue by Prof. W. Stirling at the Royal Society of Arts. Prof. Stirling will give two other lectures on the effects of fatigue on industry and efficiency on November 3 and 10 at the same place at 5.15 p.m. Dr. C. Porter will deliver three lectures at Norwich Museum during November on the health of the future citizen. Dr. J. T. C. Nash will lecture at the Hampstead Central Library on November 20 on baby-saving for the nation; and Mr. P. Waterhouse will give three weekly lectures at the Surveyors' Institution, London, on architecture in relation to health and welfare, beginning on November 30. The lectures are free, and particulars concerning them can be obtained from the offices of the Chadwick Trust, 40 (6th) Queen Anne's Chambers, Westminster.

WE regret to note that *Engineering* for October 27 records tne death, on October 7, of Col. T. Turrettini. Col. Turrettini was born in 1845, and his experience in hydraulic and electric machinery led to his election as one of the experts for the harnessing of the Niagara Falls in 1891. He was president of the Swiss National Exhibition held in Geneva in 1896. In the same number of *Engineering* is also recorded the death of Sir Henry Benbow, a prominent naval engineer officer of the past generation. In the Nile expedition of 1885 Sir Henry Benbow's name appears in the official despatch for his brilliant feat of repairing the boilers of the rescuing steamer under heavy fire, thus saving Sir Charles Wilson and his shipwrecked comrades. He was promoted to chief inspector of machinery in 1888, and was placed on the retired list at his own request in 1893.

SEVERAL further letters have reached us upon the subject of the scarcity of wasps during the past summer. The abundance of queen wasps referred to by correspondents last week seems to have been noticed in many districts. Mr. C. F. Butterworth, writing from Poynton, Cheshire, seven miles from Stockport, says:— "The queen wasps were much more numerous this year than I have known them during quite ten well-observed years, when I have kept honey bees and regarded these things with interest." Mr. K. Evershed, Kenley, Surrey, noticed a number of queen wasps in the spring, but adds, as to wasps in general:— "I do not recollect so marked a scarcity during the last thirty-five years in this county." Mr. V. E. Murray says that in the Reading district also their numbers have been considerably below the average. He adds:—"In July I observed early wasps on the flowers of Scrophularia (which they fertilise), and during the autumn, while engaged on a study of ivy, particularly as regards its fertilisation (in which they also take part), I have noticed a sprinkling of these insects obtaining honey from the discs of the flowers, this being the only occasion on which I have seen even a moderate number assembled. It was interesting to observe these wasps now and again preying on the numerous flies also attracted by the honey, bearing their victims to the ground and killing them after a short, fierce struggle. In one case when a wasp had finished feeding on a fly the head of the latter was found to have been severed from the trunk, and in another instance, when I disturbed a wasp killing a fair-sized fly, it flew off, carrying its prize bodily away!"

THE Harveian oration was delivered by Sir Thomas Barlow, at the Royal College of Physicians, on October 18. The story of Harvey's life and of his great discovery of the circulation of the blood have often been told, and Sir Thomas Barlow dwelt on certain minor, but none the less important, details of Harvey's life before proceeding to consider Harvey as physician and as Court physician to Charles I., his Oxford life, his great discovery and work on generation, and his relations with the College of Physicians. Harvey was a pupil at King's School, Canterbury, and gained there a scholarship which enabled him to proceed to Caius College, Cambridge. The regulations for this scholarship, founded in 1571 by Matthew Parker, Archbishop of Canterbury, are probably unique for the period, and enjoined that the scholar should be educated first in subjects that pertain, or are serviceable, to medicine, and then in subjects which actually constitute medicine itself. In 1600 Harvey entered the University of Padua, and studied anatomy under the learned Fabricius, returning home in 1602, became a fellow of the College of Physicians in 1607 and attached to St. Bartholomew's Hospital, with which he was connected for thirty-six years. Sir Thomas Barlow's estimate of this side of Harvey's life is that, besides being a great anatomist and naturalist, he was an experienced pathologist, a learned physician, and had the qualifications of a good, all-round practitioner. The College of Physicians was the chief interest of his old age, and he enriched it with many benefactions. The last exhortation of the great master was "ever to search out and study the secrets of Nature by way of experiment, and for the honour of our profession to continue in mutual love and affection among ourselves."

SOME weeks ago there was considerable speculation as to the truth of the reports concerning Germany's new super-Zeppelins, and the matter was referred to in these columns. Since that date two Zeppelins of the very latest type have been brought down in England, and one in such a state of preservation that detailed information has been readily obtained from it. Excellent descriptions of this airship have appeared in the daily papers, and a particularly correct account in the *Times* for October 19. All the main particulars of the early reports are justified. The capacity of the L33 has been estimated at 2,000,000 cub. ft., its length at 680 ft., and the total horse-power at about 1500, which entirely confirms the figures previously given in these columns. More information is now available concerning the minor details of the new design. A point worthy of particular notice is the centralisation of the controls, the whole airship being under the control of the men in the forward gondola. Bombs and petrol tanks are carried in a passage-way along the keel of the ship, which also serves for communication between the various gondolas. The extent of the development of small details is illustrated by the fact that provision has even been made for dropping the petrol tanks in case of emergency, to save all possible lifting power. The bomb-releasing arrangements are exceedingly neat and trustworthy, and an armament of nine machine-guns has been provided. The construction of the main framework is very ingenious, the strength being enormous for the weight of metal used. In view of the great improvements in the design of these latest Zeppelins, it is comforting to think that our defensive measures have proved so successful against them, and that the raiders no longer enjoy the comparative immunity from loss which characterised the earlier raids.

WE have received the report of the Director-General of Public Health, New South Wales, for the year ended December 31, 1914. It contains a summary by the Director-General, Dr. Paton, of the general public health administration, reports of the work of the various departments and of the State hospitals, and the report of investigation and research work of the microbiological laboratory. The routine examination of rats and mice for plague infections forms a part of the work of this laboratory, and it is of interest that no plague infection has been found since 1910 among these rodents, although some 60,000 animals have been examined during the years 1911–14 inclusive.

PHYSICIANS and psychologists will find a critical discussion of the value and limitations of the intelligence tests in diagnosing the mind of a child, in the *Psychological Review* (vol. xxiii., No. 5). The writer, Mr. J. V. Haberman, finds the Binet method entirely inadequate to furnish an accurate or truthful equation of the general intellectual ability of an individual, and, further, insists that even if general ability were so tested it would be of no diagnostic value to the psychopathologist, since in mental pathology the processes involved are not always of the nature of general ability, but of mental functioning. He suggests a method of testing which shall serve in diagnosis, prognosis, and prophylaxis, and that shall give a clue to therapy and remediable pedagogic processes. He also points out that this testing should not be in the hands of the psychologist only, but of a physician with a psychological training. The increasing importance now being attached to tests renders the criticism of an expert pertinent and valuable.

IN the numbers of *Scientia* for September and October, 1916, Prof. Eugenio Rignano writes the two parts of an elaborate and interesting psychological study of what he calls "intentional" reasoning. In *Scientia* during last year he published several articles concerned with the psychological analysis of reasoning, and the present contributions complete this analysis. In the reasoning previously considered, the reasoner, at least at the moment when he begins his reasoning, has no intention to support certain theses at the expense of certain others, but only that of discovering the truth. On the other hand, the "intentional" reasoner sets about reasoning for the purpose of proving the correctness of definite assertions which he has at heart. Prof. Rignano's work is divided into two main parts, which deal with the two chief varieties of "intentional" reasoning: dialectical reasoning and metaphysical reasoning. The latter part is subdivided into sections on metaphysical theology; metaphysics properly speaking; finalism, animism, and vitalism; the function of language in metaphysical reasoning; and positivism and metaphysics. These researches are particularly interesting at the present time, when the attention of many philosophers and men of science is fixed on scientific method in philosophy, and some philosophers are gradually coming to recognise in their work that in philosophy, just as in what is usually called science, only an unbiassed search for truth is really legitimate and can lead to permanent results. Of course, this seems a truism when stated thus as a maxim of method, but it is none the less a fact that philosophers have not, as a rule, hitherto worked in accordance with it.

