REPORT

ON THE

Progress of Medical Chemistry.

READ BEFORE THE

MEDICAL & CHIRURGICAL FACULTY

OF MARYLAND,

JUNE 8, 1855.

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CHAIRMAN OF COMMITTEE ON CHEMISTRY.

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Contributions of Chemistry to Medicine:

1. .... Pathology.

2. .... Diet.

3. .... Blood and Urine.

4. .... Materia Medica.

5. .... Toxicology and Legal Medicine.

Committee:

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REPORT.

The progress of Chemistry has been so rapid in the present age, that it is found, by the closest student, a herculean task to keep pace with it even theoretically; but to combine an experimental application of newly discovered principles with the mere theoretical knowledge, would involve such immense labor, that each one shrinks from it. Hence we find, even among those who have devoted their lives to the cultivation of this science, but few who allow themselves to work in its varied apartments. Each wishes to select some province, in which he can hope to labor so as to command all that is known of it, and, if possible, contribute additional discoveries. If this be the case with the chemist, how must it be with him who is obliged to examine the many branches which belong to his professional studies, and to keep himself posted up in the contributions which each is making towards the thorough perfection of his profession. The physician cannot expect to be a thorough chemist; but he must be ready to avail himself of the lights Chemistry sheds on his path, and must have his eyes opened so as to recognize those lights.

The committee feel that in preparing a report on Chemistry for the State faculty, it is expected of them not to travel over the whole domain, but only that part which is specially interesting to the physician. And this is also a wide field. It would require far more space than is allowed them for this report. They, therefore, propose introducing short notices of some points which Chemistry has elucidated in the past year, which seem to them important as well as interesting to the profession.

I.

One of the problems, which the profession has been trying to solve for years, is the existence or non-existence of a local cause for the affection called Goitre. Its prevalence in certain countries for ages, seems to point to the existence of such a local cause. Thus, in France, England, Spain and Germany, this "morbid enlargement of the thyroid gland" is common in the neighborhood of mountainous districts. In this country certain localities are notorious for the same reason, and it seems "to prevail as an epidemic." Gibson quotes, from Trask, the statement, "that it is so common a disorder at Windsor, in Vermont, that hardly any female is exempt from it;" and he quotes the general conclusion as to the cause, that "it prevails in valleys at the bottom of the highest mountains, which are particularly exposed to the influence of easterly and southerly winds."* Most writers are disposed to consider the disease as "most frequent in low, damp, confined spots, where the stagnant atmosphere is seldom stirred by wholesome breezes; and where the sun in summer has great power."† M. Maumene has attempted the investigation of the cause of this disease, guided by the lights of Chemistry, and has succeeded in producing some results, which, if not absolutely explaining the cause, yet point the way along which an explanation may be obtained.

M. Maumene starts out with the idea that there is some peculiar substance existing in the water which is habitually used by those who are afflicted with goitre.‡ He considers that there is strong presumptive evidence of this, in the fact, that "successive families have been found attacked with goitre when they occupied habitations on certain streams," and that under the same circumstances, goitre has been produced in animals.

Looking at the various substances found in our streams, his attention was directed to the fluorides as those which might be injurious to health, and he determined to use an experimentum crucis, to establish or refute this idea. He subjected a small dog to a diet, which contained for each day, from 5 up to 50 milligrammes of fluoride of calcuim. This he changed for fluoride of sodium, giving at first 20 milligrammes a day and increasing up to

* Gibson's Surgery, II, 61–2. † Watson's Practice, 483.

‡ The Chemist, II, 95.

120. After some four months, during which period of time the dog seemed to be in perfect health, "a general enlargement of the neck took place, forming a sort of collar or swelling," attracting the notice of strangers. Five years have since elapsed and the swelling has not disappeared. Now this experiment, though not final and conclusive in its nature, yet must direct our attention to the presence of the fluorides in water as a *probable* cause of the disease. They are often present only in very small quantities, and without the attention of the analyst is called specially to them, he might neglect them in his examination. If this experiment of of Maumene is supported by additional observations on animals, we shall need a re-examination of the composition of the various streams and springs which supply the countries, where goitre prevails, with drinking water.

Attention has been directed to the origin of sugar, heretofore considered a morbid product of the system. M. Claude Bernard some years since, proved that sugar was contained in the liver of animals and in the blood taken from different portions of the body, and that it had a part to perform in the normal condition of the system. Its presence in the blood, when food containing much starch or saccharine matter was used, had been previously demonstrated. But this presence was supposed to be only the result of a superabundance of such principles in the food, and to be purely pathological. Bernard, from a series of experiments known to the profession, took the ground that sugar could be produced *de novo* from amylaceous principles, by means of the liver, which organ was most likely the originator also of all the fatty tissues. He considers that the two substances, fat and sugar, are vicarious with each other. Where the liver is forming much fatty tissue, little or no sugar is found, and conversely, where the liver is generating much sugar, it is comparatively devoid of fat. The liver is generally of an abnormal size in cases of diabetes, just as it is in the case of drunkards. In the former case, the size is due to the large amount of work it has to perform in the formation of sugar, and in the latter, to the amount of fatty tissue it is forming. Bernard goes still further, and states if the medulla oblongata be irritated, near the origin of the pneumo-gastric nerve, that the liver begins to secrete very large quantities of sugar, and artificial diabetes may thus be produced.

These views of Bernard are very important to the medical profession. If true, then the treatment heretofore of many cases of diabetes mellitus, has been directed wrongly. If the *causa morbi* be confined to the liver, and not at all dependent on the nature of the food, it becomes important that the morbid condition of that viscus should be investigated, and that a system of strict regimen, which requires utter abstinence from amylaceous food, should be done away with. It is known to every one that it is a difficult matter to deprive patients of amylaceous food. The stomach revolts against the sole use of nitrogenous material; at least in the manner it is generally given. If the treatment of the disease does not require such regimen, then surely it is subjecting patients to much annoyance by continuing it.

