Dr. Shadwell is undoubtedly right in saying that the demand for this Act arose on account of the existence of "abnormal places" in coal-mines—that is to say, places in which men cannot make normal wages even though they work up to the normal standard, and that these conditions are due to natural causes which can be neither controlled nor foreseen. He appears to accept the Minimum Wage Act as the only means of meeting the difficulty, but in this view experienced coal-miners are not likely to concur. It should be perfectly possible to devise means other than this Act, which unfortunately encourages slack work, without the grave drawbacks which the Act has brought in its train, but such other methods must be founded on mutual confidence between masters and men.

It must be admitted that this antecedent condition does not exist; masters have in the past been only too ready to look upon hard work or successful work on the part of the men as a fair pretext for cutting piece rates, and this action has sown in the men's minds the seeds of the suspicion that they cannot rely upon the masters for fair treatment in the case of abnormal difficulties. Colliery managers to-day are, no doubt, wiser, and have learnt to appreciate the fact that it is to their advantage, no less than to that of the men, that the latter should be in a position to earn high wages, provided, of course, that they give a commensurate amount of work in return. The old suspicious feeling, however, remains, and it has been responsible for the introduction of legislation which has probably done more harm to the coal industry than any other single step that can be named.

Dr. Shadwell devotes considerable attention to the discussion of the proposal for a national pool, but he evidently fails to see the real object underlying the proposal. He says that "it is impossible to maintain that there is anything impracticable or economically ruinous in pooling or amalgamation," and cites Sir George Elliott's old proposal to amalgamate all the collieries in the kingdom into one concern. He fails to see the difference between voluntary amalgamation and compulsory pooling, which latter would necessarily bring in a large number of collieries that are no longer able to produce coal for less than its market price. He suspects, indeed, that the object with which the pool was put forward was political, but does not appear to see the real motive underlying the scheme. As a matter of fact, all the proposals put forward for a considerable time past by the Miners' Federation, the Minimum Wage Act, repeated shortening of the hours, nationalisation, the pool, as well as the less openly avowed tendency to restrict production wherever possible—all these have one and the same underlying object, namely, to keep the largest number of men in the industry.

This object has been only too successful; the coal-miner to-day produces only two-thirds of what he did fifteen years ago, so that for an equal production the number of men employed in the industry is proportionately greater. Obviously, the larger the number of men employed in the industry the greater the political power of the Federation, because it thus obtains control of a larger number of votes and of larger monetary contributions. This gain to the Federation is, however, dearly purchased by the decrease in the efficiency and prosperity of the industry, and obviously such a road can only lead to ultimate ruin and destruction. No industry can prosper if it has in its ranks more men than it can legitimately maintain. The object of nationalisation was to support out of the pockets of the taxpayers the mines incapable of producing economically; the object of the pool was to support them at the expense of the mines that could pay their way. Both schemes were political, in the sense that their object was to keep a number of men in the industry who were working at a loss, and to devise means by which that loss might be made good by someone else. If Dr. Shadwell will consider the effects of the proposed pool upon the mining industry of the country as a whole in the above light, he will readily see why both mine-owners and the Government have offered such strenuous opposition to it.

Botanical Papers from Pennsylvania.

TWO parts of the Journal of the Botanical Laboratory of the University of Pennsylvania recently received (vol. iv., No. 2, and vol. v., No. 1) contain a number of interesting papers. Dr. D. W. Steckbeck has studied the comparative histology and irritability of sensitive plants. The majority of the highly sensitive species are natives of subtropical and tropical America, and their most widespread irritable response is the nyctitropic or "sleep-movement." The author suggests that the phenomenon of propagation of stimuli is centred in the endodermis, the cells of which contain a greater or less number of crystals of oxalate of lime, the number, regularity of shape, and degree of restriction to the endodermis increasing with the increase of sensitivity shown by the plant; the climax is reached in the two highly sensitive plants *Mimosa pudica* and *Biophytum sensitivum*. Each crystal is surrounded by a protoplasmic sac, threads from which pass through adjacent cell-membranes so as to form continuous protoplasmic connections throughout the endodermal tissue; the crystals with their protoplasmic connections are regarded as the special conducting lines for stimuli. The cells of the pulvinus of the leaves are found to contain aggregation bodies, resembling those described by Darwin and others, increasing in amount and complexity with increasing sensitiveness; these show contraction and aggregation changes under stimulation. They are proteinaceous in nature, and all contractile changes resulting from external stimuli seem to be due to changes primarily in the protoplasmic sac by which each is surrounded, secondly in the aggregation body itself, and finally in the amount of liquid these may absorb or give off.

Dr. J. S. Hepburn and Dr. E. Q. St. John describe the results of their investigation of the active digestive agent in the liquor secreted in the pitchers of the pitcher-plant (Nepenthes). Does digestion result from the action of a protease secreted by the pitchers or is it due to bacterial action? The authors found that liquor taken aseptically from unopened pitchers was sterile, but liquor in partly opened pitchers which were free from insects contained bacteria. The slowness with which bacterial digestion of the protein occurred shows that bacteria play a secondary *rôle* in the digestion of insects; the leading *rôle* is undoubtedly played by the protease of the pitcher liquor. The enzymes contained in the bodies of the insects may also assist in digestion.

Miss Alice M. Russell gives a comparative study of the macroscopic and microscopic structure of some hybrid Sarracenias and their parent species. Sarracenia is the genus of pitcher-plants native to swampy districts in Atlantic North America from Labrador to Florida, and several natural hybrids have been reported. The hybrid forms are found to be inter-

mediate, in comparison with the parents, in almost all details, namely, shape of leaf-pitcher and lid, colouring, size and shape of flower (though the flower of the hybrid is inclined to be larger and more showy than the parent), and size and shape of the petals. The intermediate relation also extends to microscopic details, such as character of cells of the epidermis, number of stomata, and characters of the internal tissues.

