

On page 78, Prof. Kuss says "The materials of this active combustion are principally hydro-carbons, for the muscle oxidizes scarcely any nitrogenous substances and muscular labor causes scarcely any increase in the excretion of urea. The fact that the muscle when at work consumes principally hydro-carbon aliments and not albuminous substances, is quite a recent acquisition to science and is part of the knowledge recently obtained as to the mechanical equivalent of heat."

Prof. Huxley says: "The oxidation or in other words the *burning* of these matters, (organic molecules) gives rise to an amount of heat which is as efficient as a fire to raise the blood to a temperature of 100°." (Elementary lessons in Physiology, 8th ed., 1874, p. 17.)

See also General Physiology of muscles and nerves, by Dr. T. Rosenthal, Prof. of physiology Univ. of Eerlargen, 1877, p. 83, published in the International Scientific series, as to the combustion of carbon hydrates for the production of heat.

This oxidation, or burning of the organic matters of the food, is, at least sometimes direct. On page 138 of his physiology, Prof Huxley says: "It is highly probable that the amyloids and fats are very frequently oxidized in the blood, without, properly speaking, ever forming an integral part of the substance of the body." And on page 139 he says, "Proteids are *tissue formers* inasmuch as no tissue can be formed without them, but they are also heat producers, not only directly, but because they are competent to give rise to amyloids by chemical metamorphoses within the body."

Dr. Wilson says, "There is no doubt that a certain portion of the nitrogenous constituents is directly decomposed in the blood, and so far they contribute directly to the maintenance of animal heat." (Hand-book of Hygiene and Sanitary Science, 5th ed., revised 1883, p. 29.)

Speaking of the saccharine constituents, Dr. Wilson says, page 30, "These like the fatty constituents are directly subservient to the maintenance of animal heat."

Dr. Chambers says, "Since the sugars, which may be regarded as including starch, do not in their normal condition pass into the secretions, but are oxidized in the blood, into carbonic acid and water as ultimate products they must contribute materially to the support of the animal heat." (Encyc. Brit., 9th ed., art. Dietetics.)

Instead of heat being merely incidental to nutrition or vital action as Prof. Cook says it is, its production by oxidation is one of the chief ends of bodily energy. Dr. Wilson says, page 27, "It may be broadly asserted that the ulti-

mate destiny of food is the development of heat and muscular action."

Dr. Michael Foster, says, "Manifold as seems the body's energy it has but one source, the decay of living material, *i. e.* the oxidation of complex substances, diversely built up into living matters, and but two ends, heat and muscular work." (Encyc. Brit., 9th ed. 1885, art. Physiology.)

Dr. Burdon Sanderson says, "The production of heat is one of the essential functions of animal tissue."

"So long as the tissues are neither gaining nor wasting the quantity of heat produced by the oxidation of the food consumed is equal to the quantity which would have been produced had the same quantity of oxidizable substance been converted into similar, more or less oxidized products out of the body."

"In the case of animals which are fed exclusively on hydro-carbons, *e. g.* bees, the quantity of heat produced is at once obtained by estimating the heat value of the food consumed."

"In such animals as can be fed exclusively on hydro-carbons of known composition, the carbonic acid discharged may be taken as an exact index of the heat production, not because the heat produced, as was at first erroneously assumed, is equal to the heat which would be disengaged by the oxidation of the quantity of carbon actually contained in the carbonic acid, and of the quantity of hydrogen contained in the corresponding quantity of water, but because in such an animal, the whole of the material consumed is completely oxidized, so that the quantity of carbon discharged as carbonic acid is always equal to the total quantity of the same element oxidized. On this account bees, which can be fed exclusively on hydro-carbons, and have the additional advantage that, although they are of variable temperature, their heat production is as active as that of warm-blooded animals, are especially adapted for the investigation of the relation between heat and oxidation." (Hand-book for the Physiological Laboratory, 1873, pages 336 to 338.)

On this branch of the subject Dr. Pavy says: "In the case of sugar, starch and fat, it has been taken that the heat evolved under oxidation in the calorimeter represents the heat given off when consumed within the body, there being every reason to conclude that the ultimate products are in each case the same." (Food and Dietetics p. 51.)

On page 81, Dr. Pavy says: "Looking at these compounds (carbo-hydrates) as force (or heat) producers we must take them in their original state and upon the amount of unoxidized