The wind channels at the National Physical Laboratory were recently described in *NATURE*, and little need be reproduced of Prof. Zahm's report. He describes the aerodynamic current as the steadiest in the world with limits of $\frac{1}{2}$ per cent. in both time and space. The steadiness of the air-flow in the Eiffel apparatus is stated to be 2 per cent. in time and space.

Prof. Zahm claims priority for the use of bell-crank balances for aerodynamical work, and says that he is of opinion that several new types can be devised which shall be equally precise with those at the National Physical Laboratory, and probably more expeditious. Such new types have been in contemplation since first devising the bell-crank aerodynamic balance in 1902. It is therefore probable that the balance for the wind tunnel of the Langley Laboratory will be of the bell-crank type, but will differ in detail from those in use in Europe at the present time.

In reference to full-scale experiments, Prof. Zahm considers that the Royal Aircraft Factory most nearly approaches the organisation projected for large-scale work at the Langley Laboratory, though he excludes the possibility of manufacturing aircraft in considerable numbers. He considers the outcome of the large-scale experiments at the Royal Aircraft Factory to be the production of a stable, efficient, and safe biplane. Reports from the seat of war add strong support to this view.

A considerable amount of space in the report is devoted to a description of the apparatus for large-scale experiments at St. Cyr, near Paris, and the remark is made that the relative importance of such large-scale tests as can be carried out on moving carriages, as compared with model tests or full-scale flights with instruments mounted on the aeroplane, has yet to be determined. The difficulties of experiment are indicated by the statement that the lift measurements on simple lifting surfaces are 5 per cent. in error, whilst the resistance measurements are much less accurate.

It is interesting to note that at the time of the visit, no aerodynamical experiments had been made in Germany other than those at Göttingen, but that arrangements were almost completed for large-scale work at Adlershof, near Berlin. For further particulars reference should be made to the original report.

CHEMISTRY OF WHEAT AND FLOUR.

FEWER than ten years ago most millers and bakers would have scoffed at the idea of there being any connection between chemistry and wheat or flour, and even the man of science would have admitted that the application of chemistry to such problems as the cereals presented was in its earliest infancy. Progress, however, has come rapidly and not only is the actual knowledge in the field now very considerable, but it has been already of the utmost value when applied in practice, so that scientific milling as well as scientific baking have made great strides.

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It is safe to forecast that chemistry is destined to play as important a part in the manufacture of flour in the future as mechanical science has done in the past, and it is satisfactory to note that there is every indication that Britain is more than prepared to hold her own in this development.

Flour is primarily a starchy material, but those characteristic properties which enable it to be made into bread are due almost entirely to the presence of some 10 per cent. of nitrogenous material—the gluten. Consequently, from the point of view of the miller and the baker, gluten is the all-important constituent of flour. Somewhat irrationally gluten has come to be regarded as such also by the would-be food expert, who overlooks the fact that bread is eaten primarily, not as a source of protein, but as an easily digestible, attractive form of starch. The man in the street properly regards bread as equivalent to rice, potatoes, or the like, rather than as a substitute for meat; it is, therefore, not surprising that the would-be agitators have failed.

Gluten, which is readily obtained from a piece of dough by washing and kneading it in a stream of water until the starch has been removed, is a light brown material which has considerable elasticity.

From the chemical aspect, gluten is a mixture of several proteins, of which two only are of importance so far as its bread-making properties are concerned. These are named gliadin and glutenin, and they are apparently chemical entities so far as this description can be applied to any protein. Gluten is characterised by the properties of ductility and tenacity so that in dough it can entangle air in its cavities, which swell during fermentation and still more when heat is applied.

Wheat grown in different parts of the world is far from being always the same nor does the flour derived from it give the same type of bread. It has long been known that certain types of flour give a large, well-aerated loaf, generally white in colour, and very palatable, whereas other types give a small loaf which is close in texture, dull in colour, and of a stodgy character. Such flours are distinguished as strong and weak and are valued with a difference of several shillings a sack in their price. It has been attempted to express this difference between strong and weak wheats by analysis, and from time to time strength has been correlated with high nitrogen content or, what amounts to the same, a high percentage of gluten, or again to a certain ratio of glutenin to gliadin. Though there is a rough parallelism between strength and these factors, it is in no case absolute, so that no one of them could be said to be the cause of strength. Indeed, the solution of the question has been found in quite another direction.

Gluten prepared from the strongest flour, when carefully cleaned by repeated washing in distilled water, loses its properties; it has neither ductility nor tenacity and partly dissolves in the water.