Dr. H. W. Youngken has studied the comparative morphology, taxonomy, and distribution of the Myricaceæ (bog-myrtles) of the eastern United States. The author finds that the infesting organism in the characteristic root-tubercles is an Actinomyces, and he has also observed it in the cells of the fruit-wall; after the fall and decay of the fruit it will again make its way into the soil and infect roots of other Myricas. Coccus-like forms, believed to be involution forms of the infesting Actinomyces, were found in the pitted wood-vessels, and apparently indicate the pathway taken by the parasite in order to reach the fruit-wall.

Miss Margaret Henderson describes the results of a comparative study of the structure and saprophytism of the Pyrolaceæ and Monotropaceæ in relation to the Ericaceæ (heaths). The author suggests that the two former families differ from the Ericaceæ only in their gradually increasing saprophytism and in those characters which go hand-in-hand with this, namely, loss of green colouring matter, reduction from shrubs to herbs, reduction of leaves to scales, increase in the number of seeds, and the reduction in their size and in the number of cells of the endosperm and embryo. Similar degradation changes occur in the orchid and gentian families, and the author therefore supports the view which would regard the Pyrolaceæ and Monotropaceæ, not as distinct families, but as representing subfamilies of the Ericaceæ.

The Claude Process for Ammonia Synthesis.

IN the issue of the *Revue scientifique* for May 28 M. Georges Claude gives an interesting account of his process for the synthesis of ammonia, depending on the use of pressures approaching 1000 atmospheres. The work of compression of a gas at constant temperature varies as the logarithm of the pressure, so that if the work of compression from 1 to 200 atm. is 2·3, that from 1 to 1000 atm. will be only 3, or at most 3·5, if the diminution of compressibility at high pressures is taken into account. At high pressures, however, the percentage of ammonia in equilibrium with hydrogen and nitrogen will be greatly increased. Claude announced in 1917 that his experiments indicated that the yield could be increased from about 13 per cent. at 200 atm. to more than 40 per cent. at 1000 atm., the temperature being the same in both cases. A production of 6 grams of ammonia per gram of catalyst an hour, as compared with 0·5 grams in the Badische process, is attained. Whereas it is necessary at 200 atm., employed by the Badische Co., to circulate the gas several times over the catalyst, and to separate the ammonia after each circulation, it is sufficient to circulate only three or four times at 1000 atm. The volume of the apparatus required for the same production is only about one-tenth that required at 200 atm. pressure. The main source of difficulty in working at high pressures is the evolution of heat, which is 25 to 50 times greater than in working at 200 atm. The difficulty is then, not to conserve the heat of reaction to make the process autothermic, as is the case in the Badische method, but to eliminate this heat. The Claude apparatus has been operated with success at La Grande Paroisse with a unit producing 1·25 metric tons of ammonia per day, and a larger unit, for 5 tons per day, with a compressor dealing with 700 cu. m. of gas per day, has recently been put into operation with success.

The percentage of ammonia after passing the catalyst is about 25 at 1000 atm., as compared with about 6 at 200 atm. The partial pressure is therefore 250 atm., as compared with about 12 atm. at 200 atm. total pressure. The vapour tension of liquid ammonia at atmospheric temperature being from 7 to 8 atm., it will be seen that this is negligible in the gas obtained by the Claude process, but most appreciable with the gas obtained by the Badische process. It is sufficient, in Claude's apparatus, to pass the gas through coils immersed in cooling water in order to separate practically all the ammonia, and the residual gas, after separation of liquefied ammonia, is sent directly, without further compression, to a second catalyst chamber. Three or four catalyst chambers suffice to convert the gas into ammonia. In the Badische process, on the contrary, it is necessary to wash out the ammonia with water under pressure, requiring a complicated apparatus and expenditure of work to bring the gas again to 200 atm. after mixing with fresh gas, and 15 catalyst chambers are required. It is also necessary to use heat to separate the ammonia gas from the solution so obtained, whereas in Claude's process the liquefied ammonia is merely allowed to evaporate, producing cold which can be utilised.

The Claude process, which offers great possibilities in the synthesis of ammonia and in the utilisation of atmospheric nitrogen, is to be installed in England. The patent rights have been acquired by the Cumberland Coal and Chemicals Co., who are to erect a works in the centre of the coke-oven district in Cumberland.

Field-work of the Smithsonian Institution.

THE Smithsonian Institution has just issued its annual Exploration Pamphlet, describing and illustrating its scientific field-work throughout the world during 1920. Twenty-three separate expeditions were in the field carrying on researches in geology, palæontology, zoology, botany, astrophysics, anthropology, archæology, and ethnology, and the regions visited included the Canadian Rockies, fourteen States of the United States, Haiti, Jamaica, four countries of South America, Africa from the Cape to Cairo, China, Japan, Korea, Manchuria, Mongolia, Australia, and the Hawaian Islands. The pamphlet serves as a preliminary announcement of the results obtained, though many of the expeditions will be more fully described later in the various series of publications under the direction of the Smithsonian Institution.

Dr. C. D. Walcott, secretary of the Smithsonian Institution, continued his geological work in the Cambrian rocks of the Canadian Rocky Mountains in the region north-east of Banff, Alberta. The work was hindered considerably during July and August by forest fires and by continuous stormy weather in September, but the particular questions involved in the season's research were settled satisfactorily, and some