PHYSIOLOGICAL CHEMISTRY IN COLLEGES OF PHARMACY.*

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Physiology, or the study of the functions of the human body, has recently assumed greater importance than ever before. Allied closely with this study is that of chemistry, properly described as the science of the composition of matter. Our concern in physiology being that of living material, with its many intricate and ever changing compositions, of necessity involves minute investigation in the chemical realm. It has been only a short time since this close relationship has attracted investigators with the result now of an inestimable field designated as physiological chemistry.

The practice of medicine to-day has passed far beyond the pure empiricism of former days, but is largely founded now upon facts explained on physiological and chemical bases. It is a curious fact that it is difficult to find a paper upon a modern medical topic in which reference is not made in some way to one or more biochemical analyses.

While it is not my object to go into a detailed discussion of the many diversified analyses and syntheses, I desire to call attention to the importance of developing properly trained physiological chemists to undertake this work; pointing out at the same time the relationship of physiological chemistry as a vital factor in the diagnosis and treatment of disease.

It is by a thorough understanding of the chemical composition of the normal body fluids such as blood, lymph, gastric juice, bile, etc., in contradistinction to analysis of these fluids in the state of abnormal activity or disease that has given physiological chemistry its vital import.

The phenomenon of life is in reality a series of increasing chemical changes of both composition and decomposition in response to certain chemical and physical influences in the human body. A moment's reflection will inform us that the human structure represents in all its aspects a most comprehensive chemical laboratory. By a series of anabolic changes various food materials such as fats, sugars, carbohydrates and proteins are taken into the body and made into living material and after utilization as such are eliminated as various waste materials such as urea, carbon dioxide, etc. This latter series of decomposition is often termed catabolism. The multitude of chemical changes constantly going on within this human laboratory become not only amazingly interesting but in some instances almost beyond chemical explanation.

By chemical analysis the body can be reduced to a number of liquid and solid compounds belonging to the organic and inorganic worlds and termed proximate principles. The organic compounds consist of representatives of the carbohydrate, fat and protein groups of organic bodies.

Carbohydrate exists as glycogen in the liver and is readily convertible to dextrose, which is present in the blood in fixed amounts. Fats are capable of saponification and emulsification in the intestine, and are found distributed throughout the body. The proteins comprise a group the exact structure of which is as yet not determined, but is said to consist of carbon, oxygen, hydrogen, nitrogen,

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phosphorus, and sulphur in varying amounts. This group is absolutely essential to life, and is colloidal in character. They are utilized in the body by being reduced to relatively simple nitrogen holding compounds, termed amino-acids, of which we have a series of some twenty, as glycocoll, leucin, etc. It is to be remembered, however, as a point of prime importance that this class of proteins can undergo putrefaction or fermentation due to bacteria. Further, that the chief source of nitrogen waste excreted as urea and creatinin, and other nitrogen inorganic compounds are derived through decomposition of the proteins

The inorganic bodies consist of water, various acids and inorganic salts. These proximate principles can be further resolved by an ultimate analysis into a number of chemical elements, such as oxygen, hydrogen, nitrogen, carbon, phosphorus, iron, sodium, etc. These elements, while not existing in the free state, are found in many variable combinations throughout various organs of the body: thus calcium phosphate is largely distributed in the bones, teeth, cartilage, blood, etc. Calcium carbonate also is found in the bones, teeth, etc. Sodium chloride, itself of vast importance as it regulates to a large extent the phenomena of diffusion, is present in all tissues and all fluids of the body. Sodium phosphate and sodium bicarbonate, alkaline in reaction, impart alkalinity to the blood and are now termed "buffer substances." Of the many other salts of sodium, potassium, magnesium, iron, etc., time does not permit of discussion, except to say that each is widely distributed and has its function.

It is quite apparent that for the maintenance of life, one must supply to the body the principles mentioned above: these principles undergo digestion and absorption into the blood stream, which is the nutritive fluid of the body, and also enter into the chemical formation not only of the tissues but of all the body fluids such as bile, gastric juice, etc.

