

Elliott

The subject wh^{ch} I have chosen for my Thesis is one wh^{ch} might be detailed at great length in wh^{ch} case it would require a far more competent knowledge of Chemistry than I possess; for this reason I treat of Chemistry of in some of its Applications to Medicine.

One special reason why I have selected such a subject is from the indifference with wh^{ch} many of the Medical Profession appear to treat the Science of Chemistry & this even at the present day. This is gratifying to observe however that this indifference is gradually wearing off, now that Physiology & Organic Chemistry are bringing so many facts to light.

I might have easily chosen the applications of Chemistry & any special branch of Medicine & treated solely upon that, my present intention however is to take a very short & Comprehensive view of those departments of Medicine, in w^{ch} it is indispensably of use.

I might add a small apology by stating that my knowledge of Chemistry is not more than that possessed by Students generally & for this reason I hope my shortcomings will be pardoned; at the same time my best endeavours shall be brought to bear upon the subject & I trust they may not be entirely thrown away.

I need hardly enter into the History of Alchemy or of the Philosophers Stone, nor into the consideration of the rise, progress & present state of Chemistry, properly so called, for time will but permit me to do so.

Having proceeded thus far let us enter more deeply into the subject of our consideration.

we will next consider whether we have chiefly to do with Organic or Inorganic Chemistry. The former would naturally suggest itself as being the more important of the two, in that it is more especially concerned in the composition of the Solid & fluid Elements of the Animal Organism as also in the Factors which regulate that Organism, whether in health or disease.

We must not of course lose sight of the latter i. e. Inorganic Chemistry, for as we shall have occasion to notice hereafter, without it Animal life could not exist.

Having proceeded thus far, our next step will be to bear in mind, what are some of the more Essential Elements of which the Human Body consists & also the properties of those Elements & here I think Animal Chemistry should be a little considered, ere we proceed further, being so to speak the Key stone to what follows. So now for the: - Chemical Composition of the Human Body.

Thirke's Physiol:

Of the 60 known Elements about one-third of them enters into its composition & they are named Essential or Incidental according to the relative proportion in which they are found in the body.

Thus C. H. O. & N. are named Essential, for no Organic Matter exists which does not contain two or more of these.

The Incidental Elements on the other hand, are less constant & occur, some of them at least, in very small quantity, they consist of: - S. P. Si. Cl. H. K. Na. Ca. Mg. Fe. & sometimes of Mn. Al. & Cu. & one or more of the Essential Elements added to these in certain fixed proportions, contribute to determine by what properties one kind of organic matter may be distinguished from another.

We are not to understand by this Classification that the former are more important than the latter, by no means (this only applies as a general rule) for the incidental Element Cl. is as essential a constituent of the gastric juice as any of the Essential Elements are. -

All these Elements exist more or less in the Organic Kingdom whence the difficulty experienced in endeavouring to draw a line of distinction between the two Kingdoms, for if we take a plant as illustrating what I have just stated, we shall find that the Inorganic Elements it assimilates for its nutrition & growth, become so gradually & imperceptibly organised by the vital properties of the plant, that to repeat, we are at a loss to say where the one terminates & the other commences; Alcohol, Ether, Acetic Acid &c. are of organic origin; yet in their simplicity & mode of composition, they resemble Inorganic matters.

By the aid of Chemistry we have discovered that those compounds are the most easily decomposed which contain the greatest number of Equivalents of an Element, in an atom; & vice versa.

Thus. Ex. Gr. there are bodies that contain the greatest number of Equivalents of Oxygen & these are more easily decomposed than those which have less, as is seen in the Peroxide of Lead, by heating which we obtain the Protoxide, which

in its turn does not so readily part with the remaining atom of Oxygen, for where there is only one atom of an element combined with one of another it is obvious, that the affinity between these two, must be greater than where there are two of the one, & one of the other. I have enlarged somewhat upon this, as I think it essential we should be acquainted with the properties of matter in the study of Organic Chemistry.

