Let's Talk About Some of the Chemistry in Our Food

We may define a food to be any substance which will repair the functional waste of the body, increase its growth, or maintain the heat, muscular, and nervous energy. In its most comprehensive sense, the oxygen of the air is a food; as although it is admitted by the lungs, it passes into the blood, and there re-acts upon the other food which has passed through the stomach. It is usual, however, to restrict the term food to such nutriment as enters the body by the intestinal canal. Water is often spoken of as being distinct from food, but for this there is no sufficient reason.Many popular writers have divided foods into flesh-formers, heat-givers, and bone-formers. Although attractive from its simplicity, this classification will not bear criticism. Flesh-formers are also heat-givers. Only a portion of the mineral matter goes to form bone.Water forms an essential part of all the tissues of the body. It is the solvent and carrier of other substances.Mineral Matter or Salts, is left as an ash when food is thoroughly burnt. The most important salts are calcium phosphate, carbonate and fluoride, sodium chloride, potassium phosphate and chloride, and compounds of magnesium, iron and silicon. Mineral matter is quite as necessary for plant as for animal life, and is therefore present in all food, except in the case of some highly-prepared ones, such as sugar, starch and oil. Children require a good proportion of calcium phosphate for the growth of their bones, whilst adults require less. The outer part of the grain of cereals is the richest in mineral constituents, white flour and rice are deficient. Wheatmeal and oatmeal are especially recommended for the quantity of phosphates and other salts contained in them. Mineral matter is necessary not only for the bones but for every tissue of the body.Organic Compounds are formed by living organisms (a few can also be produced by chemical means). They are entirely decomposed by combustion.The Non-Nitrogenous Organic Compounds are commonly called carbon compounds or heat-producers, but these terms are also descriptive of the nitrogenous compounds. These contain carbon, hydrogen and oxygen only, and furnish by their oxidation or combustion in the body the necessary heat, muscular and nervous energy. The final product of their combustion is water and carbon dioxide (carbonic acid gas).The Carbohydrates comprise starch, sugar, gum, mucilage, pectose, glycogen, &c.; cellulose and woody fibre are carbohydrates, but are little capable of digestion. They contain hydrogen and oxygen in the proportion to form water, the carbon alone being available to produce heat by combustion. Starch is the most widely distributed food. It is insoluble in water, but when cooked is readily digested and absorbed by the body. Starch is readily converted into sugar, whether in plants or animals, during digestion. There are many kinds of sugar, such as grape, cane and milk sugars.The Oils and Fats consist of the same elements as the carbohydrates, but the hydrogen is in larger quantity than is necessary to form water, and this surplus is available for the production of energy. During their combustion in the body they produce nearly two-and-a-quarter times (4 : 8.9 = 2.225) as much heat as the carbohydrates; but if eaten in more than small quantities, they are not easily digested, a portion passing away by the intestines. The fat in the body is not solely dependent upon the quantity consumed as food, as an animal may become quite fat on food containing none. A moderate quantity favours digestion and the bodily health. In cold weather more should be taken. In the Arctic regions the Esquimaux consume enormous quantities. Nuts are generally rich in oil. Oatmeal contains more than any of the other cereals (27 analyses gave from 8 to 12.3 per cent.)Vegetable Acids are composed of the same three elements and undergo combustion into the same compounds as the carbohydrates. They rouse the appetite, stimulate digestion, and finally form carbonates in combination with the alkalies, thus increasing the alkalinity of the blood. The chief vegetable acids are: malic acid, in the apple, pear, cherry, &c.; citric acid, in the lemon, lime, orange, gooseberry, cranberry, strawberry, raspberry, &c.; tartaric acid, in the grape, pineapple, &c.Proteids or Albuminoids are frequently termed flesh-formers. They are composed of nitrogen, carbon, hydrogen, oxygen, and a small quantity of sulphur, and are extremely complex bodies. Their chief function is to form flesh in the body; but without previously forming it, they may be transformed into fat or merely give rise to heat. They form the essential part of every living cell.Proteids are excreted from the body as water, carbon dioxide, urea, uric acid, sulphates, &c.The principal proteids of animal origin have their corresponding proteids in the vegetable kingdom. Some kinds, whether of animal or vegetable origin, are more easily digested than others. They have the same physiological value from whichever kingdom they are derived. The Osseids comprise ossein, gelatin, cartilage, &c., from bone, skin, and connective issue. They approach the proteids in composition, but unlike them they cannot form flesh or fulfil the same purpose in nutrition. Some food chemists wish to call the osseids, albuminoids; what were formerly termed albuminoids to be always spoken of as proteids only.Jellies are of little use as food; not only is this because of the low nutritive value of gelatin, but also on account of the small quantity which is mixed with a large proportion of water.The Vegetable Kingdom is the prime source of all organic food; water, and to a slight extent salts, form the only food that animals can derive directly from the inorganic kingdom. When man consumes animal food?a sheep for example?he is only consuming a portion of the food which that sheep obtained from grass, clover, turnips, &c. All the proteids of the flesh once existed as proteids in the vegetables; some in exactly the same chemical form.Flesh contains no starch or sugar, but a small quantity of glycogen. The fat in an animal is derived from the carbohydrates, the fats and the proteids of the vegetables consumed. The soil that produced the herbage, grain and roots consumed by cattle, in most cases could have produced food capable of direct utilisation by man. By passing the product of the soil through animals there is an enormous economic loss, as the greater part of that food is dissipated in maintaining the life and growth; little remains as flesh when the animal is delivered into the hands of the butcher. Some imagine that flesh food is more easily converted into flesh and blood in our bodies and is consequently more valuable than similar constituents in vegetables, but such is not the case. Fat, whether from flesh or from vegetables is digested in the same manner. The proteids of flesh, like those of vegetables, are converted into peptone by the digestive juices?taking the form of a perfectly diffusible liquid?otherwise they could not be absorbed and utilised by the body. Thus the products of digestion of both animal and vegetable proteids and fats are the same. Formerly, proteid matter was looked upon as the most valuable part of the food, and a large proportion was thought necessary for hard work. It was thought to be required, not only for the construction of the muscle substance, but to be utilised in proportion to muscular exertion.These views are now known to be wrong. A comparatively small quantity of proteid matter, such as is easily obtained from vegetable food, is ample for the general needs of the body. Increased muscular exertion requires but a slight increase of this food constituent. It

is the carbohydrates, or carbohydrates and fats that should be eaten in larger quantity, as these are the main source of muscular energy. The fact that animals, capable of the most prolonged and powerful exertion, thrive on vegetables of comparatively low proteid value, and that millions of the strongest races have subsisted on what most Englishmen would consider a meagre vegetarian diet, should have been sufficient evidence against the earlier view.Indigestible Matter?Food is never entirely digested. As a reason against confining ourselves solely to vegetable food, it has been stated that such is less perfectly digested than animal food and that it therefore throws more work on the digestive organs. It is also urged that on this account a greater quantity of vegetable food is required. We have shown elsewhere that, on the contrary, vegetarians are satisfied with a smaller amount of food. Man requires a small quantity of woody fibre or cellulose in his food to stimulate intestinal action and prevent constipation.

About the Author

The small intestine is where the products of digestion are absorbed. The villi perform this task. Near the villi wall is an artery, into which food absorbs.