Figuier, in January of this year, read a masterly paper before the Academy of Sciences, in refutation of Bernard's views, which we consider an important contribution of Chemistry to Medicine, and from which we shall quote at some length. It is necessary before doing this, to show how Barnard's view *might be* sustained, and what supporters it has gained in Europe.

Lehman, in the first volume of his Physiological Chemistry, says "sugar cannot *generally* be found in the blood; but in the third volume, written afterwards, he believes with Bernard that "while the portal blood contains no sugar, or only traces of that substance, the blood of the hepatic veins is rich in sugar; and states that Schmidt has shown "sugar is a normal constituent of the blood of cats, dogs and men."* In the first volume, he distinctly states that in a normal state no sugar finds its way into the urine, and proves this by experiments made upon himself; but even there and afterwards, he is willing to admit that it *may* make its appearance in the urine voided, under attacks of other diseases besides diabetes.

Lehman, in a paper published in the May number of the Chemist for this year, also gives the results of a number of analyses of the blood from the Hepatic veins and of the Vena Porta, and considers, from a careful examination of them, that Bernard's opinion, as to the formation of sugar in the liver, is placed beyond doubt. He says that the blood, which issues from the liver by the hepatic

* Lehman's Phys. Chem. III, 467–8.

veins, is always the most saccharine blood of the body. Bernard, in his remarks on this paper of Lehman, considers that the glucogenic function of the liver is an established fact, and states, as the only subject now remaining to be examined, the question, "what are the elements of the blood which the liver turns to account for the production of saccharine matter." The weight of Lehman's name may thus be considered as on the side of Bernard's view. Carpenter and others incline to this view:

The sugar found constantly in the blood is not the common *glucose*, but another variety. And M. Bernard assumes, as this sugar, which may be the same as the variety called Inosite, (discovered by Scherer in muscular juice,) is found both in the blood of carnivora and herbivora, that it cannot invariably proceed from the metamorphosis of starchy articles of food. We must admit that where such substances form a large portion of the ingesta, as with the herbivora, that the action of the saliva, pancreatic and other juices will convert them into sugar. But where they are not present in the ingesta, then if sugar be found, we must be ready to adopt the view that it is formed from fibrin and the albuminous, portions of the food generally, according to Berzelius and Liebig.* Yet with this view, we are not obliged to hold that the liver has alone the power of causing the metamorphosis of protein compounds into saccharine matter, unless we find by actual observation that there is an augmentation of saccharine matter in the blood, which has passed through the hepatic veins, much above that contained by it before it entered them. And on this point, Figuier rests his argument, in his paper "on the origin of the sugar contained in the liver,"† and though his results differ from those of Lehman, yet we think it important, in a question like this, not to base our opinions upon the dicta of either, but to examine with care and deliberation, the results of the experiments which they have performed. He commenced his experiments by making a chemical examination of the soluble matters found in the liver. He finds that independent of the blood, these may be divided into three classes: I, an albuminoid matter, resembling Mialhe's *Albuminose*; II, glucose or grape sugar; III, mineral salts, chloride of sodium and others. With reference to the second, which he obtains by evaporating in

* Lehman, III, 216-7. † Chemist, II, 346.

vacuo, a watery infusion of the liver, and when nearly dry, adding pieces of caustic lime, and then dissolving it out by means of hot alcohol; and with reference to its saccharine nature, no doubt can be entertained, since it readily ferments. Thus far he only repeats Bernard's first experiment, (1848) that sugar could be discovered in the liver. He goes further however, and shows glucose in normal blood. The blood is quickly deprived of its fibrin; then the liquid portion is mixed with three times its weight of alcohol at 36.°C "After a few minutes, the blood is completely coagulated into a clod of a beautiful red, by the simultaneous precipitation of the globules and of the albumen of the serum. It is then strained through a piece of cambric muslin and pressed, and the residue is washed with a little alcohol. The liquid when filtered, passes through almost colorless, manifesting an alkaline re-action." Acetic acid is added to give it a slight acid re-action. Evaporation on a sand bath is resorted to. At first this process throws down "the last remains of coagulated albumen," and the residue contains glucose united with some mineral salts. The glucose is proven by the readiness with which it deoxidizes the copper of Trommer's liquor, giving the well known brick-red precipitate of the sub-oxide of copper. The glucose was also proven by its undergoing fermentation.

The result of these experiments on the blood, shows that there was in the blood of a rabbit 0.57 per cent. of glucose, while the liver of this animal contained 1.0 per cent. In the blood of the ox there was 0.48 gr. per cent., and in the blood of man 0.58 gr.

From his experiments then he finds that "the liver would contain, in equal weight, scarcely twice as much sugar as the blood contained in the other parts of the body." He accounts for the difference by the acknowledged fact, that the liver is the organ used for the depuration of the blood,—and that all the glucose arising during digestion is concentrated in it, afterwards to be sent into the circulation. His conclusion is then evident so far as regards the presence of sugar in the system, that it comes from without either as sugar, or as starch or gum which is converted in the digestive process into sugar.

He meets the question, with reference to the occurrence of sugar in the blood of carnivora, by assuming that these animals being fed on the flesh of the herbivora, this flesh always must contain in the vessels, which permeate it, blood containing sugar; and hence that the sugar was introduced from without, small in quantity, "but it was constant and the liver being an organ of condensation and accumulation as regards glucose, it is not surprising that the proof of its existence in this organ was found after death."

His conclusion is "that the liver in man and in animals has not received the function of forming sugar, and that all the glucose which it contains in its tissues comes from without, that is to say, from the nourishment."