This property of Instability belonging to Animal Compounds is still further increased, 1st by their containing Nitrogen, wh of all the other Elements has the least affinity for bodies & thus it is easily separated from them, & 2^{dly} by their containing Water, the presence of wh is much favourable for the decomposition of Nitrogenous Compounds.

From these circumstances, nothing more is required for the putrefaction or decay of Organic Substances than the presence of heat, moisture & atmospheric air.

The Organic compounds existing in the human body may be divided into the Azotized or Nitrogenous & the Non-azotized or Non-ni-

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-trigenous principles.

The latter comprise the various fatty & oleaginous substances & are compounds of C, H & O. Their principal properties are those of all oils or fats, so we need not dwell on them.

The former or nitrogenized principles may be classed into the gelatinous & albuminous.

The gelatinous are found in the cellular & fibro-cellular tissue in all parts of the body as the Tendons, Ligaments, Cartilages and bones & the Skin & Serous Membranes, but when boiled in water, yield the gelatine on cooling, & this is not precipitable by Ferrocyanide of Potassium.

The most delicate test for gelatine is Tannic acid which will detect 1 in 5000 parts of water. Gelatine is also distinguished from the albuminous substances in giving a yellowish brown instead of a red colour, when tested by $\text{SO}_3 \text{H}_2$ & Sugar.

Chondrine is a substance resembling gelatine in appearance & in some of its properties generally but differs from it in its behaviour with Acetic & the Mineral Acids, Alum, $\text{Fe}_2 \text{O}_3 \text{SO}_3$ & KHO but precipitate it.

It is obtained from Cartilage. The albuminous substances are chiefly Albumen, Fibrine and Caseine, found also in the Vegetable Kingdom. They differ from the gelatinous (already noticed) in producing a red colour when acted on by SO_3 & Sugar, as is the case with hile when subjected to the same test.

They are precipitable by Ferrocyanide of Potassium. Albumen is found in the blood & in some of the other tissues as in the nerves &c. (Lime creazote has been recommended for Iodolysis as it has the property of coagulating Albumen.) It is found also in many morbid conditions or Dropsy &c. It is distinguished from the other albuminous substances & from Gelatine in being coagulable by heat or Nitric Acid or by boil.

Fibrine exists most abundantly in the Blood in a state of solution, & in the Lymph & Chyle & also in the Muscular Tissue; its characteristic is the power of separating itself from the fluid parts of the blood after it has been drawn from the living body.

Caseine is found chiefly dissolved in Milk.

4 is distinguished from Albumen & Fibrine by its not coagulating either spontaneously or by heat, & by forming a skin when its solution is evaporated. It is not coagulated by heat, but by dilute acids (w^h are unable to coagulate Albumen) & is easily dissolved by Alkalies.

Sulphur is probably, next to the Essential Elements, the most nearly constant in the body. It exists in Albumen, Fibrine & Caseine, & also in the hair, cuticle & nails.

It is found as Sulpho Genide of Potassium in the Saliva & as alkaline sulphate in the Urine & Sweat.

Phosphorus exists in Albumen & Fibrine, but not in Caseine, it plays an important part in the Bones, Blood, Brain & Urine &c.

Chlorine is found with Sodium as NaCl or common salt & also with other bases, it exists in the Gastric Juice.

Calcium. The salts of Lime are by far the most abundant of the earthy salts found in the human body, & are combined with S & P. in Bones & other Tissues & in many of the fluid portions of the body &c.

Iron is found especially in the blood, forming the Haemoglobin or Colouring matter of that fluid. It is also found in the scales of fishes and other tissues.

Copper is found in the liver & this was shewn by Orfila & others, it is supposed to be accidental and to take an active part in the Economy.

So much for the Chemical composition & I have here merely alluded to some of the more important Elements & where they are found.

I now proceed to classify the subject under different heads, which we will consider separately under the following order: -

1st Physiology.

2nd Pathology & Therapeutics.

3rd Histology.

4th Forensic Medicine.

In all these branches, I hope I may be able to point out where the applications of Chemistry are mostly indicated; but to resume the subject: -

I. Physiology is that science which treats

of the Conditions, Phenomena & Laws of the Life of the Human Body in the state of health.