DR. W. D. MATTHEW, in the Bulletin of the American Museum of Natural History (vol. xxxv.), describes in great detail "A Marsupial from the Belly River Cretaceous." The remains forming the subject of this communication comprise no more than the left ramus of the mandible, the symphysis of the right mandible, and fragments of the cranium, but they constitute the most complete remains of fossil mammals yet discovered in the Cretaceous. These remains are assigned the rank of a new genus and species—*Eodelphis Browni*—of the family Cimolestidæ, which is not clearly separable from the Didelphidæ. The specimen was discovered during the work of under-mining a Ceratopsian skull, beneath which it lay. Being thus accidentally found during work with a heavy pick, it was badly shattered, but it is believed that all the fragments originally preserved have been recovered.

MR. E. C. CHUBB, the curator of the Durban Museum, is to be congratulated on the admirable "General Guide" which he has prepared for the aid of visitors, a copy of which has just reached us. Mr. Chubb has evidently made the most of the collections under his charge, though it would seem that great gaps have to be filled, even in so far as African mammals are concerned. If we may judge from this guide, neither the elephant nor the giraffe is yet represented here. When a new edition of this guide is issued we would suggest that the statement that the "lamp-shells," or Brachiopods, are possibly related to the starfishes should be corrected, while in regard to the information concerning flexible sandstone the fact might be added that it is found in India and Brazil. At the present time the Durban Museum occupies no more than the first floor of the south block of an imposing pile of buildings serving also as an art gallery and public library, and apparently yet other functions. In the course of time it is to be hoped the Natural History Department will either oust its rivals or find new and more commodious quarters elsewhere; as matters stand, the space allotted to it is inadequate.

MR. E. P. MEINECKE, in U.S. Dept. Agric. Bulletin, No. 275, entitled "Forest Pathology in Forest Regulation," gives the results of an investigation, as regards the incidence of wounds and disease, of 160 felled trees of *Abies concolor*, varying in age from 60 to 258 years. These trees were representative of the ordinary condition of the species under natural forest conditions in Oregon. Only one-fourth of the trees were found to be free from wounds. The rest had all been injured at one time or another by lightning, fire, frost-crack, etc., or by a combination of these, and as the wounds permitted infection by fungi, decay had set in. After the trees had reached eighty or ninety years of age, 70 per cent. were more or less badly wounded; and at 106 years, 80 per cent.; but serious decay of the timber rarely set in until about the age of 130 years. Fire, usually caused by lightning, is the greatest enemy. The management of the forest should be modified by the pathological conditions, as it is evident that much may be done to avert decay and destruction of valuable timber by timely removal of wounded and badly suppressed trees, and by fixing the felling rotation at 130 to 150 years.

THE richness of Sweden in water-power, and Denmark's natural poverty in any sources of power, has led to Sweden exporting electric power across the Sound. The works are established in the small river Låga, in Småland, and the current is carried by overhead wires to Helsingborg, and thence by three submarine cables under the waters of the Sound to Marienlyet, north of Elsinore, on the island of Seeland. According to *La Géographie* (vol. xxxi., No. 2), the Swedish power station sends 500 h.p. to Denmark, but the company undertakes to increase this to 5000 h.p. Precautions have been taken so far as possible to prevent the cables being fouled by the anchors of ships.

THE Royal Italian Geographical Society has issued as one of its special memoirs a handbook and index to the names which appear on the Austrian Staff map (1 : 75,000) of the Alto Adige, the new province of Italy lying north of the Trentino ("Prontuario dei nomi locali dell' alto Adige"). The index itself, apart from the introduction, runs to more than one hundred pages, and contains all the names on the fourteen sheets of the map, with their Italian equivalents. Pending the preparation of a new map, this index should be of great value, as many of the places are difficult to identify from the German versions of their names, which often bear no relation to the Italian. The work has been done under the direction of Signor E. Tolomei.

WITH the view of increasing the commercial utility of cobalt, Dr. H. T. Kalmus, of Queen's University, Kingston, Ontario, has carried out a number of investigations of the physical properties of the metal and its alloys for the Mines Branch of the Department of Mines of Canada. The fifth of these investigations deals with the magnetic properties of pure cobalt and of the alloy Fe_2Co, and has been conducted by Dr. Kalmus and Mr. K. B. Blake. The B, H curves of both materials have been obtained by the Burrows method in use at the American Bureau of Standards. For pure cobalt the value of B for $H=100$ is only about 5000, while older observations had given 8000. At $H=150$ B has risen to 6300, and shows no sign of the material being magnetically saturated. The Fe_2Co alloy, when cast, is very liable to fine cracks, but after forging is more than twice as strong as pure iron. At low fields its magnetic permeability is less than that of pure iron, but at fields exceeding 8 it is greater, and for fields of the order 50 to 200 is approximately 25 per cent. greater. The hysteresis loss is considerably less than that of transformer steel, and its electrical resistance about the same as that of pure iron.

A PAPER by the late Lieut. F. Trevor Wilkins (Northumberland Fusiliers), read at the Institution of Mechanical Engineers on October 20, gives an account of some trials of a small Diesel engine at the University of Birmingham. The manner of conducting these trials and reducing the results enabled figures to be presented additional to those usually given in such investigations. The indicator diagrams have been redrawn upon a heat-energy chart, and by this means any differences between the theoretical and practical cycles are clearly exhibited. The amounts of heat passing to the cylinder walls and to the exhaust were determined accurately. The heat flow during the compression and expansion strokes was estimated separately, and the period during which this heat flow takes place was indicated definitely. At full load the thermal efficiency, heat to jackets, and heat to exhaust are respectively 42·1, 29·6, and 28·3 per cent., these being the results of the test. The corresponding figures from the energy diagrams are 42·5, 25·3, and 32·2 per cent.

OUR ASTRONOMICAL COLUMN.

THE FIREBALL OF OCTOBER 20.—Mr. Denning writes that forty-six observations of this brilliant object have reached him. It was seen from widely distant stations, the most northerly being Rothes (Elgin), and the most southerly Totteridge (Herts) and Bristol. The fireball was a splendid one, and it traversed a long flight of about 252 miles, from over a place 60 miles N.W. of Edinburgh to 50 miles E. of Whitby, Yorks. Its elevation decreased from 68 to 25 miles, and its velocity was about 17 miles per second. The radiant point was near ζ Herculis, situated low in the N.W. by W. sky at the time of the apparition. There is no well-known meteor shower from this region in the autumn, but bright meteors have sometimes been observed from the same astronomical point at various times of the year, and this point near ζ Herculis forms the chief focus of a well-defined meteoric shower visible during the last half of May.

THE ORIONID SHOWER OF 1916.—These October meteors were fairly well seen this year between October 20 and 25 at Bristol. There were two showers, one at 92°+15°, the true Orionids, and a richer one at 98°+14°, near γ Geminorum. These results appear to substantiate observations made in 1900 and 1903 at Bristol, when the Geminids exhibited greater activity than the Orionids. The two showers, lying so near together, are very liable to be confused; in fact, in some cases it is impossible to say to which radiant the meteors are conformable.

Of the other showers belonging to this usually prolific meteoric epoch, only a few of well-pronounced character were visible this year. There were, however, some slow meteors from a sharply defined radiant at 72°+66°, and some very swift, streaking meteors from a point at 121°+43°. Several of the true Orionids, observed on October 20, were recorded at two stations, and their real paths have been computed.

