which includes the process by which the digested food is built up into the protoplasm of the cells, or assimilation, and that by which the resulting substances are broken down again, or disassimilation. It is by these processes that the energy of life is set free; the energy by which the tissues perform their functions, and which appears as body heat. Every cell in the animal body is therefore a seat of energy production, and at the same time each is a machine for converting this energy into some definite form of work. In this regard the animal machine is quite unlike a steam engine, where energy liberation occurs in the furnace, but conversion of this to movement occurs in the pistons. The furnace and the machinery of the animal body are part and parcel of the same structures, and the digestive, circulatory, respiratory and excretory systems are more highly specialized for the purpose of transporting fuel, the oxygen to burn it and the gases produced by its combustion to and from the living cell. These processes of assimilation and disassimilation constitute the study of metabolism, the practical side of which is included in the science of nutrition.

The Physico-Chemical Basis of Life.

With the object of ascertaining to what extent the known laws of physics and chemistry can explain the fundamental processes that are common to all cells, we must make ourselves familiar, first of all, with the chemical and physical structure of the constituents of the cell, and secondly with the physico-chemical laws which govern the reactions that take place between these constituents. The same laws will control the reactions which take place in the juices secreted by cells; for example, in the blood and in the secretions, such as the saliva.

The Chemical Basis of Animal Tissues.—Certain substances are found in every living cell and in approximately equal quantities; hence these may be considered the *primary constituents* of protoplasm. In general they consist of the proteins, lipoids, inorganic salts, water, and probably the carbohydrates. Protoplasm is the substance composed of these primary constituents. By its