This important subject is now being very thoroughly investigated by European students of Zoochemistry. Whichever view be correct, as to the origin of the sugar, we must not forget that this substance seems, by nature, to be intended as a transitionary condition of starch, in its conversion into fat and lactic acid—the latter being the principal constituent of the gastric fluid, and in combination with the alkalies supporting animal heat by the facility with which it is converted through the oxygen in the blood into carbonic acid. If the glucose be a transitionary condition, and its presence in the blood becomes so large that the kidneys are forced to remove it from the system,—it is a just demand, on the part of the physician, of the chemist, that he should suggest some mode of causing the glucose to advance to the stage of the formation of lactic acid. Dr. W. Bird Herapeth, in a late paper,* offers a suggestion that yeast or *Torula cerevisiæ* be employed to produce this effect. The Doctor says, that "glucose, under ordinary circumstances, at a temperature of 60° to 70° F would be converted into alcohol and carbonic acid by the fermentative agency of torula cerevisiæ or yeast, as is very well known to most persons; but if the action were to take place in the dark, in the presence of albuminous substances or other protein compounds, and at a temperature of 98° F., the products would be lactic and acetic acids, with possibly alcohol and carbonic acid. It is clear, therefore, that the former products would assist in the conversion of the protein compounds, as in the normal state of digestion, and would pass out of the system in combination with some alkaline or earthy base, and

* Chemist I, 568.

be eliminated by the kidneys, skin, or other emunctories; whilst the alcohol and carbonic acid would act as agreeable vital stimuli, whilst existing in the system, and could eventually escape by the pulmonary mucous membrane, after having perhaps served to assist the respiratory process, being thus converted into carbonic acid and water."

Acting under an impression of the truth of these views, he treated a patient whose urine (Sp. gr. 1044,) contained 850 grains of sugar to the imperial pint, at the beginning of the treatment. In two days the Sp. gr., was reduced to 1020, and the amount of sugar to 300 grs. In six weeks the sugar disappeared, and the patient recovered his health, strength, and was recovering his flesh.

The form of yeast used was that prepared on the continent by expressing the liquid article, obtaining in this way a semi-fluid mass,—of which he gave a table-spoonful in milk, two or three times daily. There is no doubt that the common yeast of the brewery would answer,—and the mode of treatment of this disease, thus suggested by chemistry, merits notice.

Headland, in an article on Diabetes, suggests "milk *just turned sour*, as containing a decomposing caseine, which transmutes sugar into lactic acid.*

For those who hold with Figuier, that the sugar depends entirely on the nature of the ingesta, which opinion, it will be recollected, was advanced primarily by Bouchardat in 1838,—it will be interesting to know that M. Durand, a baker of Toulouse, has succeeded in making *gluten* bread, which does not excite disgust in the patient, and which affords excellent nutriment.† He prepares his gluten by washing wheat flour until all the starch is removed, and by peculiar processes not given in the article by M. Durand, succeeds in making a bread nutritious and palatable. The large quantities of gluten lost annually in all our starch manufactories, might be turned to good account, if it were used in the preparation of this gluten bread which has been found not only useful in Diabetes, but as suited to cases of dyspepsia, gastritis and many other diseases.

Without wishing to occupy the time of the faculty any longer on this subject, and yet satisfied with its importance and its claims

* Western Lancet, May, 1855—copied from London Lancet.

† Chemist, II, 87.

to a large share of our notice, the committee have to conclude this portion of the report, with the opinion that the origin of Diabetes, is by no means fully explained as yet—and although the experiments of Figuier seem completely to refute the theory of M. Bernard, this theory is supported by some pathological circumstances seemingly unexplainable by any other. Thus Dr. Frerichs* reports a case of fatty liver in a girl of nine years old, complicated with ascites. It was necessary to resort to the operation of *paracentesis* for the latter—and the liquid thus obtained was found rich in sugar. When more cases shall be collected bearing on this subject, we shall be better prepared to deduce our conclusions. The number of cases is too small to justify that kind of induction, which will give us the truth, freed from all possibility of error. Therefore it is expected of every medical philosopher, not to attach himself to the theory of any man, be his position and reputation great or small, unless the touchstone of experience—the experience of such as are fitted to judge of facts by their previous habits of study—shall verify the theory, and show its truth, freed from all crude and ill-digested peculiarities.

II.

The committee think it will not be foreign to the design of this report, to introduce some of the novel suggestions, made by distinguished European chemists with reference to various articles of food now in use by man, or recommended to be used in a state of health. Hygiene is by no means an unimportant subject for the study of the physician, and diet occupies a very prominent position among the various means which are to be considered as bearing directly upon health. The distinguished chemist Liebig, has not thought it beneath his notice, to investigate the best mode of preparing a broth for the sick, which should be available in many forms of disease—especially at the commencement of convalescence.†

It seems, that "a young lady of eighteen years in his family being ill with typhoid fever," her physician, Dr. Pfeufer, suggested to the Baron that, "in a certain stage of this disease, the greatest difficulty met with by the physician lay in incomplete digestion, a

* Chemical Gazette, XII, 364.

† "A new broth for the sick," translated from the German of Liebig, for the N. Y. Tribune, by a lady of Washington. Copied in the Ohio Medical Counsellor, April 7, 1855.

consequence of the condition of the intestines, and, besides, in the want of a nutriment proper for digestion and for the formation of blood." Whenever heat is used in the preparation of broth, the latter is deficient in those constituents which are required for the formation of blood. It was desirable that the meat-albumen should be present, and other constituents not usually contained in our broths.

