some snails. The molecular weights of other proteins are, with one exception (casein, which contains protein molecules of various sizes), small multiples of about 35,000. Egg albumin and Bence Jones's albumin belong to the first group, with spheroidal molecules of radius 22 A. and molecular weight 35,000. Hæmoglobin and serum albumin have non-spheroidal molecules of weight 70,000; serum globulin belongs to the third group, with non-spheroidal molecules of weight 105,000; and the fourth group, with spheroidal molecules of radius 40 A. and weight 210,000, includes the vegetable proteins edestin, excelsin, and amandin. The results for egg albumin, by very different methods, are unanimous, and everything seems to show that it is a simple chemical unit. Serum albumin, on the other hand, has been fractionated. Although the results of Svedberg and Sjögren gave a molecular weight of about 67,500, instead of the value 45,000 found by Sørensen, the latter does not think his product contained true decomposition products, since the fractions retained their marked power of crystallisation. He considers that reversible dissociation only had occurred. He makes a far sharper distinction, in this and other examples, between reversible dissociation and true decomposition of a protein than does Svedberg.

The nature of peptic scission is considered at length, the conclusion being reached that the breaking of peptic linkages is the sole chemical process involved, the simultaneous marked change in physical properties being due to secondary processes (hydration and disaggregation).

The name 'component systems' is now preferred to that of 'co-precipitation systems' introduced by Linderstrøm Lang, the name 'component' being used for an individual reversibly linked constituent. The real character of the molecular weights found by Svedberg is accepted, and the 'average molecular weight' found for a mixture can give valuable information.

In the experimental part, emphasis is laid on the importance of determining the distribution of the components of the dispersion medium between the solution and the undissolved phase, and a number of examples from previous memoirs, as well as new investigations, are summarised in this section. Some tendency to reversible dissociation was detected with egg albumin. Serum albumin was separated into three groups of fractions differing in solubility, irrespective of whether the fraction in question is phosphorus-containing or not. The various fractions differed very little in chemical composition, and two almost identically composed substances may be widely different in solubility, a result which is not due to denaturation. Casein has a very considerable tendency to dissociation, but is not regarded as a mixture. Its ionisability in presence of acid or alkali gives rise to component systems with a much greater dissociating tendency than that of uncharged or isoelectrically charged systems.

The question of protein systems in serum is considered. They are regarded as in continual mutual interaction, forming new systems, the composition of which depends on concentration and other conditions, and the proteins may not correspond with those precipitated by salts. The question which this suggests, whether it is reasonable to retain the old terms serum albumin and serum globulin, is considered, the answer being in the affirmative.

The interesting relation between lipoids and proteins in serum is discussed, particular attention being given to Mâchebœuf's experiments. The latter obtained from horse-serum a product which he regarded as a chemical compound of lecithin, cholesterol ether, and protein, from which lipoids cannot be extracted by ether, and in which the protein is not, or is only slowly, denatured by alcohol at the ordinary temperature. This conclusion is accepted, and it is suggested that the perfect clearness of such liquids as serum and plasma, in spite of their high lipoid content, is explicable only by assuming linkages between the lecithin and sterols on one side and the proteins on the other. The linkage between lipoid and protein is weak and may be split in emulsification processes; a real chemical linkage is not probable.

It will be seen from the above brief summary that Prof. Sørensen's authoritative memoir raises many questions of considerable interest and importance, both from the chemical and the biological points of view, and it may be welcomed as a brief yet comprehensive summary of recent work in that branch of protein investigation to which its author has made so many important contributions.

General Biology in the "Encyclopædia Britannica".

ANY criticism of the articles on general biology in the "Encyclopædia Britannica" must take into consideration, first, the fullness and accuracy of the information contained in them, and secondly, the mode of presentation. For it is surely not sufficient to provide a summary, however authoritative, of any branch of science, if this is presented in such a manner that it cannot be understood by the general reader. It is for his benefit that the "Encyclopædia" is, presumably, issued, and its financial success is certainly dependent upon his willingness to purchase it.

There are some branches of physical science in particular which cannot be presented to the public in an intelligible manner. Both the subject matter and language employed are alien. But this has not in the past been true of biology. Here the general reader has felt confident of understanding articles written about it. It is in some degree a measure of the very definite advance which biology has made in the past generation that the general reader will not infrequently find these biological articles difficult of comprehension. But the fault does not always lie solely in the subject matter, for several of the authors have shirked the admittedly difficult task of presenting their information in plain English and taken the easier way of scientific 'shorthand'. The more intricate biology becomes, the greater the need for clear writing in articles such as these.

It is pleasant to find, therefore, that the articles which will probably be most frequently consulted by the general reader, evolution by Prof. E. S. Goodrich and zoology by Prof. D. M. S. Watson, are wholly admirable in both their scope and presentation. No biologist can read them without having his ideas clarified, and no layman can fail to understand them or to be impressed by the range of knowledge they display. The only criticism we have concerns the article on evolution. Here the vital need, in Darwin's opinion, of natural selection as the mechanism which prevented the swamping, as he thought, of any favourable variation by promiscuous interbreeding, is not stated. The reader is left with the impression that Darwin realised, as his successors do to-day, that there was such a thing as segregation which makes swamping impossible.