ULTRA-VIOLET RADIATION FROM THE SUN.—Prof. Birkeland has recently given an account of some observations of the zodiacal light, and of the registration of the ultra-violet radiation of the sun (*Cairo Sci. Journ.*, vol. viii., p. 287). The most effective rays of the zodiacal light appear to have a wave-length of about 3200 Å.U. and under, so that, in attempts to obtain photographs, lenses of quartz, or mirrors of Mach's metal (67 Al+33 Mg) or of nickel, should be employed. Regarding the zodiacal light as a manifestation of the general electrical activity of the sun, Prof. Birkeland was led to investigate the ultra-violet radiation of the sun itself by the use of a filter consisting of a silver film which was opaque to visible light. Sunbeams transmitted through such a film were received by a photo-cell and registered in the usual manner. Variations of intensity were observed, and there was some slight evidence of a relation to changes in horizontal magnetic intensity. While allowing that some of the observed variations of the ultra-violet intensity were probably due to atmospheric differences, Prof. Birkeland finds reason to believe that variations also arise through real changes in the electrical state of the sun. The possibility of extending such observations to stars and planets by the use of large concave mirrors, say 4 metres in diameter, is suggested. A new analysis of celestial bodies giving information as to their general electrical states, might thus be founded.

THE SOIL SURVEY OF WISCONSIN.[1]

FOLLOWING the lead set by the American Bureau of Soils, the State of Wisconsin has arranged for a soil survey, and is publishing the results in a series of attractive booklets, well provided with maps, diagrams, and illustrations. First of all, there was issued in 1911 the so-called "Reconnaissance Soil Survey of Part of North-West Wisconsin," in which a general account was given of the geology, climate, soil, and agriculture of the area. This has now been followed by more detailed accounts of the various counties. It is proposed to complete the work by issuing a series of bulletins dealing with the management of the different types of soil, and on the 1-in. maps issued with these reports the various soil types are so clearly defined that the farmer would have no difficulty in locating his land, and so discerning which particular bulletin would give him advice as to cropping and management.

The region lies wholly within the great Mississippi valley, and its main topographical feature is the relatively level or gently sloping surface of the land. Like other parts of the valley, it is an undulating plain into which lesser valleys have been cut by the rivers and streams.

The underlying rocks belong to the Cambrian or pre-Cambrian systems, and include crystalline rocks, sandstone, and limestone (mainly magnesian limestone). But on the whole the soils are not derived from the rocks immediately below them. Upon the broad uplands are extensive deposits of Glacial drift which in many cases retain the general forms left by the great ice-sheets that invaded this region. The lakes are here intimately related in origin to the Glacial deposits. There are also extensive wind deposits of loess over large portions of the uplands. In many of the valleys are thick deposits of loose sand and gravel, which assume the form of terraces.

The climate is not influenced by the Great Lakes, but it is by the storms that move eastward along the Canadian border and those that drift up the Mississippi valley from the south-west. As in other parts of the northern Mississippi valley, extremes of temperature prevail, the summer being warm, with abundant rainfall, and the winter cool and relatively dry. The mean temperature of the summer months is about 65°–70° F.; in January and February about 10° F.; the extremes range from about 105° F. in the summer to −48° F. in winter.

Originally the land was covered with hardwood and pine, the latter being especially abundant on the sandy lands along the rivers. Much of this still remains, and there is considerable land available for agricultural settlement. Only in the west of the area do the thinly wooded and prairie lands occur.

The first settlers after the explorers and fur-traders were lumbermen, and their way into the country was by boat on the Chippewa River. But fifty or sixty years ago the agricultural settlement began, and now all the ordinary crops are raised in quantity, oats being the most important cereal, followed by maize, barley, and wheat. Among the special crops cultivated in certain districts are potatoes, sugar-beets, tobacco, peas, and maize for canning. Dairying is a particularly important industry; and it has further given rise to the well-known researches of Woll on feeding problems, and of Babcock and Russell on the composition of milk and the estimation of fat.

Typical analyses are given of the various soil types; as usual in the States, they are almost wholly mechanical analyses, only very few chemical data being given. In studying the results it must be remembered that the terms have very different meanings from those assigned to them in this country. The substances indicated by the analysis owe their properties to their sizes, and therefore the names given to them are intended simply to define the diameters of the particles, but unfortunately no international agreement has yet been reached, and hence the same name is used in different countries for wholly different-sized particles. Thus the terms have the following meanings in American and British surveys respectively:—

Mean diameter of particles, mm.

	United States	Great Britain
Fine gravel ...	2 –1	... Above 1
Coarse sand ...	1 –0·5	... 1 –0·2
Medium sand ...	0·5 –0·25	... Not used
Fine sand... ...	0·25–0·10	... 0·2 –0·4
Very fine sand...	0·10–0·05	... Not used
Silt	0·05–0·005	... 0·04–0·01
Fine silt	Not used	... 0·01–0·002
Clay	Below 0·005	... Below 0·002

Direct comparison with British soils is therefore impossible, a circumstance much to be regretted, as in

[1] Wisconsin Geological and Natural History Survey: Bulletins 28-32 Soil Series, Nos. 2-6), and Bulletins 37-40 (Soil Series, Nos. 7-10).

many cases the comparison would undoubtedly prove interesting. But fortunately the descriptions are so good that the student loses less than might be expected, and the results are very valuable, not only to the farmers for whom they were intended, but also to the student of soil problems all over the world.

E. J. R.

THE SCIENTIFIC WORK OF A SCHOOL OF TECHNOLOGY.

THE eighth volume of the Record of Investigations undertaken by members of the Manchester Municipal School of Technology, covering technological researches carried out during the year 1914, has just been issued. It is a highly interesting record of work accomplished, and is comprised in 258 quarto pages replete with explanatory diagrams and photographs illustrative of the text. This attempt to put upon permanent record the investigations conducted by members of the staff and by advanced students was begun in 1905, and has now extended to 2346 pages, and in its eight volumes covers researches carried out since the year 1900 in all departments of the school, including pure and applied mathematics, mechanical engineering, physics and electrical engineering, pure and applied chemistry and metallurgy, the science and practice of sanitation and building, textile manufacture, and the photographic and printing industries.

For investigations in all these important departments of industrial enterprise the school is exceptionally well equipped, and it has, moreover, had the assistance of many enlightened manufacturers, and in this connection many considerable extensions are in contemplation, only awaiting the conclusion of the war to give them full effect. Meanwhile new laboratories for advanced training and research in the subject of coal-tar chemistry in its bearing upon the dye-stuff industry have been opened under the charge of Prof. A. G. Green, of the University of Leeds, with the help and advice of Dr. E. Knecht, the professor of chemical technology, thus giving full opportunity, not only for the efficient training of chemists for the growing demands of the organic chemical industries, but for the establishment of a school of research for the chemistry of dyes and allied substances employed in industrial chemistry.

Many of the articles and researches published in these journals have also appeared in the scientific and technical Press. Lists are also given of important papers read in connection with the various technical societies connected with the school, including the Engineering Society, the Day Students' Chemical Society, the Textile Society, which itself publishes an important journal, the Printing Crafts Guild, and the Bakery and Brewing Students' Societies, together with the titles of fifty-four theses prepared by graduate students in technology for the degree of M.Sc.Tech. in the University of Manchester. Lists also appear of the titles of nearly fifty volumes of technical works issued by members of the staff since 1900.