Liebig recommends the following receipe; "for one portion of broth take half pound of freshly killed meat, (beef or chicken,) cut it in small pieces, add to it $1\frac{1}{8}$ pound of distilled water, to which has been added four drops of pure chlorhydric (muriatic) acid, and half to one drachm of common salt; mix them well together. After standing an hour, the whole is strained through a conical hair sieve, such as is ordinarly used in the kitchen, allowing it to pass through without squeezing. The portion passing through first being cloudy, it is again poured through the sieve, and this process repeated until it becomes perfectly clear. Upon the residue of the meat remaining in the sieve, half a pound of distilled water is poured in small proportions. In this manner about one pound of liquid (cold extract of meat) is obtained, of a red color, and pleasant meat broth taste. It is administered to the sick, cold, by the cup-full, according to their inclination. It must not be heated, as it becomes cloudy thereby, and a thick coagulum of meat, albumen and hematin is deposited."

This broth is certainly far more nutritious than the beef tea which has heretofore been used, since it contains, in addition to the gelatine of that compound, albumen, hematin, (with the iron contained in it,) and a small portion of acid which contributes to its ready digestion. Care must be taken in warm weather that it be kept in a cool place, as it undergoes a species of fermentation in the warm.

Liebig has seen this used in a case of ovarian inflammation, when the patient could not take solid food. Life was sustained for two months on this broth; flesh and strength were regained and health restored. He says that "patients generally take this food without opposition so long as they are ill; as soon as they can take other food, they reject this, perhaps owing to the color and the faint meat odor. It might be in many cases of use to color the broth brown by adding burnt sugar."

Some of the most celebrated physicians in Munich use this broth in their hospital and private practice. It seems to furnish the desideratum in certain cases where the disease has been arrested, indeed cured, but owing to the feeble condition of the digestive organs, sufficient material cannot be appropriated to meet the wants of the system, and the patient dies of sheer debility, not having strength enough to meet the varied necessities which a convalescent body requires.

Liebig has contributed a paper to the "Annalen der Chemie und Pharmacie," on a mode of freeing bread from acidity, and of making a good article from damaged flour."* Years ago it was known that the Belgian bakers formed a good article of bread from damaged flour, and indeed increased the quantity and whiteness of that which could be made from good flour, by the addition of alum and sulphate of copper. Normandy speaks of the use of alum for this purpose being so common in London, that (with but one exception) he has invariably found it in bread obtained even from bakers of the highest respectability in that city. Whatever effect its use may have upon the appearance of the bread, its presence must be detrimental, when admitted day after day with each meal, into the animal system. The rationale for its action on the bread is given by Liebig in this way, first: "all panification is principally due to the presence of gluten, which has the property of condensing water, fixing the liquid under a form similar to that under which it is found in muscular tissues and in coagulated albumen, substances which do not communicate moisture to dead bodies, although they contain water." Owing to this property, it forms paste readily with starch. When gluten is baked in the form of bread, freed from starch, as already mentioned by the process of M. Durand, it may be kept an indefinite length of time. But when kept in the form of flour it is hygrometic and attracts so much moisture as to lose its viscid character, to become soluble in water and unfit for panification. Now, the alum forms with this metamorphosed gluten, under the influence of the heat of the oven, a combination, by means of which this proteic substance recovers its original qualities and again becomes insoluble and hygroscopic."

* Chemist, II, 343, and Journal de Pharmacie et de Chimie, xxvii, 75.

Liebig proposes to produce this effect by the use of lime, which, instead of being a disadvantage to the system like alum, would be an important addition, as it is a necessary constituent of bones. By the admixture of lime water, a light, spongy and elastic bread is produced, which is perfectly free from acid, and has such a peculiarly agreeable taste that those accustomed to its use are said to prefer to it to all other kinds of bread.

The lime is used in the form of lime water, and as 500 grammes of lime require 300 quarts of water to effect the solution, we shall find that the proportion of lime present in the bread must be quite small. The proportions of flour and lime water are in the ratio of 19 to 5, (52 litres of lime water to the metrical quintal of flour.) The flour is first kneaded with the lime water; the yeast is afterwards added; and after the panary fermentation has taken place, more flour is added to the dough before baking. The yield is said to be greater, owing to more water being taken up by the gluten, under the influence of the presence of the lime. Liebig found that 19 lbs. of flour would give 24½ lbs. of bread when kneaded *without* lime water; when five quarts of the latter were used, there was produced from 26 pounds 6 ounces, to 26 pounds 10 ounces. He concludes his article by the statement that it is "a physiological truth, established by experience, that corn flour is not a perfectly alimentary substance; administered alone, in the state of bread, it does not suffice for sustaining life; from all that we know, this insufficiency is owing to the want of the lime so necessary for the formation of the osseous system. The phosphoric acid likewise required, is sufficiently represented in the corn, but lime is less abundant in it than in leguminous plants. This circumstance gives, perhaps, the key to many of the diseases which are observed among prisoners, as well as among children brought up in the country, where the diet consists essentially of bread; in this respect, the lime water bread deserves perhaps to attract the notice of chemists."

It will be understood that by the term *corn* is meant wheat, rye, &c.; farinaceous grains used for food.

A word here may be not out of place as to the nutritive properties of bran or the husk of the grain, which is rejected in the process of bolting. This substance has been carefully examined by M.

Poggiale,* and his conclusious are adverse to the generally received opinion that its absence really deprives the meal of much nutriment matter, and that unbolted meal contains a much larger proportion of nutriment matter than fine flour. The latter position is held by Prof. Johnston, of Europe, and was supported by Prof. Lewis C. Beck, in his "report on the breadstuffs of the U. S.," made Jan. 1, 1850, to the Patent Office. Poggiale shows that the conclusions are incorrect which chemists have arrived at, because there is only from 5.73 to 9.42 per cent. of cellulose left back after bran has been treated with boiling water, acids and alkalies, that therefore all the remaining portion is nutritious. He says this remaining portion consists largely of non-assimilable matter, substances not alimentary as coloring, extractive, resinous, gummy matter, &c.

