Several actual analyses have already been made which will be described in detail elsewhere.[1] It has been found very easy to recognize at a glance each component in a three component mixture and in the case of the simpler salts many more than this could certainly be identified. Accurate quantitative tests have

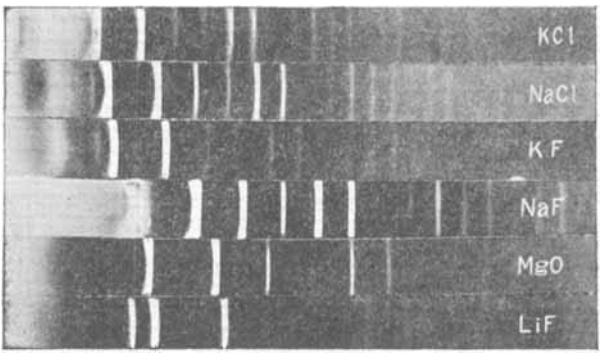

Fig. 1.

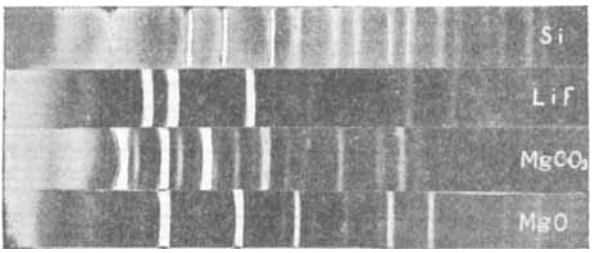

Fig. 2.

not yet been made, but it is anticipated that an accuracy of one percent will be easily obtainable, for components present to the extent of one percent or more of the whole sample.

THE RELATION OF LIGHT TO HEALTH.*

BY CHARLES E. DE M. SAJOUS, M.D., LL.D., SC.D.

The word "ferment" is steadily being replaced in medical phraseology by the word "enzyme." In the words of Professor Mendel, of Yale, "Enzymes are no longer thought of exclusively as agents of the digestive apparatus; they enter everywhere into the manifold activities of cells in almost every feature of metabolism." In other words, the same ferments, pepsin, trypsin and others which first prepare foodstuffs in the stomach and intestine, for assimilation by the tissues of the body at large, are the same agents which carry on certain functions in the intimacy of the tissues.

[1] *J. Am. Chem. Soc.* for June or July.

* Abstract of a paper presented before the Philadelphia Section of the Illuminating Engineering Society, and published in the Transactions of the Society.—Through *Scientific American.*

Considerable evidence is available to show that these digestive ferments are carried from the alimentary canal to the tissue cells by certain white corpuscles of the blood, in which they are readily found. To these white corpuscles belong the phagocytes, which ingest and digest disease germs. We thus have digestive ferments taking part—along with the oxidizing ferment—not only in the vital processes of each tissue cell, but also in the defense of the body against disease.

Prevost's theory of mobile temperature equilibrium is now known to apply to radiant heat as well as to heat energy derived from other sources. It is simply that if two bodies of different temperature are placed close to each other, the warmest of the two will lose heat by emitting radiant heat which the colder body will take up until the temperature of both is equalized. Briefly, the skin absorbs radiant heat when the cutaneous temperature is lower than that of the radiations received, up to certain limits (influenced by the perspiration and other factors) and the temperature of the tissues of, and beneath, the skin is thus raised.

The penetration of radiant light through the tissues when long wave lengths characterize the rays is considerable, that of red rays, for instance, exceeding one inch. Careful experiments by Rollier showed that solar rays could penetrate the hand and forearm and also, under favorable circumstances, the entire chest.

How does light energy influence the vital processes of those tissues and contribute to the defense of the body against disease? Charcot, the French neurologist, as far back as 1859, urged that we should distinguish between the purely chemical effects and those produced by heat. In the present connection we probably are dealing with a process in which the chemico-physical effects credited to oxidizing ferment I have termed "adrenoxidase" and heat both take part, particularly near the surface.