The eighth volume of the journal under review contains, among other articles of value, interesting papers concerned with the applications of chemical science, such as those on vulcanising, industrial gas-burning, the action of strong nitric acid upon cotton cellulose and of sulphuretted hydrogen upon sodium hydrosulphite, together with papers on the dilution limit of inflammability of gaseous mixtures and on the ignition of gaseous mixtures by the electric discharge. Not the least valuable paper is one entitled "A Contribution to the History of Dyeing in Scotland," being a sequel to one in vol. vii. of the journal on the history of dyeing suggested by a remark of the late Prof. Meldola in his presidential address of 1910 to the Society of Dyers and Colourists on "The Antiquity of Tinctorial Art": "I have in mind the desirability of technical societies such as ours including in their work the antiquarian side of their subject. This is, as a rule, neglected. Nevertheless, it is desirable to secure records of the past with respect to ancient industries, and the experts in any particular subject are assuredly the right people to undertake such work." Other important articles in the current number deal with researches on the ultimate endurance of steel and of the results of experiments with lathe-finishing tools, a continuation of valuable experiments and investigations begun in the school so far back as 1903 on high-speed tool steels and cutting tools, which are even now under investigation; on modern boiler-room practice and the prevention or abatement of smoke; on the effect of structure on the strength and wearing qualities of cloth, copiously illustrated; on a null method of testing vibration galvanometers; and on the commutation of large continuous-current generators and rotary converters under heavy-load conditions.

The school is thus "an excellent example of the kind of work which the engineering colleges and the higher technical schools in this country ought to undertake, and must be prepared to perform, if they are to occupy the place of similar institutions abroad in the very important matter of practical research, not merely as teaching young men the elements of technical science, but also as establishments where industrial experiments can be carried out on a practical scale." It only remains to say, as exhibiting the great resources of this school, that the journal has been admirably printed and its illustrations prepared at the school press.

J. H. R.

PHYSIOLOGY AT THE BRITISH ASSOCIATION.

THE attendance of physiologists at the Newcastle meeting was comparatively small, but there was a good programme, and several of the papers elicited considerable discussion. Prof. Cushny, the president of the section, took a pharmacological subject for his address. Reports of research committees were then presented, and Prof. Waller exhibited a simple apparatus for the administration of known percentages of chloroform. The recent modifications suggested by the extensive use of the instrument were described.

A series of lantern-slides illustrating the action of pituitary extract on the secretion of cerebro-spinal fluid was shown by Prof. Halliburton. The increased secretion is claimed by him to be an indirect result of the extract, the immediate cause being ascribed to stimulation of the cells of the choroid plexus by an increased quantity of CO_2 in the blood.

Prof. W. H. Thompson detailed the results of further investigations into the formation of arginine and creatine. An interesting paper by Prof. Cushny on the secretion of urea and sugar by the kidney was the outcome of a repetition of Heidenhain's experiments, with this difference, that urea in some experiments, and sugar in others, were injected instead of a dye into the blood of an animal after transection of its spinal cord. Analysis of the kidneys after a suitable interval showed no increase of urea or sugar in them above the normal, and there was therefore no accumulation of these substances in the cells of the convoluted tubules.

Prof. Herring gave the results of several series of experiments in which white rats had been fed on small doses of fresh thyroid for various periods of time. The administration of 0·2 gram of fresh ox thyroid in the food daily for one month led to a 75 per cent. increase in the weight of the suprarenals, and a 50 per cent. increase in their adrenalin content. Further, there was great hypertrophy of the heart, especially of the ventricles, the weight of the heart being double, and in some nearly treble, the weight of the heart of control animals. The kidneys were also enlarged, though not to the same extent. Prof. Herring directed attention to the similarity in the condition produced in white rats by small amounts of thyroid to the condition sometimes found in "soldier's, or trench, heart" in man, and suggested that cardiac hypertrophy, associated with excessive production of adrenalin and changes in other organs, might sometimes be caused in man by over-action of the thyroid glands. A paper by Dr. Kojima followed, in which changes in the pancreas induced by thyroid-feeding were illustrated by lantern-slides. The pancreas of thyroid-fed animals showed numerous karyokinetic figures, and alterations in the amount of secretory granules in the cells.

In the discussion which followed these two papers Sir William Osler, Sir Edward Schäfer, Prof. Drummond, and Prof. Moore took part.

On Friday morning, September 8, Dr. Itagaki described the action of ovarian extracts, more especially of luteal tissue, on preparations of uterine and intestinal muscle.

A paper by Prof. Bayliss on "The Properties Required in Solutions for Intravenous Injection" was read, in which the author recommended the use of a 7 per cent. solution of gum acacia. Such a transfusion fluid has a viscosity, and exerts an osmotic force, more nearly resembling blood plasma than normal saline, and when used in cases of hæmorrhage gives better results.

Prof. Moore and Mr. Barnard gave a paper on the nutrition of living organisms by simple organic compounds.

The meeting closed with a discussion upon "Food Standards and Man Power," introduced by Prof. Waller. The object of the discussion was to prepare the way for the formation of a committee to formulate definite figures for the value of work done by man, woman, and child.

THE BRITISH ASSOCIATION AT NEWCASTLE.

SECTION H.

ANTHROPOLOGY.

OPENING ADDRESS (ABRIDGED) BY R. R. MARETT, M.A., D.SC., PRESIDENT OF THE SECTION.

THE question to which I beg to direct attention on the present occasion is: What function ought anthropology to fulfil among the higher studies of a modern university? The subject may be commonplace, but it is certainly not untimely. At the present moment those of us who are university teachers in any of the warring countries are feeling like fish out of water. Our occupation is to a large extent suspended; and already it seems a lifetime since we were assisting, each after his own fashion, in the normal development of science.

"Usus abit vitæ: bellis consumpsimus ævum."

Can the hiatus be bridged, the broken highway mended? Never, if memories are to prevail with us; but if hopes, then it goes equally without saying that we shall somehow manage to carry on more actively and successfully than ever. So the only problem for brave and hopeful men is, How? Ignoring our present troubles, we are all thinking about the future of university education, and reform is in the air.

Of course, every university has difficulties of its own to meet; and my own University of Oxford, with eight centuries of growth to look back on, is likely to be more deeply affected by the sundering of traditions due to the war than such of its sister-institutions as are of more recent stamp. Now, when I discuss university matters, the case of Oxford is bound to weigh with me predominantly; and, indeed, no man of science could wish me to neglect what, after all, is bound to be my nearest and richest source of experience. But various kind friends and colleagues hailing from other universities in Great Britain, France, and the United States have furnished me with copious information concerning their home conditions, so that I shall not altogether lack authority if I venture to frame conclusions of a general nature. Besides, it is not on behalf of any university, but rather as representing the interests of the science of anthropology, that I am entitled to speak in my present capacity. I do indeed firmly hold that anthropological teaching and research can be admitted to the most ample status in the curriculum of any modern university without injury to established industries and activities. But, even if this were not so—even if it needed a sort of surgical operation to engraft the new in the old—we anthropologists must, I think, insist on the fullest recognition of our science among university studies, realising, as we are especially able to do, its immense educational value as a humanising discipline. Let me not, however, rouse prejudice at the outset by seeming to adopt an aggressive tone. "Live and let live" is the safest motto for the university reformer; and I have no doubt that the peaceful penetration whereby anthropology has of late been almost imperceptibly coming to its own in the leading universities of the world will continue to accomplish itself if we, who make anthropology our chief concern, continue to put forth good work in abundance. For, like any other science, the science of man must be justified of its children.

Now, it is customary to contrast what are known as technical studies with university studies proper; and such a distinction may prove helpful in the present context, if it be not unduly pressed. Thus, in particular, it will afford me an excuse for not attempting to travel afresh over the ground covered by Sir Richard Temple in his admirable presidential address of three years ago. What he then demanded was, as he termed it, a school of applied anthropology, in which men of affairs could learn how to regulate their practical relations with so-called "natives" for the benefit of all concerned. Let me say at once that I am in complete agreement with him as to the need for the establishment or further development of not one school only, but many such schools in this country, if the British Empire is to make good a moral claim to exist. Indeed, I have for a number of years at Oxford taken a hand in the anthropological instruction of probationers and officers belonging to the public services, and can bear witness to the great interest which students of this class took at the time, and after leaving Oxford have continued to take, in studies bearing so directly on their life-work.

