

and therefore *Vertebraria*, belong to seed-bearing plants. Prof. Walton of Glasgow and Miss J. R. Wilson have recently thrown some light on the structure of *Vertebraria* (*Proc. Roy. Soc. Edin.*, 52 (ii), 8, 200, 1932). With the help of Walton's cellulose peel method it has been shown that the greater part of the axis consisted of secondary wood of the gymnospermous type. The tracheids are provided with multiseriate bordered pits, which may be either opposite or alternate; the medullary rays are narrow, and in the area common to a medullary ray cell and a tracheid several bordered pits are present. The primary wood and pith (if one was present) appear to have been very poorly developed. In specimens preserved at right angles to the planes of bedding the thin plates of tissue radiating from the centre represent the much-compressed wedges of secondary wood. In the living plant these wedges must have nearly filled the large triangular spaces between them, leaving room only for the medullary rays. The present work thus supports the view that *Vertebraria* belongs to a seed-plant.

#### A Fossil Dicotyledonous Wood, Devoid of Vessels, from the Rajmahal Hills.

Sahni describes under the name *Homoxylon rajmahalense* gen. et sp. nov. (*Mem. Geol. Surv. Ind., Palaeont. Indica*, N.S. 20 (2), 1, 1932) what is no doubt an angiosperm wood of an archaic type. It resembles *Drimys*, *Trochodendron* and other members of the

primitive Ranalean plexus in the absence of true vessels, the pitting of the tracheids, the structure of the medullary rays and in other features. The age of the fossil is believed to be Jurassic, but is not known with certainty.

#### A Comparative Study of the Phosphagens with some Remarks on the Origin of Vertebrates.

[O. M. Needham, J. Needham, E. Baldwin and J. Yudkin, *P.R.S.*, Ser. B. 110, No. 767, 1932.]

SUBSEQUENT to the discovery of labile phosphorus in muscular tissue by Eggleton and Eggleton (1927), it has been practically assumed that arginine phosphate is characteristic of invertebrates while creatine phosphate is characteristic of *Cephalochorda* and *Vertebrates*. The usual Fiske and Subbason (1929) method with the various modifications thereon have been followed. Practically examples of every group have been experimented upon and it should be noted, however, that *Balanoglossus* and *Echinoderma* contain both the kinds of phosphates, thus affirming Bateson's (1886) view of the affinity between *Echinoderma* and Chordata. Curiously the *Ctenophora* alone exhibit the presence of arginine phosphate in the phylum *Cœlenterata*. Further evidences are put forward to show that the arginine phosphate may be somehow associated with the ciliary movement.

### The Industrial Outlook.

#### Tea Fermentation.

THE essential characteristics of black tea are developed during the fermentation process. The exact nature of the chemical changes involved or even the agency responsible for fermentation is still obscure and until scientific research clarifies the situation, rigid control of the process cannot be hoped for or replace the existing arbitrary standards based on visual and sensory judgments.

A certain degree of insight has, however, been obtained by the work done in several

countries. Thus it is known that fermenting leaf requires oxygen, indicating that some component of the leaf is oxidised. The absorption is rapid at first but gradually slows down and the time-oxygen consumption curve is similar to curves representing enzyme action. At the same time carbon dioxide is evolved but the course of respiration is not normal. The free tannin content of the leaf decreases as also the total soluble constituents and starch. Nitrogenous compounds do not appear to take part during the fermentation. Tea tannin is capable of forming red derivatives called phlobaphenes



and these substances which are soluble in aqueous solutions of tannins impart the red coppery colour to tea decoctions. Prolonged oxidation leads to the formation of brown oxidation products which make the liquors dull. Aroma is developed during fermentation and this has been traced to the release of an essential oil which, on fractionation, yields an alcohol containing 6 carbon atoms and methyl salicylate. This oil is found exclusively in the leaves. Prolonged fermentation leads to a loss in flavour and Mann in 1907 suggested that this was due to the development of micro-organisms. As a result of the chemical changes, heat is developed during the fermentation and the temperature of the fermenting leaf increases in the early stages but gradually slows off.

There are at least two theories which have been put forward from time to time to elucidate the nature of the causal agency of the fermentation. The earliest was that fermentation was a putrefactive change but this had to be given up when it was shown that oxygen was essential for fermentation. The observation that fermentation was arrested at elevated temperatures—say at about 212° F.—showed that the fermentation was caused by thermolabile agents. The micro-organic theory was put forward by Kozai in 1891 and this was rigorously put to the test by Bosscha and Bozeskowsky who showed in 1916 that normal fermentation did occur with sterilized leaf. The usual sign of over-fermentation—the objectionable odour—did not develop with the sterile leaf even on prolonged fermentation. It was further shown that although the presence of some yeasts did not interfere with the normal course of the process the presence of moulds and bacteria was detrimental to the quality of tea. Oxidases, peroxidases and catalase have been demonstrated in the leaf and fermentation is ascribed to the oxidase group of enzymes. Although there is a general acceptance of this theory there has as yet been no work to show that the addition of the isolated enzyme to fermenting leaf alters the rate of degree of fermentation and until this is done the enzyme theory cannot be accepted without reservation.