Why is it, however, that bran bread, that is bread made from unbolted meal, is prescribed by physicians "against constipation and disposition to cerebral congestion?" Mons. H. M. Mouries† quotes from Magendie the statement that dogs will live on bran bread, but will die if fed on white bread alone, and then goes on to say that this *cannot* be explained by the large amount of nitrogen contained in the proximate principles of the bran, since the latter contains but a small quantity as compared with white flour. He proposes as a solution to the question, the fact that the internal surface of the bran contains a small quantity of peculiar nitrogenous principles, which are readily soluble in warm water, and are possessed of the property of liquefying starch and changing it into dextrine and sugar. Although these peculiar nitrogeneous principles of bran, according to the showing of M. Poggiale, may not be so nutritious in themselves, yet, according to Mouries, they may have the property of hastening panification and digestion. By an experiment tried on a definite quantity (130 grammes) of bran and white bread, this fact was shown: They were respectively bruised along with 520 grammes of water, and exposed to a temperature of 104° F. for three hours. The first was divided with ease and assumed the appearance of a milky mixture; the

* Chemist I, 100.

† Chemist, I, 220.

second that of a half solid mass. When filtered, the following results were obtained:

Bran bread:	Soluble matter, dried at 212° F.,....59.35
	Insoluble matter,.................69.75
White bread:	Soluble matter,.....................9.03
	Insoluble matter,.................120 25

The value of bran bread, it will be seen is not in preventing constipation by the mechanical presence of its coarse particles, but in facilitating the changes which the amylaceous portions of the food must undergo, before they enter the system, and thus preventing accumulations which may give rise to constipation.

Attention has been directed to the impure milk now sold in our cities, and various means have been adopted, both by the strong arm of the law and by the promulgation of scientific means for detecting its presence, to prevent its introduction into use. Even in its unadulterated form, we find it is mostly furnished from animals which have been fed on swill slop—which ensures an abundant secretion from the mammary glands, of such a pernicious character however that it cannot fail, when used for a long time, to produce disease. In its adulterated form, we find either pure milk or swill slop milk adulterated with a number of articles—water to increase the quantity, starch or chalk to give it a white color and a somewhat milky appearance, sheeps brains (previously well triturated in a mortar,) to give it the creamy consistence, annatto to give cream color, &c., &c. It was proposed by means of railroad communications, that the dealers in large cities might be furnished with a pure and unadulterated article. This however cannot be done in warm weather very well, since the souring of the milk by the heat makes the article comparatively valueless. For some years it has been proposed to adopt a plan, by which milk could be solidified and thus become capable of transportation without injury. This has been accomplished, and is now successfully carried on at Amenia, some 20 or 30 miles east of Poughkeepsie, N. Y., by Mr. Blatchford.

A gentleman, who was present with the committee from the N. Y. Academy of Medicine, during their examination of the establishment, in last autumn, writes a description of the process of preparation and uses to which this important preparation can be applied.* Twenty-eight pounds of Stuart's sugar were mixed with 112 lbs of milk, and a little bicarbonate of soda to counteract and neutralize any acidity that may be present. "The sweet milk is then poured into evaporating pans of enameled iron, embedded in warm water heated by steam." By means of a thermometer in the water, a fixed degree of temperature is maintained. "To facilitate the evaporation—by means of blowers and other ingenious apparatus—a current of air is established between the covers of the pans and the milk." The milk is stirred but slightly so as not to churn it. In about three hours, it assumes a pasty consistence; and, by after treatment, is reduced into a powder, which when cool is compressed into blocks of a pound weight, by means of a heavy press.

This solidified milk when dissolved in water was found to give off, like liquid milk, cream, which could be converted into butter. In every particular it seems to be equal to the best fresh milk.

The committee have introduced this subject by way of attracting attention to it, on the part of the members of the Faculty, resident in the city of Baltimore. Our milk is *probably* not as bad as that furnished the New Yorkers†—but it is too impure, as a general thing, to be employed for family use. Might not this solidified

* American Medical Monthly, II, 315.

† The city authorities of Baltimore have recently passed an ordinance with reference to the adulterations of milk, containing the following sections:

SECTION 2. *And be it enacted and ordained,* that it shall not be lawful for any person or persons to adulterate milk offered for sale or sold within the limits of the city of Baltimore, by mixing therewith *water, chalk* or any *drug or* other *article* whatsoever, under a penalty of not less than twenty dollars for each and every offence, one half to go to the informer and the other half for the use of the city.

SEC. 3. *And be it enacted and ordained,* that any person or persons who shall offer for sale any milk of a *diseased cow* within the limits of the city of Baltimore, shall pay a fine of twenty dollars for each and every offence, one half to go to the informer and the balance to the use of the city.

This is taking one step towards banishing a nuisance from our community. The query, however, naturally arises as to the mode of ascertaining these adulterations. How can this be done, unless Dr. Hassall's suggestion, with reference to the adulterations of food in general in the city of London, be adopted? That is, by the establishment of a board with analytical chemists, whose duty it must be to detect adulterations and to bring the offenders under the penalties of the law.

milk afford us an excellent means of obtaining an article reliable because pure—and might not the agricultural portions of our state find in the preparation of this article a fruitful source of profit to themselves as well as of benefit to the citizens of our great city?