It acquires these properties again directly small quantities of electrolytes are present, and it is argued, therefore, that the physical properties of gluten are largely controlled by the presence of salts. The analytical study of strong and weak flours, made by Prof. Wood, in following this clue, indicated that the former contained a larger proportion of phosphates: this gave the stimulus to Mr. A. E. Humphries—a practical miller—to try the addition of an extract of phosphates from bran to a weak flour, and when this addition proved advantageous in increasing the strength, the effect of adding small quantities of pure phosphoric acid was tried in its turn. A great deal of painstaking research has been necessary for the elaboration of the new technique of improving flour, and it is now commercially possible to impart the qualities of strength to a weak flour, so that it works better in the dough, has an increased water absorption, and gives a larger loaf of lighter texture, which is more easily digested than when untreated. One result of the treatment, which is of the highest national importance, is that it enables a larger proportion of English wheat to be used in the bread mixture. Notwithstanding all that is said by food reformers and agitators in the daily Press, the public do demand a certain degree of lightness and texture in their daily bread, for which the presence of a considerable proportion of strong foreign wheat in the mixture is essential. This is especially the case in the large manufacturing towns in the North: any sceptic as to the difference can easily make the experiment of comparing the bread from two kinds of flour at his own table.

English wheats as a class yield weak flours, characterised by their excellent flavour. Since they can only be used by the baker to a limited extent they fetch a correspondingly lower price on the market, and to-day are very largely used for household purposes where strength does not matter. The possibility of using a considerably increased percentage of home-grown wheat in the bread mixture is bound to have a favourable effect on the price, the more so as the small country miller can make use of the local supplies near at hand and will be much less dependent on the supplies of foreign wheat, on which he has to pay freight from the ports of entry where the large milling concerns, with which he is in competition, are usually situated. Chemical science has thus rendered a service which promises to be of the utmost importance to the farmer and the country miller.

It is, of course, necessary that a close control should be exercised over the materials allowed to be used as improvers, and nothing but the spraying with soluble electrolytes in minute quantities should be allowed, anything in the nature of loading the flour being strictly prohibited. There is still much prejudice to be overcome against any scientific treatment of wheat, although the baker is allowed free latitude to make the best possible looking loaf from the flour available—an obviously irrational position.

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Returning to the scientific aspect of the difference between strong and weak flours, it would appear to be yet another instance of those elusive problems in the chemistry of organic colloids such as are concerned in most physiological problems and most of all in that of life itself. The state of aggregation of the colloid and its susceptibility to this and that alteration, owing to the presence of electrolytes of acidic or basic character, as manifested by changes in the physical properties is a general problem which is engaging the attention of many workers. In the case of flour, sufficient has been done to enable great advances to be made on the purely utilitarian side, though their theoretical explanation may be still veiled in obscurity.

Although strength in flour has been traced as due to the state of the colloid protein brought about by the presence of a certain proportion of electrolytes, our knowledge is still too indefinite to enable the farmer to produce a strong wheat by appropriate manurial treatment. The Cambridge School of Plant Breeders has offered good evidence that strength is a factor in the Mendelian sense, and it is considered possible by appropriate selection to obtain a wheat suitable for English soils which will combine strength with the equally important factors of yield and good straw. The efforts of the Home-grown Wheat Committee to encourage the growth of strong wheats in this country have met with only partial success, because, as a rule, strong wheats give poor yields and inferior straw. Much further research is necessary, which can only be done effectively at agricultural stations, such as Rothamsted, or by the agricultural departments of the universities. The composition of the flour is due to the state of maturation of the wheat berry at the time of harvesting, and it will be valuable to know the strength of the wheats produced on the individual plots at Rothamsted with different manurial treatment.

However, as shown above, the short cut which the miller is able to take renders him much more independent of the nature of his wheat supply, and it is probable in consequence that the considerable difference in price between strong and weak wheats will disappear to a large extent in the near future, so that the incentive to the farmer to grow strong wheats in this country will disappear. That they can be grown has been proved.

E. F. ARMSTRONG.

THE FOOD OF BRITISH WILD BIRDS.

SCIENTIFIC investigations concerning the economic importance of our British wild birds are of comparatively recent date, so that at present the sum total of our knowledge is only limited. To arrive at the precise economic value of each of our commoner species is a task of no mean magnitude, and yet it is slowly but surely being forced upon the minds of all thinking people who are concerned with the produce of the land