Under this division of the subject, we will select the functions of Digestion, Secretion & Respiration, as types of Physiological Action & in w^h we shall see that Chemistry takes an active part.

Digestion then may be defined as a process by w^h the Animal assimilates food, either for Respiration & Animal heat or for new formation & repair of the Tissues, the absorbed & added to the blood w^h we may accordingly term, a most complex fluid, inasmuch as it not only affords the necessary elements for the Tissues, but contains in addition the products of their oxidation, & w^h being carried to the Lungs there maintains the Animal heat by combining with Oxygen; This we shall notice more at large when speaking of Animal Respiration.

We find, that, in accordance with what has just been stated, all articles of food may be divided into: -

1st The Sanguiferous or those necessary for Nutrition & Growth. These must contain

the Element Nitrogen but as already mentioned exists in Organic Compounds.

2nd The Respiratory or those articles of food necessary for producing & maintaining Animal heat by causing their Carbon & Hydrogen to combine with the inspired Oxygen of the Atmosphere.

For this purpose such articles of food must contain a large proportion of C+H than is sufficient to form water with the Oxygen that they contain; but more of this hereafter.

We also find the name Nutritive or Klastic is given to those principles of food which may be converted, by the process of decomposition, into the Albumen or Fibrine of the blood & which are assimilated by the tissues through the medium of that fluid.

While the term Respiratory or Calorific is given to that form of food which consists of non-nitrogenous materials as Fat, Starch, Gum & Sugar; the object of these I need not repeat. —

Liebig's Animal Chem.

Man can support himself by vegetable as well as by animal food, for both contain the Essential Compounds Albumen, Fibrine & Caseine, & not only this, but the Albumen Fibrine & Caseine of the one, may be (from the Identity of their Chemical Composition or Isomerism) by the vital process, transmutated into the corresponding substances of the other, where I may state that M. Denis succeeded in converting Fibrine into Albumen, i. e. in giving it the solubility & Coagulability of heat which characterize the white of Egg; thus proving the identity of these two. Animal & vegetable food must not only contain the substances just enumerated, but also certain Mineral Elements as P_2O_5 , as Alkalies KO & NaO . Alkaline Earths CaO & MgO . Oxide of Iron & Common Salt.

For in fact the incombustible parts of the Blood (i. e. the Ashes) when analysed are known to contain these very elements & how could they come there, except from the constituents of the food of Man or of the fodder of Animals? Hence all food must contain them in greater or less quantities. —

Dr. Gregory's Eng. Chem.

There can be no doubt that in the healthy state the body is constantly exhaling matter, through the pores of the skin, the retention of which by mechanical obstruction of the pores would induce disease of the Lungs.

Another point to be kept in mind is that a due Admixture of food is very essential for our health (as we shall see afterwards.)

Ex. Gn. were we to live without consuming fat with Introgenous materials as meat &c. we would find respiration somewhat impeded & to insure that we would find it necessary to have recourse to constant exercise, & that to the expense of the muscular & other tissues, for we are compelled to burn a portion of the sanguiferous matter for Heat.

This explains why Carnivorous animals are incessantly moving about & this is well seen in places where they are confined.

It may not be improbable that in some acute forms of Fever, the sudden waste of tissues (esp. the Muscular) may be owing to the same cause, for the patient is unable to take food of any sort, & this coupled with the accelerated pulse, would soon cause the Emaciation characteristic of acute febrile disorder, and besides we know that under such circumstances, the Exhalations from the Skin & lungs of a fever patient are of a very disagreeable nature.

This must be borne in mind when discussing the application of Chemistry & Pathology. We have seen that life cannot be well sustained by sanguiferous food alone, now we shall see that no animal can live long on Respiratory food. Magendie & other Physiologists have proved this beyond all doubt by the following facts:- They fed dogs & other animals on Sugar, Gum, Olive oil & water & also on Starch paste; The result of this was that after the lapse of a few days they became emaciated & died & on being opened, nothing whatever was found in the Stomach; these constituting Respiratory food.