Proper insight into the nature of fermentation cannot be obtained by isolated laboratory experiments alone, but such work should be coupled with large-scale factory experiments. Important work is being carried out in this direction in the laboratories of the Tea Research Institute of Ceylon. Thanks to the generous grant from the Empire Marketing Board, small-scale machinery for the manufacture of tea have been provided and it is hoped that with these facilities the nature of this important process in black tea manufacture will be elucidated.

B. N. SASTRI.

#### New Type Storage Battery Exhibited in France.

(*Electrical World*: June 18, 1932.)

CONSISTING essentially of a centre electrode of carbon surrounded by an absorbent material saturated with zinc iodide and contained in an electrode sheet of metallic zinc, a new type of electric storage battery was announced before the French Academy of Sciences early in June. F. Boissier is the inventor. When the battery is charged, the zinc iodide breaks down into metallic zinc that is deposited on the zinc sheeting and iodine that accumulates on the carbon electrode and in the absorbent material which may be an absorbent carbon powder. The zinc iodide is reformed during the discharge. M. Boissier claims this battery to be superior to the conventional storage batteries of the lead or nickel variety. As the plates do not disintegrate, there is no acid or caustic liquid to spill, no dangerous gases or vapours are given off and continual maintenance is not necessary.

B.K.R.

#### 4-Ton High Frequency Induction Furnace Installed in Chicago.

(*Electrical World*: June 28, 1932.)

A 4-TON Coreless Induction Furnace has been put in operation in the Chicago District, capable of melting 40 to 50 tons per day. This is double the size of any coreless



furnace previously installed, and is designed to melt low carbon stainless steel scrap, Ferro-alloys, etc. Essentially the furnace is an air transformer whose primary is a single layer helix of water-cooled copper tubing and whose secondary is the metal charge. Power from 1250 KVA—1000 cycle generator induces currents to circulate in the outer part of the charge thereby heating it. No electrodes are used. The charge is stirred by the electrical forces within the bath. Metal can be melted rapidly and with very little wear on the lining.

It is reported that this is probably the first time that the problem of carrying 12,000 Amp. at 1000 cycles or more has been successfully handled.

B.K.R.

#### Hollow Electrode Furnace reduces Ores to Steel.

By passing finely divided ores intimately mixed with reducing materials through the hollow electrodes of an electric furnace high grade plain carbon and alloy steels may be produced. Such a furnace reported in the *Electrical World* of June 18, 1932, as a notable advance in steel making has been manufactured by the Buffalo Electric Supply Corporation, Buffalo, N.Y. This type of furnace accomplishes in a single unit the production of a refined and finished product from metalliferous ore. It is said to have an output comparable to even the highest grade electric furnace, though acting in melting, refining and alloying capacities simultaneously with its equivalent blast furnace function.

B.K.R.

### Science News.

**A**CHARYA Sir P. C. Ray, the veteran chemist, completed his seventieth birthday this year. The services of this savant in the cause of Chemistry in India are very well-known. He could easily be described as the father of chemistry in this country, and the Indian Chemical Society, the only organization for Chemists in India, owes its origin and existence to the untiring efforts and munificence of the Acharya. As the founder of the Bengal Chemical and Pharmaceutical Works, he is the pioneer of Indian Chemical Industry. No less are his efforts in the cause of the afflicted and the distressed. His organization for the relief of the flood-stricken in Bengal, time after time, bears testimony to the public activities of the scientist. His work on "The History of Hindu Chemistry" is the only one of its kind. Translated into several languages it represents a great contribution to this interesting subject. He has been responsible for the building up of a school of Chemistry in Bengal, several of whose pupils have achieved great eminence in their fields of study.

At a public meeting of his admirers and students held in Albert Hall, Calcutta, on the 1st. March 1932, it was decided to celebrate the 70th. birthday of the Acharya in a fitting manner. A committee has been constituted to issue a commemoration volume contributed by those who know the Acharya intimately as a master or a public worker. A book of 500 pages is promised next September. We await the publication with keen interest.

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Dr. Zia-ud-din Ahmad, M.L.A., addressing the members of the University Union, Bangalore, on the 19th. July discussed the limits of error in marking the examination papers, arising from

causes such as the difference of perception of excellence, personal idiosyncracies of examiners, difference of standard of awarding marks adopted by them, their fatigue and their speed of valuing. He pointed out that the total deviation due to all these sources of error, when mathematically deduced, would amount 7.5 per cent in an examination in one subject, in which there are two papers of 50 marks each. He also dwelt on the theory underlying the practice of gracing up the marks of candidates failing to obtain the minimum for a pass, and as the result of statistical investigations, it is found that in case a candidate is required to obtain 33 per cent., in an examination comprising four subjects, each consisting of two papers carrying 50 marks, the true mark of the candidate may be anything between 28—38. After reviewing the other aspects of examination, such as the deviation in the average marks of any two examiners, the determination of the order of merit, and so forth, he was led to the view that the element of chance plays an important rôle even in the best conducted examinations.

All this philosophy apart, the man in the street would like to know how far the examination marks represent the true and complete picture of the normal state of the candidates' mind, its power, range and flexibility.

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The annual convocation of the Dacca University took place on the 28th. July when the address was delivered by Sir C. V. Raman. He chose for the subject of his address "Science and Human Life". He complimented Dacca on her happy environments and Bengal on having as the Chancellor of her two Universities, one whose early interest had been in the field of science.