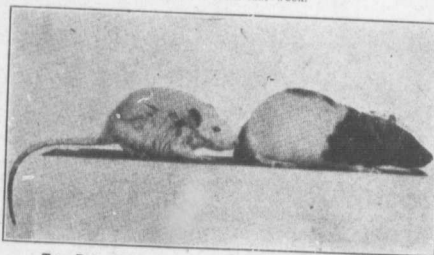


When a Balanced Ration is Not Balanced

New Facts in Feeding for Growth and Reproduction That Upset Some Old Theories

(Continued from last week.)

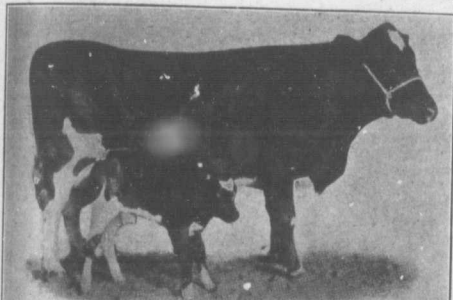
THESE experiments for the first time show the limitations of the theory of a balanced ration and indicate the very great importance of other factors besides protein and energy in the successful diet. It was, indeed, surprising to find that the common wheat kernel had a definite though low toxicity, and that mineral matter is of such great importance. It is well to keep in mind that, while from the economic standpoint it is important to prevent waste by conforming in feeding practice to the lowest requirements of our standards, it is also important to remember that it is well to have sufficient excess of the various necessary constituents in order to provide a safe margin for the animal. The restriction of the amounts of two indispensable constituents to the border line of deficiency between two different rations may not be a serious matter, but when both are restricted in one ration the effects may be disastrous. Similarly, as brought out with the animals fed with wheat grain, the presence of toxicity may or may not be shown by the animals, depending entirely upon the character of the other constituents of the ration. The necessity of considering such factors as toxicity, suitable proteins, growth-promoting substances or vitamins, and a proper balance of salts, indicates how complex the problem of nutrition really is and how necessary it



Two Rats of the Same Age. Food Made the Difference.

The rat on the right received a small amount of butter fat; the one on the left received an equal quantity of vegetable oil similar to the oils from which oleomargarine is made. Otherwise their rations were the same. The second ration lacks "vitamins." Those vitamins, which are necessary in both animal and human rations, are also found in the yolks of eggs and in the leaves of plants, are also found in the yolks of eggs. The illustration explains why the universal substitution of oleomargarine for butter would be disastrous to the human race. It also throws light on the newest problem of animal nutrition.

If we take such a mixture of foodstuffs which do not allow an animal to



The Effect of Adding Alfalfa to a Wheat Ration.

A cow and her calf showing the effect of a ration of wheat grain, wheat straw, and alfalfa hay. With half the roughage as alfalfa hay, reproduction in the first season period was successful. The calf was normal and strong and the cow was apparently healthy and vigorous. This illustrates the great influence of a good roughage.

is that the relative importance of the factors be clearly exposed in order that we may place the various feeds in their proper category.

Vitamins. These are as yet unidentified chemical substances in foods, which are indispensable for growth and reproduction. Without them no growth will take place. They appear to be abundant in milk and eggs and in the leafy portion of plants. One class—soluble in water—is abundant in seeds, while another class—soluble in fat—is apparently not so abundant in seeds. We know very little about either class, but we know that both kinds must be present in ample quantity if a ration is to be complete. Our results with the wheat ration are not to be attributed to a low supply of the fat soluble vitamins since the addition of butterfat, which contains it in abundance, did not improve it for reproduction. The other class of vitamins—the water soluble type—was abundantly supplied by the wheat grain.

A number of years ago chemists tried to get young animals to grow on rations which were made up of mixtures of carefully purified proteins, carbohydrates, and salt mixtures from the chemical laboratory. These salt mixtures must contain all salts which are left as ash when the body of the animal is burned, and include potassium, sodium, calcium and the magnesium salts of sulphuric, phosphoric, and hydrochloric acids. When such rations are fed, the animals not only do not grow, but they will not live any great length of time, ordinarily not over two months. The essential thing to remember about these experiments is that the foods used were

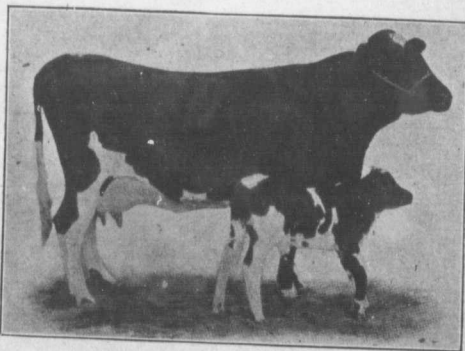
necessary for growth while other fats do not contain such substances, there has arisen the necessity of speaking of the presence or absence of fat soluble vitamins. These vitamins are closely, though not exclusively, associated with fats, as seeds to a certain extent and the leafy portion of plants to a considerable extent also contain these substances. Alfalfa leaves are a very good source of these unknown constituents, although there is every reason to suppose that the storage portion of plants in general is a better source of this class of vitamins than the grains.

Another Class of Vitamins. Besides the fat soluble type of vitamins we have still another class to consider. Suppose that to our unsatisfactory ration of proteins, carbohydrates and salts there is added the egg yolk fat or butterfat; we will find that the ration will still be unsatisfactory. If now we make a water extract of the egg yolk from which the fat has been previously removed and add this

plete and that there is much to learn about nutritionally balanced rations, yet the farmer would gain nothing by discarding his present methods of balancing rations and would indeed lose much by so doing. Energy and proteins are the nucleus of good ration construction and calculating their proper proportion as prescribed in the standards should be continued. It will be in the majority of cases bring success. What we learn in addition in the future about the balancing of salts in a ration, about the supply of vitamins and their preservation in the handling of our farm crops, about the inequality of the nutritive value of will be so much gained, and we want such knowledge; but the central nucleus of ration construction is sound and such results as given here should only not in the least shatter our faith in what we already possess.

Eventually the balanced ration will mean the complete ration, but that only when more knowledge is available; and the complete ration which we hit most of the time now (but when we miss it are at a loss to know the reason thereof) will include more than protein and energy; it will include both of these, and in addition it will mean a proper mineral content, an absence of poisonous materials, an adequate supply of vitamins, and possibly things yet to be discovered. Our understanding of nutrition must expand. Under conditions of forced restriction it is danger zone, as in the case of the Nebraska farmers, and only when we have complete understanding of all the nutritional factors required by animals and

(Continued on page 13.)



The Effect of the Wheat Ration Fed Continuously.

The same cow shown, showing the effects from the continuous feeding for the second season period of a ration of wheat grain, wheat straw, and alfalfa hay. This calf was carried to the full time, but was weak, and at first was fed from the bottle. It grew strong, but the fore legs were so weak that it stood for the first few days of its life on the first joints. This calf was blind. The mother, however, remained in an apparently good condition.