The use of coffee and tea as regular beverages has been discussed by M. J. Lehmann, in a late paper,* with the following results; the quantity of the urine was increased by it when taken after the habit has been given up for some time, and the solid materials of the urine were notably diminished. The following propositions are deduced from some carefully performed experiments: 1. "Coffee exerts two distinct actions on the economy, which appear dificult to reconcile—augmenting the activity of the vascular and nervous systems, and lessening the rapidity of the metamorphosis of the tissues. 2. The salutary state of excitement produced by the use of coffee is due to the simultaneous action of the empyreumatic oil and caffeine. 3. The comparatively slow intimate decomposition must be attributable principally to the empyreumatic oil, caffeine contributing to this effect only when acting in rather large doses."

Dr. Bocker found, by comparing results with the use of water alone and with tea alone, that the fæces, urine and perspiration, were diminished with the latter, and the daily loss of weight by these means was not as great as when water was used alone.

III.

The journals bring us, with each month, accounts of new remedial agents, proposed to meet different therapeutic indications, and also, what is of still more importance, new facts connected with those which we have been using for years. Among the latter may be mentioned the new experiments which are being performed, from time to time, with cod liver oil. But few years have elapsed since the first proposal of this substance, and yet a host of suggestions have been made as to the cause of its action. At first it was attributed to the amount of iodine it contained This, however, was proven to be present in so homeopathic a quantity, that the suggestion militated against reason. Then it was stated, that in Phthisis, there was required some substance to supply the

* Chemist, I, 287.

fatty matter which was needed to keep up animal heat by its oxidation. Hence cod liver oil acted as a combustible material, and if its only use was as a fatty fuel for the system, as the defenders of this theory boldly asserted, *any other* oil would do as well. Indeed a prominent lecturer on Physiology, some years since, warmly defended the use of all sorts of oil as equally advantageous with cod liver oil in Phthisis. These are but two out of the large numbers of theories advanced on this subject. It is pleasant to see that experimenters are now looking into the changes which this substance produces in the blood itself, and from these deriving useful data for the use of the profession.

Mr. Dugald Stewart* analyzed some blood, with reference to the effect of a course of this oil, which was fonnd, as exhibited in the following table, to increase the red corpuscles. The same quantity of blood was taken in each case:

	Red Corpuescles.	Fibrine.
First stage, before the use of Cod Liver Oil,	Female,. . 129.26	4.52
	Male,. . . . 116.53	13.57
First stage, after the use of Cod Liver Oil,	Female,. . 136.47	5.00
	Male,. . . . 141.53	4.70
Third stage, after the use of Cod Liver Oil,	Male,. . . . 138.74	2.23

The benefit of this kind of experiment consists, in its not being based upon any special theory, but being carried on for the purpose of gaining facts from which afterwards theories may be formed.

The examination of the blood with reference to changes produced in it by disease, is effecting many results important in a pathological point of view. The committee have only room here to notice one. In a case of epilepsy,† occurring at Toronto, the blood of the patient was examined by Mr. Stratford, in the hope of finding something that might point to the cause of the complaint. After the red corpuscles were broken up by absorbing water, a number of cellæ form bodies were found, generally ovate and which were proven to be starch corpuscles, both by their form and

* Chemical Gazette, XII, 275.

† Quarterly Journal of Microscopical Science, (January, 1855,) 168.

the chemical test of iodine. Since this case, these corpuscles have been found in the matter of *fungus haematodes*, and also in specimens of urine. What may be the full pathological import of this cannot be stated now, though Mr. Stratford suggests with reference to their form in the blood—that *there*, they may exist only as granules, yet when removed from the dense fluid (the blood) to one of less density, (water) they take up this latter fluid and then assume the appearance of corpuscles.

Dr. Hassall of England, has shown* that indigo is a more common constituent of the urine than was suspected when its presence was first detected in this secretion. Its composition consists of a large quantity of carbon and a small quantity of nitrogen. Hassall, in his communication to the Royal Society, suggests from its close alliance with haematin and urine pigment, that "it forms a vehicle for the elimination of any excess of carbon contained in the system. This view is borne out by the important fact that the greater number of cases in which indigo has been observed to be developed in the urine in large amount, have been cases of extensive tubercular disease of the lungs, and in which the decarbonizing functions of these organs are greatly impaired.

Von Sicherer† found no abnormal condition in urine containing indigo, with respect to the amount of uric acid, urea, chloride of soduim, phosphates, &c., and that changing the kind of food used, produced no special alterations. He states, that this blue coloring matter was not betrayed by mere spontaneous deposition, but was separated on the addition of nearly an equal quantity of fuming chlorhydric acid, or dilute sulphuric and nitric acid. The urine assumes gradually a reddish brown color, and the coloring substance is found as a blue froth on shaking, or as a reddish blue film on standing for some time. It is, when dry, of a blue color with a coppery tinge, sublimes at 537° F., and forms crystals agreeing in form, color and properties with those of sublimed indigo, and furnishes a dark blue solution with concentrated sulphuric acid.

Much has been done in the way of studying the properties of urine, both microscopically and chemically, during the twelve

* Chemical Gazette, XII, 320.

† Chemical Gazette, XII, 267.

months which have elapsed since the last meeting of the Faculty. Though our knowledge of the normal constitution of and pathological changes in the urine, is by no means as full and accurate as it should be in order to attain those results, microscopists ardently predict, from chemical and microscopical examination of urinary deposits in disease—yet every day seems to be bringing us towards that point. Many of the dicta of the too confident urinoscopist will have to be recalled; but this will only open the way for a more reasonable series of theories, although they should be built at the expense of the wrecks of other theories, which were not based upon truth. New substances are now found in the urine, heretofore not discovered by other observers—among which may be mentioned silicate of iron, by Mr. Harley of England, and the spontaneous deposition of creatine without the use of any chemical tests whatever, from urine voided in a certain form of dyspepsia, observed by Prof. Miltenberger of the University of Maryland. This department is quite promising to the investigating physician as being but little cultivated, although abounding in much that is important and useful to our common profession.