Prof. J. B. S. Haldane has made the best of a very difficult task in his article on heredity. It is not easy reading, but, in view of the nature of the facts with which it deals, this could not be avoided, and the

reader who takes the trouble to work his way slowly and carefully through this article will be repaid by the acquisition of a clear idea of the present state of knowledge on this subject, and also with a respectful feeling that biology *is* developing into an exact science. The article is a thorough-going account of the modern developments of Mendelism, but, with all possible respect to the work which it summarises, one is left with a feeling of the immensity of the superstructure which is now borne on the shoulders of the chromosome theory, and with a doubt as to whether some future edition of the "Encyclopædia" may not contain accounts of underlying principles of heredity as yet unsuspected.

Prof. F. A. E. Crew also provides an excellent summary of modern knowledge on sex, but, with somewhat more tractable material at his disposal, he is not quite so successful in his presentation. By some oversight, his long article contains no illustrative diagrams or graphs. It is doubtful whether the general reader, however painstaking, will really acquire a clear idea of the subject from this article, but to the biologist it can be recommended as a masterly summary of the facts.

Two articles, one on ecology by Mr. C. S. Elton and the other on experimental embryology by Mr. G. R. de Beer, bear testimony to the development of work on these subjects of recent years. The general reader will find Mr. de Beer's article full of surprising and unexpected information, and few biologists, outside the limited number who work on this subject, will fail to profit by the reading of it. Mr. Elton's article is interesting and well written but rather surprisingly long—the result, not of excess of knowledge, but of too little and a consequent lack of summarising generalisations. But it is a little difficult to understand why this article should be so long, when Prof. C. Lloyd Morgan is so restricted in his article on animal behaviour that his statements are condensed almost to the point of being unintelligible.

Prof. J. S. Huxley gives most interesting and well-written accounts of the courtship of animals and of sexual selection, and Sir J. Arthur Thomson is equally successful in his treatment of parasitism. Indeed, all the articles on what might best be described as natural history are excellent.

In his article on marine biology, Prof. J. Johnstone has largely confined himself to a clear but very general account of the different zones and conditions of life in the sea. The general reader is unfortunately left largely in ignorance of some of the recent advances in this subject, notably on the factors which control the abundance of the plankton and its variations throughout the year and in different regions.

It remains only to mention the articles on special groups of the animal kingdom, three of which, on protozoa, sponges, and tunicata, have been examined. The information therein contained is as concise and authoritative as the names of the respective authors, Dr. K. Bělař, Dr. G. P. Bidder, and Prof. W. Garstang, would lead us to expect. They all, in greater or less measure, give an account of the functioning of the animals, as well as of their structure and systematics, and so bear witness to the slow but ever-increasing accumulation of knowledge which, as Prof. Watson states in his article on zoology, is gradually building up a science of comparative physiology, of which, it may safely be prophesied, the next edition of this great "Encyclopædia" will have much to say.

Fuel Research in Great Britain.

THE Report of the Fuel Research Board for the year ending Mar. 31, 1930 (London: H.M.S.O., 1930; 2*s*. net), is an interesting document, because it seems to touch upon almost every technical problem of fuel in the British Isles.

One of the original plans of the Board was the prosecution of a survey of the national coal resources. The report shows that the recent establishment of a laboratory at the University of Leeds to study the West Yorkshire coalfield brings under survey areas producing 96 per cent of the coal raised, and the remaining 4 per cent can be handled by the existing organisation. The value of this work will be increasingly recognised as time goes on. One example is given in the report, namely, the publication of a hasty survey of Scottish coals made during the War, when the need arose to increase the production of furnace coke in Scotland, and it was found that the data had to be sought as an emergency measure.

The report gives a survey of the position of low temperature carbonisation, leading to the conclusion that its true place in the carbonisation industries cannot yet be defined, although several processes are being worked on a considerable scale and making good solid fuel products. The world prices for oil fuels have fallen so much recently as to make the economic position of these processes worse. Motor spirit is the most valuable by-product; but the yields of this are usually small, and the most hopeful line appears to be the conversion of a larger portion of the tar into this product. The tars themselves have such a character that they are largely inapplicable for the purposes to which tars are normally used. In order to find a basis for exploitation, their chemistry is being studied at the Chemical Research Laboratory, Teddington. Two methods are suggested for promoting the utilisation of tar. The first is the use of 'cracking', following the practice of the petroleum industry; but the tendency to form large quantities of coke and gas is unfavourable to the use of these tars as 'cracking stock'. Alternatively, the tars may be hydrogenated under pressure, which may be regarded as a form of 'cracking' in which coke formation is prevented by the union of hydrogen with the fragments. Very interesting experiments in this direction are recorded. By means of controlled hydrogenation, it has been possible to convert nearly the whole of a low temperature tar into motor spirit and neutral oil—the yields of the former working out at 16 gallons per ton of coal carbonised. The Admiralty staff has also examined the possibility of using low temperature tar oil as fuel for steam raising and for Diesel engines, with encouraging results.

The hydrogenation of coal and its products is obviously a subject of great potential importance nationally and to the coal industry. Though much has been done by private interests, the amount of authentic published experience is not great. The report describes the results of experiments—both static and continuous—on the hydrogenation of coal. With the use of suitable catalysts, it is found that Continental experience can be repeated with British coals and satisfactory yields of oil obtained. The character of the product is such that its after-treatment is difficult. A modification of the process, in which the coal is treated with a rapid stream of preheated hydrogen, has shown that much better products can thus be obtained. Indeed, it is stated that yields of motor spirit up to 120-130 gallons per ton of coal could be realised in a suitable plant. Another interesting scientific observation is the possibility of converting non-coking coal into coking coal by partial hydrogenation.

Much is hoped from the use of pulverised fuel as a