What I have to say to-day, however, must be regarded as complementary rather than as immediately subsidiary to Sir Richard Temple's wise and politic contention. The point I wish to make is that, unless anthropology be given its due place among university studies proper, there is little or no chance that technical applications of anthropological knowledge will prove of the slightest avail, whether attempted within our universities or outside them. Anthropology must be studied in a scientific spirit—that is, for its own sake—and then the practical results will follow in due course. Light first, fruit afterwards, as Bacon says. So it has always been, and must always be, as regards the association of science with the arts of life. That Sir Richard Temple will heartily subscribe to such a principle I have no doubt at all. As a man of affairs, however, whose long and wide experience of administration and of the problems of empire had convinced him of the utility of the anthropological habit of mind to the official who has to deal with "all sorts and conditions of men," he naturally insisted on the value of anthropology in its applied character. On the other hand, it is equally natural that one whose career has been wholly academic should lay emphasis on the other side of the educational question, maintaining as an eminently practical proposition—for what can be more practical than to educate the nation on sound lines?—the necessity of establishing anthropology among the leading studies of our universities.

How, then, is this end to be attained? The all-important condition of success, in my belief, is that all branches of anthropological study and research should be concentrated within a single school. For it is conceivable that a university may seek to satisfy its conscience in regard to the teaching of anthropology by trusting to the scattered efforts of a number of faculties and institutions, each of which is designed in the first instance to fulfil some other purpose Thus for physical anthropology a would-be student must resort to the medical school, for social anthropology to the faculty of arts, for linguistics to the department of philology, for prehistorics to the archæological museum, and so on. Such a policy, to my mind, is a downright insult to our science. Is the anthropologist no better than a tramp that he should be expected to hang about academic back-doors in search of broken victuals? Fed on a farrago of heterogeneous by-products, how can the student ever be taught to envisage his subject as a whole? How, for instance, is he ever to acquire the comprehensive outlook of the competent field-worker? Such a makeshift arrangement can at the most but produce certain specialists of the narrower sort. In "The Hunting of the Snark" they engaged a baker who could only bake bride-cake. Anthropological expeditions have, perhaps, been entrusted before now to experts of this type; but they have not proved an entire success. I am not ashamed to declare that the anthropologist, be he field-worker or study-worker—and, ideally, he should be both in one—must be something of a Jack-of-all-trades. This statement, of course, needs qualification, inasmuch as I would have him know everything about something, as well as something about everything. But the pure specialist, however useful he may be to society in his own way, is not as a rule a man of wide sympathies; whereas the student of mankind in the concrete must bring to his task, before all else, an intelligence steeped in sympathy and imagination. His soul, in fact, must be as many-sided as that complex soul-life of humanity which it is his ultimate business to understand. . . .

It has sometimes been objected that, however much we strive by means of organisation to invest anthropology with an external semblance of unity, the subject is essentially wanting in any sort of inner cohesion. Nor does such criticism come merely from the ignorant outsider; for I remember how, when the programme for our diploma course at Oxford was first announced to the world, Father Schmidt found fault with it in the columns of *Anthropos* on the ground that it was not the part of one and the same man to combine the diverse special studies to which we had assigned a common anthropological bearing. In the face of such strictures, however—and they were likewise levelled at us from quarters nearer home—we persisted in our design of training anthropologists who should be what I may call "all-round men." Let them, we thought, by all means devote themselves later on to whatever branch of the subject might attract them most; but let them in the first instance learn as students of human life to "see it steadily and see it whole." Since this resolve was taken, a considerable number of students has passed through our hands, and we are convinced that the composite curriculum provided in our diploma course works perfectly in practice, and, in fact, well-nigh amounts to a liberal education in itself. It is true that it cuts across certain established lines of demarcation, such as, notably, the traditional frontier that divides the faculty of arts from the faculty of natural science. But what of that? Indeed, at the present moment, when the popular demand is for more science in education—and I am personally convinced that there is sound reason behind it—I am inclined to claim for our system of combined anthropological studies that it affords a crucial instance of the way in which natural science and the humanities, the interest in material things and the interest in the great civilising ideas, can be imparted conjointly, and with a due appreciation of their mutual relations.

Now, there is tolerable agreement, to judge from the university syllabuses which I have been able to examine, as to the main constituents of a full course of anthropological studies. In the first place, physical anthropology must form part of such a training. I need not here go into the nature of the topics comprised under this head, the more so as I am no authority on this side of the subject. Suffice it to say that this kind of work involves the constant use of a well-equipped anatomical laboratory, with occasional excursions into the psychological laboratory which every university ought likewise to possess. It is notably this branch of anthropology which some would hand over entirely to the specialist, allowing him no part or lot in the complementary subjects of which I am about to speak. I can only say, with a due sense, I trust, of the want of expert knowledge on my part, that the results of the purely somatological study of man, at any rate apart from what has been done in the way of human palæontology, have so far proved rather disappointing; and I would venture to suggest that the reason for this comparative sterility may lie not so much in the intrinsic difficulties of the subject as in a want of constructive imagination, such as must at once be stimulated by a fuller grasp of the possibilities of anthropological science as a whole.

In the next place, cultural, as distinct from physical, anthropology must be represented in our ideal course by at least two distinct departments. The first of these, the department of prehistoric archæology and technology, involves the use of a museum capable of illustrating the material culture of mankind in all its rich variety. Here instruction will necessarily take the form of demonstration-lectures held in the presence of the objects themselves. To a limited extent it should even be possible to enable the student to acquire practical experience of the more elementary technological processes, as, for instance, flint-knapping, fire-making, weaving, the manufacture of pottery, and so on. May I repeat that, to serve such educational purposes, a special kind of museum organisation is required? Moreover, it will be necessary to include in the museum staff such persons as have had a comprehensive training in anthropology, and are consequently competent to teach in a broad and humanising way.

The other department of cultural anthropology is one that embraces a considerable complex of studies At Oxford we term this branch of the subject social anthropology, and I do not think that there is much amiss with such a title. Among the chief topics that it comprises are kinship- and marriage-organisation, religion, government, law, and morals. Further, economic and æsthetic developments have to be examined in their reference to the social life, as apart from their bearing on technology. In one aspect all these subjects lend themselves to a sociological method of treatment; and, though no one is more concerned than myself to insist on the paramount importance of psychology in the equipment of the perfect anthropologist, I would concede that the sociological aspect ought so far as possible to be considered first, as lending itself more readily to direct observation. To reveal the inner workings of the social movement, however, nothing short of psychological insight will suffice. Indeed, all, I hope, will agree that the anthropologist ought to be so trained as to be able to fulfil the functions of sociologist and psychologist at once and together.

It remains to add that no training in social anthropology can be regarded as complete that does not include the study of the development of language. On the theoretical side of his work the student should acquire a general acquaintance with the principles of comparative philology, and, in particular, should pay attention to the relations between speech and thought. On the practical side he should be instructed in phonetics as a preparation for linguistic researches in the field. But detailed instruction in particular languages, more especially if these are not embodied in a literature, is scarcely the business of a school of anthropology such as every university may aspire to possess. . . .

So much, then, for the multiplicity which an anthropological curriculum must involve if it consist, as has been suggested, of physical anthropology, technology with prehistoric archæology, and social anthropology with linguistics. And now what of its unity? How best can these diverse studies be directed to a common end? I would submit that there are two ways in which the student may most readily be made to realise the scope of anthropology as a whole, the one way having reference to theory and the other to practice.

