

is essential to animal life, and in food it fulfills the same function as that drunk by the animal. In calculating the food value of any feeding material the water contained is, of course, not taken into consideration.

ASH.—When a food stuff is burned until the organic matter is all driven off, the residue is the ash. It is composed largely of lime, magnesia, potash, sulphuric and phosphoric acids, and a few other oxides. The ash of the food is the source of the mineral matter found in the animal body, and as such is of importance. Ordinary combinations of feeding stuffs, however, usually contain an abundant supply of mineral matter for the use of the animal; so this is not often a matter of practical concern, except as it has a bearing on the mineral elements of fertility in the manure.

FATS.—This class of substances includes the fat in the meat or butter which we eat. The proportions of fat in feeding stuffs vary within wide limits. In general, seeds and their by-products contain more fat than coarse fodder. Straws contain less fat than hays, the amount varying from one-half to one and a half per cent. But little fat is found in the dry matter of roots or tubers. Corn and oats contain from four to five, while cottonseed meal contains from eight to twelve per cent. of fat.

CARBOHYDRATES.—This class includes starch, sugar, gum and other minor substances, and also the fiber or woody part of plants. The first are quite freely digested; the last is much less so, though fulfilling the same function as far as it is digested. The carbohydrates constitute the largest part of most vegetable foods. They are not stored in the body as such, but are converted into fat, or used to produce heat and energy. Since the carbohydrates and fats serve nearly the same purpose in the animal body, they may, for convenience, be grouped together. Experiments, however, have shown that fat, as a food, is about two and one-fourth times as effective, weight for weight, as are the carbohydrates. That is, one pound of fat will produce about as much heat or energy as two and one-quarter pounds of carbohydrates.

PROTEIN.—The protein of foods, like that of the animal body is characterized by containing nitrogen. It is, therefore, included in what is termed "nitrogenous matter." The function of protein in the food is first of all to build up new tissue and repair the working machinery of the body, and to supply material for the production of milk, wool, muscle, and repair of organs. No other food constituent can fulfill this function.

Since the animal body and all animal products are composed of the same group of substances as food stuffs contain, we have a basis on which to begin the feeding of animals. Rational feeding of animals is to supply these different elements in sufficient quantity and in the proper proportions for the needs of the animal's body. This is what is known as a balanced ration.