There exists immediately under the superficial tissue a great system of small interwoven canals which, so to say, act as sewers of the tissue cells. They serve not only to carry off, but also to purify, the fluids received from these cells by breaking down, as far as possible, the wastes and detritus that they form while carrying on the process which constitutes their life. These channels are interspersed with glands that contain phagocytes, *i. e.*, cells of the type that destroy, by means of their digestive ferments, disease germs and other harmful substances that the small canals carry to them from every direction. This system of lymph channels and glands, known as the lymphatic system, is a prominent weapon of defense. Everyone has seen lymph, a whitish viscid fluid, collect on abrasions, and also enlarged glands on the necks of children. These latter are enlarged lymphatic glands trying to destroy bacteria from some source, the tonsils, adenoids, etc., thus preventing general infection.

The beneficial influence of sunlight is readily accounted for when we take the lymphatic system into consideration in addition to the tissue cells, in view of the effect of light energy as manifested by its radiated heat. Indeed—and this is the dominating factor in the process—the ferments of both kinds previously referred to, those which promote tissue oxidation and those that digest and destroy bacteria and organic poisons, become increasingly active as the heat to which they are exposed is increased, and we obtain as result an increase of both vital activity and defensive aggressiveness.

This *increased efficiency of ferments under the influence of increased tempera-*

ture is the method adopted by Nature, according to my own viewpoint. It explains the process we term "fever," long deemed an enemy, but in reality a defensive function calculated to destroy poisonous substances or germs that have found their way into the body fluids and cells from a focus somewhere, either in the superficial or deep tissues. In the course of fever, the germ destroyers, or phagocytes, are not alone at work in the blood streams, but the whole internal lining of the blood vessels themselves is made up of these germ-destroying cells. Again, the lymphatic vessels which act as drains for the tissue cells, we have seen, afford additional aid in the defensive process by means of the multitude of phagocyte-laden glands through which the serum obtained from the blood by the tissue cells must pass before it is returned to the circulation.

Of course, abnormally high fever, *i. e.*, fever above 104° F., for instance, may become dangerous in the sense that the very digestive ferments which have their purpose to defend, become too active and begin to digest not only the red blood corpuscles, a process physicians term "hemolysis," but also certain tissues, a process known as "autolysis." To offset these morbid effects of excessive radiation during hot weather, the skin protects the body by perspiring; the water which moistens the skin, by evaporating, keeps the surface temperature within normal limits. The cool baths physicians employ in the treatment of typhoid fever have the same end in view; they keep the fever within safe limits.

On the whole, the relation of light to health may be summarized, in view of the few data submitted, by the statement that it is intimately bound up with the perpetuation of life, whether the tissues be normal or diseased. It tends to sustain health by promoting, as radiant energy, the activity of the oxidizing ferment adrenoxidase, which sustains the oxidation of tissue cells, an essential function of their life. It tends to defend the cell, when endangered by certain germs and poisons, by enhancing through the heat energy developed the efficiency of the defensive ferments which submit these harmful agencies to digestive destruction.

PHARMACY FROM AN EDUCATOR'S VIEWPOINT.*

I cannot help associating in my mind the profession of the pharmacist with that of the physician. It seems to me as if they are inseparably connected with each other. There was a time, long ago, when it was difficult to distinguish between the pharmacist and the physician. In fact, in early times, the man who attempted to heal the ills of the human race was both physician and pharmacist. It was in these same early days of the professions that their practice and methods relied more upon the superstition and credulity of their patrons than upon any scientific knowledge. We may still read in some of the old books how healing recipes and medicines were compounded from dried bats. How live toads and mystical plants, plucked from a murderer's grave at midnight, would be efficacious in curing disease. We have long since passed out of that period into what might be called the scientific age of these professions in which they have made enormous strides. The last fifty years have seen scientific developments in every profession

* Parts of an address by Dr. W. E. Stone, President of Purdue University, before the Indiana Pharmaceutical Association.