IV.

As a contribution to the Materia Medica, M. Thoulose proposes an infusion of roasted acorns to be used as an adjuvant to quinia, in cases of Intermittent fever. It seems that it destroys the bitterness of quinia without altering in any way its therapeutic qualities. The principle extracted from the acorn is doubtless a form of tannic acid; but the tannate of quinia formed with this kind of tannic acid is insoluble at the moment of administration and is consequently tasteless, and hence would be desirable in cases where quinia is required to be administered continuously for some days. The infusion of acorns may also contain some aesculin, a bitter principle first discovered by Trommsdorff in the bark of the horse chesnut.

Thoulouse observed that a decoction of roasted acorns diminished the secretion of the urine in such a way, as to make it quite desirable in cases of incontinence arising from relaxation of bladder, &c.

The last committee on chemistry noticed M. Melsens suggestion of the iodide of potassium treatment in all diseases resulting from the deposit of lead in the animal tissues. Dr. Corson of New York, has since published an article on this subject, which fully substantiates this plan of treatment. As a proof of the large quantities of this medicament which may be borne, one of Dr. C's cases took five grains three times a day for eleven months. Dr. C., notices also the fact, which is familiar now to the experience of many of the Faculty, who have used this treatment, that the lead is eliminated sometimes so rapidly that the symptoms of lead poisoning are wonderfully exaggerated under the use of the iodide. The salivation, which occasionally results after the remedy has been employed for awhile, is never present, unless mercury has been previously taken and become fixed as it were in the tissues. Hence is seen also the propriety of following up a long course of mercurial treatment, with the iodide of potassium as a means of removing any ill effects of the mercury.

V.

Prof. Doremus of New York, has been doing good service to the cause of public hygeine by his paper on the "poisonous effects of soda water from copper fountains and lead pipes."* His attention was attracted to the subject by the sudden illness of several persons immediately after drinking a single glass of mineral water. In some soda water examined, on boiling off the excess of carbonic acid, a green scum of carbonate of copper arose to the surface, which yielded as much as one grain and a half of metallic copper. The condensers are generally made of copper, which are said to be lined with tin. This coating however, even if well put on, is liable to be removed in part by chemical and mechanical action. Then the carbonic acid slowly causes the formation of a carbonate, which is soluble in carbonic acid water. The longer the water remains in the condenser, the more copper will it contain under these circumstances.

The condensers examined by Prof. D., however, were often found to be lined with tin mixed with soft solder, and the lead in the latter of course was readily destroyed—leaving the interior of the vessel more or less denuded of its lining and exposed to the action of the water.

* American Medical Monthly, II—25 and 137.

It had been known for years, that injurious effects have occasionally resulted from the use of soda water, and this had always been attributed to the lead pipes through which the water was forced before it reached the fountains. Honest vendors of the article, aware of this, employed tin pipe for the conveyance of the water. But these experiments of Doremus, show that still more caution is to be employed in order to prevent an agreeable beverage becoming an insidious poison.

As to the effects of the copper not being more generally experienced as dangerous, Doremus remarks, that the cases are not few in New York where immediately after drinking soda waters, parties were seized with vomiting, epigastric pain, &c.; and that "it is probable the syrups which are the usual accompaniments of the soda draught act in many cases as antidotes." He suggests, that this poisoned soda water may be an exciting cause of cholera in those predisposed to it, and during its prevalence.

The mode of preventing all danger is to have the condensers well tinned, and the connecting pipe composed of pure tin, or what is still better to have the condensers made of stone ware, as in Boston, "covered externally with copper and circlets of iron to secure strength."

The season is now here when great quantities of this beverage are employed, and we should be prepared not only to understand apparent anomalous cases of poisoning that may arise in this way, but, as conservators of the public health, to warn against the use of mineral waters unless obtained from those who are known to be careful in their preparation. It is true according to the experiments of Wackenroder,* that the blood may contain very small quantities of copper without injury, yet where it is admitted so freely into the system as in the way just spoken of, pernicious consequences must result.

A case of poisoning by the eating of a root, is recorded in the papers of the day as having taken place in Baltimore county in the month of April. Judging by the symptoms, it is presumed the root was that of the *aconitum uncinatum*. There was severe epigastric pain, vomiting, general coolness of surface, spasmodic movements of the limbs; the whole series closing with death before

* Chemical Gazette, XII, 176.

medical aid could be made available. Two cases are reported in English journals of death* through the tincture of the same vegetable, being administered in large dose. One case of poisoning by the same substance which however yielded to treatment, came under the knowledge of the Chairman of the Committee, during last summer. The patient took too large a dose of the officinal tincture—and was seized with the special symptoms of poisoning by aconite—burning in the throat and stomach, foaming at the mouth, an obscuration of vision, epigastric pain, spasmodic movements of the limbs, vomiting, &c. The case was successfully treated with alcoholic stimuli, and aqua ammonia; it is believed that this treatment preceded by active emesis, in the early stages of such cases will generally be effectual.

An interesting case of the detection of cyanhydric or prussian acid is published in the *Comptes Rendus* of Nov. 13, 1854.† The The stomach was examined three weeks after death. "On the addition of pure neutral nitrate of silver, a yellowish floculent precipitate was formed in abundance, which, when well washed, dried *in vacuo*, aud afterwards heated for a few moments on the sand bath, acquired a grayish color." This was soluble in ammonia and cyanide of potassium; prussian blue and prussic acid were readily formed from the cyanide of potassium into which it was converted by means of the decomposing power of potassium. There did not seem to be any chemical combination with the organic matter, and a quantity equal to 0.120 gr. of anhydrous acid was obtained.