Moreover Dogs thus fed were found to have an affection of the Cornea; this being also the case with the Hindoos who subsist on the almost non-nutritious food Rice, the diseases of the eye to which they are liable are only to be explained on the same grounds; this interesting fact was shown by Dr Budd.

We cannot but admire the wonderful provision Nature has made for the nourishment of the young of Mammalia in the fluid substance of

Milk, here we find both the klastic & respi-
ratory Elements of food in solution viz:
Caseine from which Albumen & Fibrin are subse-
quently formed, & various other materials as butter
but is respiratory food & some others but we
need not enumerate.

Lichig says "Experiments have shown that dif-
ferent forms of food are extremely unequal
in regard to the production & restoration of the
physical forces; for instance, wheat surpasses
Rye, Rye potatoes & Rice, & flesh in these respects
surpasses all other vegetable food whatever".

Hence we find all Carnivorous Animals
are more powerful than the Herbivorous.

Having considered the nature & qualities of
the food of Man, we shall now briefly
run over some of the Chemical Phenomena
we meet with, in the process of Digestion.

The food of animals is first masticated
& mixed with the Saliva, which has an
alkaline reaction, converting all the starchy
matters of the food into the condition of Sugar,
by which they can be readily absorbed.

The gastric juice as its composition contains
water & several acids in addition, has

Hicks Elpidio. -

the remarkable property of dissolving coagulated Albumen as well as fibrine and Caseine, properties not possessed by the Saliva. After digestion to a certain extent, the food passes out of the Stomach into the intestines and mixes with their mucous secretion, as also with the Bile (Its properties will be presently noticed) & Pancreatic Juice, but secretion is supposed to act chiefly in dissolving fats or oils but are not fitted for absorption; all the plastic & respiratory matters of the food are taken up during its passage through the intestines, & the insoluble residue or faeces, consist of woody fibre, a little colouring matter supposed to come from the Bile & the insoluble earthy salts of the food, as well as of the Effete tissues; while the soluble salts entering the circulation, are expelled in the urine.

Secretion. —

1. Saliva is a secretion consisting chiefly of water, an albuminous substance named Ptyaline, Soda, Iron & Sulpho-Cyanide of Potassium, but may be detected by a neutral solution of $\text{Fe}_2\text{O}_3\text{SO}_3$. The Saliva, as already said, has an alkaline reaction & has also the remarkable property

of converting starch or starch paste into Dextrine or grape sugar, so as to fit it for absorption. Were it not for the Saliva, dry starch could not be swallowed.

What active part it takes in digestion is not well known, but that it does perform certain important chemical functions, cannot be doubted, as food without it introduced into the Stomach of Dogs, has remained unchanged, this was proved by Dr Wright who tied the oesophagus & placed the food in the Stomach & the results I have just stated, but as soon as Saliva was admitted, Digestion went on rapidly.

2nd - The gastric juice or fluid is a secretion but consists of water, HCl, H_2O_2 , Acetic & Lactic Acids &c. It has decidedly an Acid reaction & contains various salts, amongst the most important of which is Common Salt or NaCl.

We have observed it will not act, unless the Saliva is introduced, in digesting food.

It has the property of coagulating albumen, fibrine & caseine & that without any doubt; It dissolves them also after coagulation to be fitted for absorption, for albumen has been

injected into the Jugular veins of Dogs & has been found shortly after in their urine.

It is also a powerful antiseptic, checking the putrefaction of Meat.

The gastric juice appears to convert all food to an albuminous principle, but would appear to be the principal material from w^h the Tissues are formed, as we know to be the case in the Hen's Egg.

Common salt has a remarkable property in exciting the secretion of the gastric juice, & as it is also one of the constituents of the Blood we see the importance of combining it with food. This action of salt explains the reason why those who have given up the use of it, are at first liable to suffer from Indigestion.