The theoretical way of making it plain that the special studies among which the student divides his time can, and must, serve a single scientific purpose is to make his work culminate in the determination of problems concerning the movement of peoples and the diffusion of culture—in a word, of ethnological problems (if, as is most convenient, the term "ethnology" be taken to signify the theory of the development of the various ethnic groups or "peoples" of the world). A great impetus was given to the investigation of such matters by Dr. Rivers in a now famous presidential address to this section, followed up, as it was shortly afterwards, by a monumental work on the ethnology of the Pacific region. But it would be quite a mistake to suppose that anthropologists were not previously alive to the importance of the ethnological point of view as a unifying interest in anthropological theory. So far back as 1891, when the second Folklore Congress met in London, under the presidency of the late Andrew Lang, the burning question was how far a theory of diffusion and how far a theory of independent origins would take us in the explanation of the facts with which the science of folklore is more particularly concerned. It is true that there has been in the past a tendency to describe the theory of independent origins as the "anthropological" argument; but such a misnomer is much to be regretted. Anthropology stands not for this line of explanation, or for that, but for the truth, by whatever way it is reached; and ethnology, in the sense that I have given to the term, is so far from constituting the antithesis of anthropology that it is rather, as I have tried to show, its final outcome and consummation. Recognising this, the Oxford School of Anthropology from the first insisted that candidates for the diploma should face an examination paper in ethnology, in which they must bring the various kinds of evidence derived from physical type, from arts, from customs, and from language to bear at once on the problem how the various ethnic individualities have been formed. The result, I think, has been that our students have all along recognised, even when most deeply immersed in one or other of their special studies, a centripetal tendency, an orientation towards a common scientific purpose, that has saved them from one-sidedness, and kept them loyal to the interests of anthropology as a whole. Let me add that, as our anthropological course ends in ethnology, so it begins in ethnography, by which I mean the descriptive account of the various peoples considered mainly in their relation to their geographical environment. Thus, from the beginning to the end of his work, the student of anthropology is reminded that he is trying to deal with the varieties of human life in the concrete. He must first make acquaintance with the peoples of the world in their unanalysed diversity, must next proceed to the separate consideration of the universal constituent aspects of their life, and then, finally, must return to a concrete study of these peoples in order to explain, as well as he can, from every abstract point of view at once how they have come to be what they are. If this theoretical path be pursued, I have little fear lest anthropology appear to the man who has really given his mind to it a thing of rags and tatters.

The second way in which the unity of anthropology may be made manifest is, as I have said, practical. The ideal university course in anthropology should aim directly and even primarily at producing the field-worker. I cannot go here into the question whether better work is done in the field by large expeditions or by small. For educational purposes, however, I would have every student imagine that he is about to proceed on an anthropological expedition by himself. Every part of his work will gain in actuality if he thinks of it as something likely to be of practical service hereafter; and, to judge from my own experience as a teacher, the presence in a class of even a few ardent spirits who are about to enter the field, or, better still, have already had field-experience and are equipping themselves for further efforts, proves infinitely inspiring alike to the class and to the teacher himself. Once the future campaigner realises that he must prepare himself so as to be able to collect and interpret any kind of evidence of anthropological value that he comes across, he is bound to acquire in a practical way, and, as it were, instinctively, a comprehensive grasp of the subject, such as cannot fail to reinforce the demand for correlation and unification that comes from the side of theory. . . .

The conclusion, then, of the whole matter is that, for practical and scientific reasons alike, our universities must endow schools of anthropology on a liberal scale, providing funds not only for the needs of teaching, but likewise for the needs of research. Money may be hard to get, but nevertheless it can be got. We must not hesitate, as organisers of education, to cultivate the predatory instincts. For the rest, it is simply a question of rousing public opinion in respect to a matter of truly national importance. If anything that I have said to-day can help in any way to improve the position of anthropology among university studies, I shall be satisfied that, trite as my subject may have seemed to be, I have not misused the great opportunity afforded to every holder of my present office.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LIVERPOOL.—Mr. C. Sydney Jones has given the University the sum of 8000*l.* for the endowment of the chair of classical archæology, in memory of his father, the late Mr. C. W. Jones, who was one of the founders of the chair in 1906.

LONDON.—The several faculties have elected their respective deans for the period 1916–18; among these are:—*Medicine,* Sir Bertrand E. Dawson, London Hospital Medical College; *Science,* Prof. Herbert Jackson, King's College; *Engineering,* Dr. H. C. H. Carpenter, Imperial College of Science and Technology; *Economics,* the Hon. W. Pember Reeves, London School of Economics.

OXFORD.—Much interest has been aroused in Oxford by the debate in the House of Commons on the second reading of the Rhodes Estate Bill. The Bill proposes to establish twelve scholarships of 300*l.* a year each in lieu of the fifteen scholarships of 250*l.* tenable by German students nominated by the Kaiser. The scheme in its present form contemplates the distribution of the twelve new scholarships among colonists of the British Empire, but it is felt in some quarters that it might be advantageous, and not out of accordance with Mr. Rhodes's intention, to extend the benefit to a wider sphere. The adoption of Lord H. Cecil's proposal to give the committee power to grant discretion to the trustees to make the substituted scholarships available for students whether within or without the British Empire has accordingly been received by many with approval. It remains to be seen what form the Bill will ultimately take in its passage through Parliament.

SIR DOUGLAS HAIG, Commander-in-Chief of the British Forces in France, has been elected rector of St. Andrews University, in succession to Lord Aberdeen.

ACCORDING to the *Nieuwe Courant,* the number of women students in the German universities during the last summer semester was 5460, or double the number of 1911. The women now represent 10·5 per cent. of matriculated students, as against 4·8 per cent. in 1911. Of the students actually present in the universities (*i.e.* outside the Army), the women now form one-third. The number of women medical students is now 1394, as against 582 in 1911. In this way the losses caused by the war will to some extent be repaired, for the first 600 German casualty lists contain 1500 names of medical men.

THE Institution scholarship of the North-East Coast Institution of Engineers and Shipbuilders for the present year has been awarded to E. V. Telfer. The council of the institution, believing that the time has arrived for making the subjects of the scholarship examination of the institution more comprehensive than hitherto, has decided that the syllabus of future examinations shall be:—(1) English; (2) English history and geography; (3) Latin, Greek, French, or German (one of the four); (4) extra mathematics; (5) and (6) either experimental science and mechanics, or any two of the following:—Chemistry, physics, mechanics.

A COMMITTEE was appointed at the Newcastle meeting of the British Association to report upon the method and substance of science teaching in secondary schools, with particular reference to the place of such instruction in general education. The following resolution was adopted by the committee at a meeting held on October 18:—"That in order to secure freedom of action for teachers of science in schools, and to prevent the instruction from becoming stereotyped, it is undesirable for any external authority to prescribe a detailed syllabus in science for use in schools, whether intended as the basis of examinations or otherwise."

IN his recent presidential address to the Institution of Automobile Engineers Mr. L. A. Legros dealt, among other topics, with the part science might with advantage take in the education of our governing classes. He spoke of the deplorable ignorance of technical and scientific matters among those on whom the responsibilities for running the war have fallen. Never, he said, in the history of engineering has the ignorance of science by the politicians, the military, and the other authorities been so openly displayed as in the early stages of the war, and never has it proved so costly in time, in life, and in substance. The views of teachers brought up on classical lines are, he maintained, devoid of that perspective which would enable them to realise that for the majority of their pupils the dead languages are useless except as a discipline or gymnastic which can be provided as efficiently in the course of work which is really useful to them. A knowledge of the classics is undoubtedly of value to men of the clerical, legal, literary, and even of the medical professions, but, Mr. Legros urged, how much greater would have been the value, in this war, of that small section which deals with politics had it been as well grounded in the sciences as in the dead languages?