The Herapath's of England‡ have lately communicated some views on the changes which this most active poison may undergo during the putrefaction of the animal body, and which changes have heretofore been overlooked in chemical examinations. These gentlemen found that there were clear indications of the presence of sulphcyanhydric acid in the blood, when prussic acid had previously been taken, although all tests failed to detect the latter substance. This acid (as also the sulph cyanides,) they hold, has not yet been detected in normal blood by the most careful analyses, and indeed it is admitted by Heintz and Lehman, that it only exists

* Medical Monthly, I, 223. † Chemical Gazette, XIII, 51.

‡ Chemist, I, 321.

in the saliva. Now if it does not appear as a normal constituent of the blood, it is easy to perceive how it may have been produced by the action of nascent sulphydric acid gas, on prussic acid which had entered the system from without. Thus the spontaneous decomposition of albumen might prepare the way for the disappearance of the prussic acid, with the formation of the sulphcyanhydric acid. It remains however, before we trust to this experiment, to have instituted the most thorough and complete analyses of the blood with reference to the presence or absence of this substance in its normal condition. If it be not a normal constituent, prussic acid can be recognised with as little difficulty as a metallic agent. It would only be necessary to evaporate to dryness at a low heat, the organic substance to be examined; then to boil it with some strong alcohol, being mixed with some pure and recently ignited ivory black. The alcoholic solution should be filtered, evaporated to dryness, and dissolved in a few drops of water. If a sulphcyanide be present, on acidulating the solution with chlorhydric acid and adding a few drops of a transparent solution of a persalt of iron, a blood red color will present itself—not likely to be confounded with that produced by the presence of any other substance.

The molybdate of ammonia has been recommended as a capital test for the detection of an arsenical from an antimonial tache, as produced in the process of Marsh. This salt has the property of forming a yellow colored compound with phosphoric or arsenic acids,* even though the latter should be present but in small quantities. The tache must be dissolved in boiling nitric acid, and the addition of the molybdate will produce a precipitate of a yellow color, if arsenic be present.

Dr. Tschudi has published descriptions† of toxicophagi, or poison-eaters, who live in the lower part of Austria and Styria, and who are habituated to the use of arsenic They consume it for a double purpose;—"to give themselves a fresh and healthy appearance and a certain degree of *embonpoint*." This is done by the peasant girls and young men by way of increasing their personal attractions; and "to attain more freedom in respiration so as

*Will's Outlines of Chemical Analyses, 121.

†Chemist, I, 762.

to be able to ascend high mountains with ease." For the latter purpose they put a small piece of arsenic in their mouths whenever they have a long excursion to take up a mountain. This seems to give them the ability of ascending high mountains with an ease not otherwise accomplished.

They commence with a piece about a half grain in size. After some time has elapsed, during which they use this quantity twice a day—the quantity is somewhat increased. A case is mentioned of one who followed the habit for forty years—taking as much as four grains a day—and had transmitted the habit to his son. Whenever the habit is dropped, emaciation follows. It increases the sexual feeling. The Vienna coachmen mix a little of it with the food of their horses—with the view of giving them "a bright aspect of the skin, roundness and elegance of form, and foam at the mouth."

This communication of Tschudi settles the point, which has been mooted for years, whether any one could keep up the habit of arsenic-eating for a long time without being a victim to the supposed cumulative effects of the poison.

In the detection of blood spots in medico-legal examinations, the chairman of the committee has found that the suggestions of M. Morin of the School of Rouen,* were very valuable and reliable, in cases where it is necessary to examine such spots on clothing that has been washed with boiling water and soap. The stained part has a greater consistence than the tissue itself, and the stain cannot after the treatment just mentioned, be removed by water either hot or cold.

The course to be followed, is first to immerse the stain in a solution of pure caustic potassa. This solution will dissolve out the stain and the addition of nitric or chlorhydric acid produces a white precipitate, which indicates the presence of a proteine compound. Secondly—the stained tissue is to be placed in contact with pure chlorhydric acid, which dissolves the entire matter of the stain, forming a solution that, when concentrated, will give us a blue precipitate with the ferrocyanide of potassium, and a blood red with the sulphcyanide of potassium.

* Journal de Chimie Medicale.

Alfred Taylor recommends glycerine as the best fluid for removing blood stains, which have not been exposed to the action of hot water, since it does not dry, and therefore the microscope can be used at one's leisure in the examination of the corpuscles. Whatever evidence a chemical examination of blood may furnish, it is to a certain cxtent presumptive, since there are no positive chemical tests which will reveal its presence. We can only show the presence of the different constituents of this fluid, and then the conclusion will be so strongly presumptive that it will closely approximate to—yes even equal, positive demonstration. With the microscope conjoined, there can be no doubt about the matter; and *it* should *always* be employed in conjunction with the chemical experiments on the suspected spots.

In closing the report, the committee feel that the contributions of Chemistry during the past year have neither been small nor unimportant to that profession, we have all selected as the business of our lives to study and investigate. Often its cultivators are too rash and careless in their deductions from the various facts which have collected in the course of experiment. These must not be taken as arguments against the data on which they were founded, but as incentives to a more thorough study of the importance and proper relation of these data. Chemistry is a science, so to speak, of yesterday, and yet, like a young David, it has accomplished the overthrowal of the Goliah of superstition and ignorance. It must be employed as the servant of the physician—not with the view of utterly rejecting all other means of acquainting himself with the animal body, in health and in disease—but to substantiate and confirm what is indicated by those other means. Under such circumstances, it wlll be found one of the most useful of all the collateral sciences, in elucidating the secrets of the profession and the saying of Libavius—a student of Paracelsus—may be understood, "Medicus ille nequit esse magnus, cui chymia non est magna."