3rd The Bile is a secretion essential to the process of digestion, though much of it is not known. It consists like all the foregoing secretions principally of water, the Essential Elements (C. H. O. N.) Sulphur & Phosphorus, & along with the pancreatic juice, assist in converting the Acid Chyme into Chyme w^h is Neutral. Liebig's Analysis shows it contains much more C & H than Blood, so that it would appear to

assist the latter in the production of Animal heat & thus perform a part of the function of the Lungs; Moreover we know that according as the respirations are increased, after the introduction of food into the Stomach, so there is a large quantity of the Bile secreted, during Digestion. We can also refer the sympathy of action between the Lungs & Liver in another way:—

In the Fetus the Liver is proportionally large to the Lungs, & what we find in the Adult. For, in the former during intra-uterine life, the Lungs are not engaged in respiration & consequently the effete matter $C \& H$, are only to be excreted by the Liver, & is therefore found to be very large.

Even in the Adult, the more capacious the Cavity of the Chest, the smaller the Liver will be found to be.

We must hope the Science of Chemistry will reveal more of the Physiological functions of these Secretions, than what is at present known.

There is one other important secretion which we have not mentioned yet, viz that of Urine. We shall find this treated in the Pathological division.

of the subject, when comparing healthy, with diseased urine.

The next & last physiological function we shall speak of is that of Respiration, or Animal Respiration.

Respiration and Heat.

All living creatures whose existence depends on the absorption of Oxygen, possess within themselves a source of heat, independent of surrounding objects.

Arterial blood which has the power of conveying Oxygen to the tissues, is the only medium by which animal heat is produced & maintained. Hair, wool & feathers; receive no arterial blood & therefore in them no heat is developed.

We shall presently see that what we are now considering, is essentially a Chemical action.

The venous blood loaded with the Carbonic Acid, which it has brought from the tissues, is sent to the Lungs & there exposed to the respired air.

Here the Law of diffusion of gases, in contact with an absorbent liquid, comes into play.

The blood gives off Carbonic Acid & takes up Oxygen in its stead, & this Oxygen combining with the C. of the food & Effete tissues, is given off as Carbonic Acid, while another portion,

Nevertheless we do find that the Inhabitants of Hindostan consume great quantities of Ghee or Vegetable butter. This would seem to occur as a matter of habit inasmuch as the Europeans in those climates are incapable of eating much fatty substance with their food if indeed any.

continuing with H_2O is given off as water by the Skin, Lungs & Kidneys & the Oxidation of the Carbon & Hydrogen is the source of Animal heat.

Having now considered the Theory of production of Respiration & Animal heat, let us see what practical inferences can be drawn from them. What are the Elements of Respiration?

I may here state that the Animal body has been compared to a furnace, but we are constantly compelled to supply with fuel, in order to support combustion & heat, & when we do compare it to one, there certainly is a very great similarity.

From this it would appear that the greater the amount of heat required, the greater must be the amount of fuel added. Hence we find the Esquimaux & other Northern Inhabitants consume more carbonaceous or respiratory matter than the Inhabitants of the South.

In the former case, the extreme cold makes the body of the heat, to maintain but such immense quantities of Fat, Oil & Blubber are consumed, these being rich in Carbon; whereas those of the South living as they do in a much warmer temperature require a far smaller

Lieber's Letter on Chemistry

In Kltier's pulmonary where great quantities of Cod Liver are taken of the patient we find the fatty Liver. Some believe that the Liver here is inappropriate the Cause that is not consumed by the disorganised Pulmonary Organs, on the ground that fatty Liver is now much oftener met with than formerly as Cod liver oil has been comparatively of late introduction.

quantity of Respiratory food.

Now on this principle we can explain two forms of disease at any rate & so entirely based are they upon Chemical principles, that the Physician could not well understand their nature, unless educated in that Science.

The Englishman in Jamaica sees with regret the disappearance of his appetite, previously a source of frequently recurring enjoyment; he succeeds by the use of Cayenne pepper & the most powerful Stimulants, in enabling himself to take as much food, as he was accustomed to eat at home.

But the whole of the Carbon thus introduced into the System is not consumed (there, as we have already seen, the Liver takes up the excess of Carbon & as this function continues from day to day, hepatic disease arises from the excess of function that organ is called upon to perform). The temperature of the air is too high & the oppressive heat does not allow him to increase the number of respirations by active exercise & thus to proportion the waste to the amount of food taken; Disease of some kind necessarily ensues.