MR. M. S. PEASE has sent us from Ruhleben a copy of the prospectus of work for the autumn term at the Ruhleben Camp School. It would be difficult to provide more convincing proof of the hope for the future which inspires our countrymen at Ruhleben and of the courage and initiative of these prisoners there than the arrangements they have made for study and self-improvement. The camp school is in charge of a businesslike general committee, which has discovered in the camp teachers of nearly every conceivable subject, means for arranging and equipping laboratories for practical work, for starting a good library, and for holding examinations in connection with the home examining authorities. The prospectus is able to print the proud boast that "in most subjects the tuition provided by the school ranges from that required by absolute beginners to that required by advanced university students." We can refer here only to some of the numerous departments, and mention may be made of those for biological sciences, mathematics and physics, chemistry, engineering, and nautical subjects. In zoology, for example, courses are being given in vertebrate embryology, and in the study of the Echinodermata; in botany the Gymnospermæ are being studied, with laboratory work; all branches of pure mathematics, including, for instance, infinitesimal calculus and differential equations, are being taught; lectures and laboratory work are available in all branches of chemistry; and every branch of engineering is catered for. No saner way of relieving the awful tedium of prison camp life could be found than the classes and circles for study which have been provided by the Ruhleben Camp Committee.

IN Scotland for some time it has been possible for young men to obtain engineering training by attending during the winter classes in the universities, and by getting works experience in the summer. This plan suits Scotland, where the university session is condensed and there is a long interval between the closing of the university and its reopening. In England the university session is distributed more evenly throughout the year, and Dr. Wertheimer, the dean of the faculty of engineering of the University of Bristol, has, therefore, proposed a modified "sandwich" system of training. A student on leaving school will enter the university and will spend a session there, passing the intermediate examination for the B.Sc. degree in engineering at the end; if his record is good, and he is a promising student, he will be recommended to a firm which will allow him to enter its works for a period of fourteen months. This will enable the student to judge to what extent he is fitted for an engineering career, and will also enable the manufacturers to form an impression as to his suitability. He will then return to the university and continue his studies for a further period of two years, in some cases spending the long vacation in the works; after that he will return to the same works, if he has given satisfaction, for another period of fourteen months. A number of firms have already agreed to take part in the experiment, so that a satisfactory trial is assured. The "sandwich" scheme, besides providing an improved method of engineering training, will also, it is hoped, bring the important firms which are taking part in it into closer touch with the University, and thus lead to more co-operation in research and other matters.

SOCIETIES AND ACADEMIES.

MANCHESTER.

Literary and Philosophical Society, October 3.—Prof. S. J. Hickson, president, in the chair.—Prof. F. E. **Weiss**, Sir E. **Rutherford**, W. **Thomson**, and Dr. G. **Hickling**: The discussions at the Newcastle meeting of the British Association.

October 17.—Prof. S. J. Hickson, president, in the chair.—Prof. W. H. **Lang**: *Rhynia Gwynne-Vaughani*, Kidston and Lang, a new type of vascular cryptogam from the Old Red Sandstone of Rhynie, Aberdeenshire. The chert in which the plant occurs was discovered by Dr. Mackie, of Elgin, and the plant remains are being studied by Dr. R. Kidston and Prof. W. H. Lang, the results being published by the Royal Society of Edinburgh. Photographic slides showed the underground rhizomes attached to the peaty soil by rhizoids, the branched cylindrical aerial stems, which were leafless, and the large cylindrical sporangia. The internal structure is well preserved, so that our knowledge of this ancient land plant is pretty complete. Rhynia differs so much from other vascular cryptogams that a new class, the Psilophytales, has been founded to contain it.

PARIS.

Academy of Sciences, October 9.—M. Camille Jordan in the chair.—P. **Puiseux**: The physical libration of the moon, studied on forty photographs obtained at the Paris Observatory between the years 1894 and 1909. The method of measurement and calculation employed is fully described, and the conclusion is drawn that the theory of the movement of the moon round its centre of gravity, established by considering the satellite as an indeformable body, does not correspond with the facts.—D. **Eydoux**: The transmission of strokes of a hydraulic ram in pipes with bifurcations.—F. **Houssay**: The sound of distant cannonades. The complexity of the question. A description of observations made at Sceaux. Heavy cannonades can be heard at distances at which single cannon-shots cannot be detected; there would appear to be a summation effect. —M. **de Broglie**: On a system of absorption bands corresponding to the L-rays of X-ray spectra of the elements, and on the importance of the phenomena of selective absorption in radiography. Commenting on a recent communication by M. Boll and L. Mallet, the author agrees that the radiations emitted by a Coolidge tube are as heterogeneous as those given by other bulbs, and give a relatively complex spectrum. Filtration through a non-selective screen, such as aluminium, may be made to give a roughly monochromatic beam. From a discussion of the action on a silver bromide emulsion, it is shown that a practically monochromatic radiation can be obtained by interposing a selective screen containing a substance (cadmium, antimony) with an atomic weight slightly higher than that of silver.—P. **Nicolardot**: The action of reagents upon French, Bohemian, and German glassware. Glassware for chemical purposes is now made by several firms in France. Some of these glasses have been submitted to the attack of various chemical reagents (water, solutions of hydrochloric acid, ammonia, ammonium chloride, sodium carbonate), comparative tests being carried out under the same conditions with Jena glass, two Bohemian and two Thuringian glasses. The French glasses proved to be equal to the best German glasses. Comparative tests were also carried out on the resistance of the glasses to sudden changes of temperature and to the action of water at temperatures up to 160° C. Complete analyses of the French, Jena, and Bohemian glasses used are given.—A. **Pictet**, L. **Ramseyer**, and O. **Kaiser**: Some hydrocarbons contained in coal. A soft Sarre coal was extracted on the large scale (five and a half tons) with benzene. From the extraction product (0·25 per cent. of the coal) seven unsaturated and seven saturated hydrocarbons were isolated. These have been compared with the hydrocarbons obtained by the distillation of coal at 450° C. in a vacuum, and it is shown that a part, at least, of the hydrocarbons of the vacuum tar exist as such in the coal. The extracted material proved to be optically active, although no fraction from the vacuum tar possessed this property. Hence it would appear that a temperature of 450° is sufficient to racemise the volatile active substances contained in coal. This furnishes a proof that the materials from which the coal has been formed have never been carried to that temperature.—R. **Masse** and H. **Leroux**: The estimation of phenol in crude tar phenols. The process suggested consists of a preliminary fractional distillation, followed by a determination of the melting point.—J. **Bougault**: The semicarbazones of α-ketonic acids. The α-iodocinnamic acids.—G. **Barthelat**: The structure of the floral pedicel of Mesembryanthemum. —M. **Mirande**: The cytological formation of anthocyanin in the living plant.—M. **Molliard**: The disengagement of oxygen arising from the reduction of nitrates by green plants.—Em. **Bourquelot**: Remarks on the rotatory powers of the α- and β-alcohol-*d*-glucosides and alcohol-*d*-galactosides.—J. **Legendre**: The destruction of mosquitoes by fish. It has been proved that the Chinese carp (*Carassius auratus*) flourishes when introduced into the rice plantations of Madagascar, devouring the larvæ of the mosquito in large numbers, thus helping to reduce malaria.—A. **Lumière**: The presence of the tetanus bacillus at the surface of projectiles buried in cicatrised wounds.

BOOKS RECEIVED.

Dyeing in Germany and America, with Notes on Colour Production. By S. H. Higgins. Second edition. Pp. viii+143. (Manchester: University Press; London: Longmans and Co.) 5*s*. net.

Philips' Planisphere showing the Principal Stars Visible for Every Hour in the Year. (London: G. Philip and Son, Ltd.) 1*s*. 6*d*. net.

