is one, however, that requires extended quantitative and qualitative treatment. The supposition that an action is *entirely* due to a colloid, because the action ceases on separation of the colloid from the system, is an error commonly made by physiologists, due to the omission of taking into account phenomena of adsorption, and the complete alteration of conditions produced by the change.

There can be no doubt as to the value of this work in its completed form; it traverses practically the whole of physiology in its chemical aspect, so far as it is now possible to do so, and illustrates in an excellent manner the results that have been produced through application of chemical methods to physiological problems; it is the first extended treatise of the biochemistry of plants, and as such fills a void that was distinctly appreciable, and moreover fills it in a manner that places all vegetal physiologists under great obligation to its author.

F. ESCOMBE.

EXPERIMENTS WITH EXPLOSIVES.

New Methods of Testing Explosives. By C. E. Bichel. Translated and edited by Axel Larsen. Pp. 62. (London: Chas. Griffin and Co., Ltd.) Price 6*s.* net.

IN collecting together and translating the papers on the researches carried out in the laboratory of the Carbonite Explosives Company, Hamburg, the translator has given to English readers a valuable and interesting little volume. The title is perhaps a trifle misleading, but the whole scope of the work may be seen from the following quotation:—"(1) Why does a smaller quantity of one explosive than another cause ignition of fire-damp? (2) What are the incidental phenomena and the influences tending to promote such result? (3) In what manner do they co-operate in producing it?"

Appreciating the fact that it is desirable to work with quantities as nearly as possible approaching those employed in actual practice, special apparatus has been constructed, so that for the particular explosives dealt with we now have details obtained from experiment on a much larger scale than any hitherto adopted. In some cases charges of gunpowder as great as 1500 grams were exploded, and for the higher explosives often 300 grams. Even for the calorimetric determinations the bomb had a capacity of 30 litres, which was capable of taking a charge of 100 grams. There must always, however, be some risk with heavy charges of recording undue pressures, a point to which Noble has directed attention.

The actual pressures, gas volumes and composition of the products were determined from charges fired in Bichel's apparatus, the pressure being recorded by a piston indicator working on a drum. The record is really in excess of the true pressure, but it is stated that the indicated pressure is rarely more than two or three per cent. from the actual. The apparatus permits of variations of surface area for a definite charge, and so the cooling effect of the chamber may be eliminated. It appears that with this allowance the pressure at a given density of loading is proportional to that with higher densities. This, however, may not be strictly true with very high densities.

The actual temperature at the moment of explosion was calculated from the heat developed, the composition of the products and their specific heat, in the usual manner, but all such calculations are uncertain owing to doubt as to the specific heats of gases at these high temperatures, and the impossibility of taking into account dissociation. The possibility of fitting a thermo-junction into the Bichel apparatus might be worthy of consideration, for although the results cannot approach actual values, yet the relative temperatures recorded would probably serve as a useful check on those calculated. Macnab has already employed the thermo-junction for this purpose.

In connection with the safety of explosives for mining, undoubtedly the length of the flame, its duration and temperature are of the greatest importance. The two former were recorded photographically, a quartz lens being used. Some excellent plates of the flames are reproduced. A factor deduced from the ratio of the flame duration to the detonation time, termed the "after-flame ratio," is shown to have the greatest influence on the ignition of fire-damp, and a most instructive diagram shows the temperature developed, the length of flame, and the "after-flame ratio" for the explosives examined.

In considering the efficiency of an explosive the author makes a distinction between the dynamic action, due to the projectile-like action of the products on the surrounding surfaces, and the static energy, deduced in the usual manner from the volume occupied by the products at the calculated temperature of explosion. It certainly seems that a more rational classification is thus possible than when the two are considered together, and the results are claimed to be fairly in accordance with those obtained in actual practice.

The general bearing of the work on the question of safety is clearly dealt with, and four very complete tables give a mass of information relating to the explosives examined.

Sufficient has been said of the contents of the book to convince those interested in the subject of its great value. It deals almost exclusively with mining explosives, but it would certainly be of very great interest if the investigations could be extended to military explosives, for the author has such valuable apparatus at his disposal that experiments on this large scale could not fail to give much valuable information.

J. S. S. B.

CAUSALITY AND THE HUMAN WILL.

The New Science of Causation. By H. Croft Hiller. Pp. xiii+386. (London: The Walter Scott Publishing Company, Ltd., 1905.) Price 10*s.* net.

IF intrepidity were the prime essential of a philosopher, this work would be epoch-making, and its author would be a thinker of the first rank. He claims to have formulated a case—to his mind, abso-