Lichy's Letters.

Lichy evidently would infer that as the organs of respiration are more liable to be "consumed" in Cold than Hot Climates - that Phthisis Pulmonalis is oftener met with in the former than the latter Regions. This we do not find for Statistics (of our Regiments quartered in all parts of the world) show, Phthisis is as common - most in India as here. Hot Climates are beneficial to patients (suffering under the disease) from the Climate is assumed as they relieve the symptoms of Phthisis as the Bronchitis, Cough, Pneumonia & Pleuritic Complications, Coryza &c. but are in Cold Climates very troublesome concomitants.

On the other hand England sends her sick, whose diseased digestive organs have in a greater or less degree lost the power of bringing the food into that state in which it is best adapted for oxidation, & therefore furnish less resistance to the oxidising agency of the atmosphere than is required in their native climate; & Southern regions where the amount of respired oxygen is diminished in so great a proportion; & the result viz: an improvement in the health is obvious.

The diseased organs of digestion have sufficient power to place the diminished amount of food in equilibrium with the inspired oxygen; in the colder climate, the organs of respiration themselves would have been consumed in furnishing the necessary resistance to the action of the atmospheric oxygen. In our climate Hepatic diseases, or those arising from excess of carbon, prevail in summer; in winter, Pulmonic diseases, those arising from excess of oxygen are more frequent.

From the foregoing we cannot but observe that Exercise is essential to health & especially in

of Phthisis Pulmonalis.

Phthisis Pulm. is moreover a very different disease to that inferred by Liebig. It consists, and is combustion of the Resp. organs by Cold, but in a morbid deposit from the blood, which deposit supplant the pulmonary tissue & takes its place. Then when softening of the Tubercular matter takes place it is coughed up or got rid of in some other way & hence the lungs are deprived of that amount of tissue which had been supplanted by the Tubercular deposit.

those individuals who take large quantities of food, as by this means the respirations are increased, & the excess of food thus got rid of.

These examples will also serve to show the mutual dependence of the Liver & Lungs on each other. Now the Kidneys are also dependent on them, for if the functions of the Skin or Lungs be in any way interrupted or disturbed, compounds rich in carbon are found in the urine.

How admirably then do we behold the harmony in this & all other instances, displayed of Nature's unerring Laws!

According to the preceding hypothesis, the quantity of food is regulated by the number of respirations, & the temperature of the air & by the amount of heat given off to the surrounding medium.

Before concluding Physiological Chemistry, perhaps I should say something of the use of Alcohol & its chemical action on the body. I shall here quote from Liebig's work on the Subject:—"Beside, fat & other substances which contain Carbon & the elements of water, man consumes, in the shape of Alcohol of fermented liquors, another substance which in

his body, plays exactly the same part as the non-nitrogenised constituents of food.

The Alcohol taken in the form of wine or any other similar beverage, disappears in the body of Man.

Although the Elements of Alcohol do not possess by themselves the property of combining with Oxygen at the temperature of the body, and forming Carbonic Acid and Water, yet Alcohol acquires, by contact with bodies in the condition of Greenacids or absorption of Oxygen, such as are invariably present in the body, this property in a far degree than is known to occur in the case of fat & other non-nitrogenous substances.

Decisive experiments have proved that the Urine, after moderate use of wine, contains no appreciable trace of Alcohol: it has even been found that the condensable fluid obtained by passing the expired air through a cooling apparatus, that is, the perspiration of the Lungs, is, in the same circumstances entirely free from Alcohol.

From these facts we can draw no other conclusion but this, that the Elements of the

Alcohol consumed, have been given out as oxidised products, the Carbon as Carbonic Acid, the Hydrogen as water.

If, moreover we reflect that after the use of wine, the proportion of Carbonic Acid drinks in a certain proportion, obviously corresponding to the Hydrogen of the Alcohol, no doubt can then remain that the Elements of Alcohol are available for the respiratory process and are actually employed in Respiration.