With this brief resumé of the elementary chemistry of the body, it is apparent that we can easily study the degree of physiological or pathological conditions: thus, an analysis of the blood, which requires but a small amount of material, may yield many facts of physiologic as well as of clinical importance.

Blood chemistry stands out as a conspicuous factor in present-day analysis, especially in two diseases, nephritis and diabetes. The blood determination for non-protein nitrogen and urea content, which are greatly increased in nephritis, especially in the chronic type, is highly important. Often the total nitrogen content, in conjunction with the factors above, is highly indicative not only in the diagnosis, but in the prognosis for the future welfare of the patient. This is especially true in uremia where there is a great increase in nitrogenous components of the blood, such as uric acid, creatinin, creatin, amino-acid nitrogen and even ammonia in conjunction with urea nitrogen and non-protein nitrogen. Very often the surgeon prior to operation, especially upon one with prostatic disease and associated nephritis, demands the determination mentioned above which, under increased percentages, would contraindicate a general anesthetic like ether.

In diabetes, blood chemistry reveals its chief significance in the determination of glucose content and for the study of acidosis. In this latter and often fatal condition, there is an increase in acetone, diacetic acid and hydroxybutyric acid, but blood examination alone will present the significant findings showing

the severity and gravity of the condition. In conjunction with the various tests under acidosis, recent investigation has yielded other methods which are more or less typical of this condition. These include the determination of the alkali reserve of the blood, sometimes known as "buffer value." The correlation of these facts in all cases of diabetes, in conjunction with the sugar findings in the urine, are necessary for the rightful knowledge of the progress of the case.

Recently the determination of the cholesterol content of the blood has been said to be an aid in the diagnosis of gall-stone formation. Aside from blood chemistry, with its many chemical analyses, the study of other fluids of the body by laboratory tests are highly significant. Especially is this true in gastric analysis. The former examination of a single gastric content has now given way to the fractional method of gastric analysis, by which is meant the determination and findings of stomach content removed at short intervals. The determination for total acidity, free acidity, pepsin, trypsin, lactic acid, occult blood, and bile have great significance in all cases where the stomach is to be studied in relation to the various forms of gastritis, ulcer, and malignant growths.

With this brief synopsis of a few of the laboratory tests and their significance in medicine, there naturally comes the thought of the development of those best fitted to undertake such work. While physicians frequently develop into laboratory workers, especially along serological lines, yet I feel that those who have the fundamental chemical knowledge, acquired from the courses given in our better colleges of pharmacy, would be excellently equipped for this field of physiological chemistry.

While it is true that the physician is the one to interpret the significance of laboratory findings, yet the determinations should be made by one who has a thorough understanding of the basic chemical principles underlying these tests.

A course in physiological chemistry would indeed be an asset to colleges of pharmacy, not only in advancing scientific teaching, but also in preparing men pharmaceutically trained to take up this important, necessary and newer science.

THE CHEMISTRY AND THERAPEUTIC PROPERTIES OF CHAULMOOGRA OIL.*

BY L. E. WARREN.

Within the last few years certain derivatives of chaulmoogra oil have attracted considerable attention in the tropics because of their increasing use in the treatment of leprosy. In India and adjacent countries chaulmoogra oil has been used both orally and externally in the treatment of leprosy since prehistoric times. It has also been used there for rheumatism, syphilis and various skin diseases. However, it is so irritant to the intestinal tract that the oral dosage can seldom be pushed to the curative point in leprosy. It is a current belief among the natives of India that even if the digestive tract of a leper patient can withstand the chaulmoogra oil treatment the disease can not always be cured, *i. e.*, that chaulmoogra oil is not a specific in the treatment of leprosy. Since it seems probable that the derivatives of chaulmoogra oil are destined to have a prominent place in therapy in tropical

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