A Text-Book of Quantitative Chemical Analysis. By Drs. A. C. Cumming and S. A. Kay. Second edition. Pp. xv+402. (London: Gurney and Jackson; Edinburgh: Oliver and Boyd.) 9*s*. net.

The Camera as Historian. By H. D. Gower, L. S. Jast, and W. W. Topley. Pp. xv+259. (London: Sampson Low and Co., Ltd.) 6s. net.
The Biology of Tumours. By Dr. C. M. Moullin. Pp. 55. (London: H. K. Lewis and Co., Ltd.) 2s. 6d. net.
Insect Enemies. By C. A. Ealand. Pp. 223+plates. (London: Grant Richards, Ltd.) 6s. net.
Memoirs of the Geological Survey. Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for 1915. (London: H.M.S.O.; E. Stanford, Ltd.) 1s.
Dynamics. By R. C. Fawdry. Part i. Pp. viii+177+ix. (London: G. Bell and Sons, Ltd.) 3s.
Chronicles of Man. By Dr. C. F. Coxwell. Pp. xiv+654. (London: Watts and Co.) 6s. net.
Elements of Military Education. By W. A. Brockington. Pp. xvi+363. (London: Longmans and Co.) 4s. 6d. net.
Crowley's Hygiene of School Life. New edition. By Dr. C. W. Hutt. Pp. xv+428. (London: Methuen and Co., Ltd.) 3s. 6d. net.
A Hausa Botanical Vocabulary. By J. M. Dalziel. Pp. 119. (London: T. Fisher Unwin, Ltd.) 6s. 6d. net.
The World's Wonder Stories for Boys and Girls. By A. G. Whyte. Pp. xiv+272. (London: Watts and Co.) 6s. net.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 2.

ROYAL SOCIETY, at 4.30.—Waves in an Elastic Plate: Prof. H. Lamb.—(1) Multiple Integrals; (2) The Order of Magnitude of the Coefficients of a Fourier Series: Prof. W. H. Young.—A Determination of the Heat of Vaporisation of Water at 100° C. and 1 Atmosphere Pressure in Terms of the Mean Calorie: T. C. Sutton.—The Mechanical Relations of the Energy of Magnetisation: G. H. Livens.

MATHEMATICAL SOCIETY, at 5.30.—Annual General Meeting.—Address of Retiring President: The Fourier Harmonic Analysis; its Practical Scope and its Limitations: Sir Joseph Larmor.—Multiple Integration by Parts and the Second Theorem of the Mean: Prof. W. H. Young.—Moving Axes and their Uses in the Differential Geometry of Euclidean Space: E. H. Neville.—Areas and Conformal Representation: J. Hodginson.

CHEMICAL SOCIETY, at 8.—Overvoltage Tables. Part IV. The Theories of Overvoltage and Passivity: E. Newbery.—Studies of the Carbonates. Part II. Hydrolysis of Sodium Carbonate and Bicarbonate, and the Ionisation Constants of Carbonic Acid: C. A. Seyler and P. V. Lloyd.—The Synthesis of Hydroxyquercetin: M. Nierenstein.—(1) The Reaction between Methyl Iodide and some Metallic Cyanides; (2) Some Reactions produced by Mercuric Iodide: E. G. J. Hartley.—The Dual Theory of Acid Catalysis. A Comparison of the Activities of Certain Strong Acids: H. M. Dawson and T. W. Crann.

EUGENICS EDUCATION SOCIETY, at 5.15.—Mental Differences in Children: C. Burt.

FRIDAY, NOVEMBER 3.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Thomas Hawksley Lecture: The Gas Engineer of the Last Century: H. E. Jones.

SATURDAY, NOVEMBER 4.

GEOLOGISTS' ASSOCIATION, at 3.—Followed by Annual Conversazione.

MONDAY, NOVEMBER 6.

SOCIETY OF ENGINEERS, at 5.30.—Heating and Ventilating Private Dwelling-Houses: C. T. A. Hanssen.

ARISTOTELIAN SOCIETY, at 8.—Presidential Address: The Problem of Recognition: Dr. H. Wildon Carr.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Great Passes of the Western and Central Alps: The President.

TUESDAY, NOVEMBER 7.

ZOOLOGICAL SOCIETY, at 5.30.—Two New Species of Cestodes belonging respectively to the Genera Linstowia and Cotugnia: Dr. F. E. Beddard.—Notes on the Development of the Starfishes *Asterias glacialis*, O.F.M., *Cribrella oculata* (Linck), Forbes, *Solaster endeca* (Retzius), Forbes, *Stichaster roseus* (O.F.M.), Sars: Dr. J. F. Gemmill.—Studies on the Anoplura and Mallophaga, being a Report upon a Collection from the Mammals and Birds in the Society's Gardens. II.: B. F. Cummings.—Notes on a Collection of Heterocera made by Mr. W. Feather in British East Africa, 1911–13: Lt.-Col. J. M. Fawcett.—The Structure and Function of the Mouth-parts of the Palæmonid Prawns: L. A. Borradaile.—Heude's Collection of Pigs, Sika, Serows, and Gorals in the Sikawei Museum, Shanghai: A. de C. Sowerby.—The Classification of the Tineinæ, a Subfamily of Moths of the Family Pyralidæ: Sir G. F. Hampson.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—Address by the President, Sir Maurice Fitzmaurice, and Presentation of Medals awarded by the Council.

MINERALOGICAL SOCIETY, at 5.30.—Humite: Prof. W. J. Lewis.—(1) The Combination of Twin Operations; (2) Modification of the Kohlrausch Method of Determining Refractive Indices: Dr. J. W. Evans.—The Basalts of Hare Island, West Greenland: A. Holmes.

RÖNTGEN SOCIETY, at 8.15.—Presidential Address; Capt. C. Thurstan Holland.

WEDNESDAY, NOVEMBER 8.

FARADAY SOCIETY, at 5.30–7 and 8.30–10.30.—General Discussion on Refractory Materials.—Introductory Address: Sir R. Hadfield.—The Texture of Refractories: Dr. J. W. Mellor.—The Application of Petrographic Methods to the Study of Refractory Materials: Prof. W. G. Fearnsides.—Silica as a Refractory Material: Cosmo Jones.—The Transmission of Heat through Materials Employed in Furnace Construction: Ezer Griffiths.

GEOLOGICAL SOCIETY, at 5.30.

THURSDAY, NOVEMBER 9.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Methods of Raising a Low Arterial Pressure: Prof. W. M. Bayliss.—Selective Permeability; the Absorption of Phenol and other Solutions by the Seeds of *Hordeum vulgare*: A. J. Brown and F. Tinker.—The Toxic Action of Dilute Pure Sodium Chloride Solutions on the Meningococcus: C. Shearer.—The *Rôle* of the Phagocyte in Cerebro-spinal Meningitis: C. Shearer and H. W. Crowe.—Investigation dealing with the Phenomena of "Clot" Formations. IV. The Diphasic Erosive Action of Salts on the Cholate Gel: S. B. Schryver and Mary Hewlett.—Some Photochemical Experiments with Pure Chlorophyll and their Bearing on Theories of Carbon Assimilation: Ingvar Jorgensen and F. Kidd.

OPTICAL SOCIETY, at 8.—Some Notes on Glass Grinding and Polishing: J. W. French.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Natural Divisions of England: C. B. Fawcett.

FRIDAY, NOVEMBER 10.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 7.—Has Lymnæa an Auriculoid Ancestry? C. Hedley.—(1) *Anodonta cygnaea*, L., and *A. anatina*, L.; (2) *Pseudanodonta rothomagensis*, Locard: H. H. Bloomer and H. Overton.—Sexual Characters in the Shell and Radula of *Cyclostoma elegans*: Prof. A. E. Boycott.

CONTENTS.

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.
Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.