If however more Carbon is taken into the body in the form of Alcohol than there is oxygen to combine with it, then it may either be discoverable in the body, or it becomes decomposed such as Acetic & Butyric Acid."

There is one thing I suggested here but has occurred to me & it will not occupy much space perhaps I may be excused viz! - that it is undoubtedly from the Respiratory properties of Alcoholic Liquors, that we find so many of the poorer population continually in a state of intoxication, & were they better fed & better clothed & protected,

there is no doubt but such a measure would
 to considerable extent, avert it.

For it is a fact, that those who eat much
 food, do not drink so much spirituous li-
 -quors & for these reasons if a few more
 such institutions, as the "Poor Man's Refect-
 -ment Rooms" were &c raised, I am of opi-
 -~~ion~~ they would confer a great blessing on
 Mankind in general.

Having finished the 1st Division of the Sub-
 -ject, let us proceed to the next which is: -

II. Pathology and Therapeutics.

Pathology is that branch of Medicine which
 investigates the nature of diseases, while
 Therapeutics relate to the cure of those diseases.
 In the Pathological branch of Medicine
 the Medical Practitioner will inevitably find
 himself at a loss to state what are the
 nature & qualities of certain morbid fluids
 & solids found either in or out of the body,
 unless he be a practical Chemist.

Which of the numerous abnormal fluids of the
 human body shall I select as illustrative?
 I propose we should consider the healthy &
 some of the abnormal conditions presented
 by that

important secretion - the Urine.

We will commence then by observing, what are the Character it presents in a state of health. Human Urine is naturally of a pale, amber colour & is at times often of a dark hue, presenting all the shades of shade between these two extremes.

When recently discharged it has a characteristic & slightly aromatic odour, though it becomes pungent & ammoniacal as soon as decomposition sets in.

In the natural state the Urine has an acid reaction in all Carnivorous animals & is alkaline in the Herbivora.

By substituting the Vegetable for the animal food however, the reverse takes place in both these classes of animals, & this shows what a material effect, diet, has on the urinary secretion.

Healthy Urine when first voided & at the temperature of the body, is perfectly clear though it grows turbid or muddy on cooling. It is only in disease that we find it turbid at the temperature of the body at 98° or 100°. The reason of this will soon ap-

Bowman's Med: Chem:

Of course from what is here stated the Sp. Gr. of the urine will vary at different times of the day. Dr. Bowman states the urine specific gravity may be as low as 1003, I have scarcely found it so low as that myself. —

- few evident.

According as it contains more or less of its solid or fluid Elements has the urine been classified as follows: -

1st Urina Languinis, is that wh^{ch} has been excreted after rising in the morning & consequently before food or drink have been taken.

2^d Urina Potus, is where it has been caused by drinking much fluid of any sort.

3^d Urina Cibi, is that wh^{ch} succeeds a meal of solid food.

The Specific gr. of the urine in health is about 1020 according to Dr. Prout though Becquerel makes it 1017.

The Sp. gr. varies in different diseased conditions of the body. Thus for example it reaches from 1030 to 1045 & occasionally as high as 1050 & 1055 in Diabetes, this is when sugar exists in large quantities in the urine.

In making an examination of it, the urine voided after a night's rest is the best & can be most relied upon.

According to M. Becquerel 1000 parts of healthy & diseased urine contain the following amounts: -

Notes on Pathology.

Solids &c.	Normal Urine.	Febrile Urine.
Water	972	964
Solids	28	36
Urea	12	13
Uric Acid	0.4	1.4
Strong. Salts	7.	7.
Org. Salts & Extr.	8.6	14.6
Total	1000.00.	1000.00

Now to show what Chemical Analysis has done in the investigation of morbid conditions of the urine, I will adduce the following:—

Some authors, have held that in fever cases, where swellings or tumours of any sort have existed, as soon as a deposit was observed in the urine, that that was the result of the subsidence of that tumour or diseased Mass whatever it was; & this they termed the urinary crisis, inasmuch as the urine was here supposed to be the Chief agent in coming off the morbid structure after it had become absorbed.

Now the above table will show how a man in fever passes less urine on the whole than a man in health in the 24 hours; although in the former case there are more of the Solid constituents in proportion to the water; the

Notes on Kalthatay.

Notes & Observations.

uric acid being the only substance increased in quantity.

Hence the Turbidity observed in febrile urine caused by the proportional increase of the solid elements & the water.

We observe then how it was such a gross error was committed by the older observers; of the fallacy of which we are now perfectly satisfied.

Then again the Analysis of Becquerel clears up another point of so small importance:—Some have supposed the Turbidity of the febrile urine is the result of certain solid tissues of the body which have become effete, so that an attempt to account for the extreme Emaciation attending some acute fevers, has been thus explained.

A glance at the Table will also refute this, besides I have on a previous occasion stated that the Emaciation attending fevers occurs chiefly from the exhalation through the skin & lungs; This important fact then has been made out of Chemical Science.

Let us now see how another marked condition of the urine is generated & what it

Gregory's Org: Chem:

On these principles it has been proposed to inject certain Chemical Solvents into the bladder with a view of dissolving the Stone.

If indeed this were more energetically tried no doubt the severe Operation of Lithotomy might be less had recourse to, than at the present day.

give rise to. Dr. Gregory says: -

"Gelatinous food, not animal from blood & is deficient in alkali & strong wines but contain no tartar, health promote the uric acid Calculus; light wines, but contain Tartar, vegetables but are rich in alkali, Exercise in the open air & moderation in sanguiferous diet, are the best remedies. On the Rhine where light wines are freely used, uric acid Calculus is unknown as a native disease, but with drinkers of Port & Sherry, this Calculus as well as its concomitant Gout, are never frequent.

If alkali, instead of free acid should prevail in the urine - for as we have already seen, healthy urine is always acid - the Earthy Phosphates are thrown down & give rise to Phosphate Calculus.

A change of diet & mode of life on the principles we have endeavoured to explain, will alter entirely the Character of the urine. & of course of the Blood.

Hence the supreme value of diet & Regimen acknowledged as a means of cure by all experienced Physicians.

Glomer on the Appl. of Chem. & Med.

It is probably in this direction, in the study of the secretion & the means of changing their nature, that we may hope for the greatest practical improvement in Medicine."

The most important diseases of the Kidney are manifested by changes in the character of the urinary secretion & which for the most part must be detected by chemical analysis where I will take the opportunity of stating that the food of Animals may be regarded as eventually decomposed by the action of the Organism into Carbonic Acid & Urea - The former excreted by the Lung the latter by the Kidney.

In disease, either the healthy ingredients of the urinary are in their proportion from the normal standard, or some of them are removed & frequently foreign matters are substituted.

The most important points in the Pathology of Bright's disease of the Kidney have been elucidated by the use of the microscope, but Chemistry furnishes.

Thus we are enabled to discover that in this disease the nutritious principles of the

blood are allowed to escape of the Kidney, while this organ does not separate that excrementitious principle & those Salts which in the healthy state, its chief office is to remove.

Diabetes is another disease in which Chemical analysis has been of great service, & the detection of Sugar in the blood of Diabetic patients, has given us a clearer insight into the real nature of this affection, proving that it is not the attributed to the Kidney, but to mal-assimilation, either in the processes of the Primary or the Secondary Digestion.

There is yet one remaining division of this branch of the Subject & will now be briefly considered; I allude to Therapeutics or that Science which relates to the cure of Disease. From the foregoing Page, it will appear evident; that a great many diseases which are not amenable to treatment by the ordinary method of administering medicines, may be brought under control either by the influence of Climate, or by strict Attention to diet & Exercise.

Now it is clear that as those I have to-

I have heard some persons strongly objecting to the treatment of diseases on Chemical principles, because the following had not been successful: - Having treated certain diseases of the Brain & Spinal ^{Cord}, with ~~no~~ success by the administration of Phosphorus internally, they argue that such Chemical reasonings are incorrect & erroneous, ⁱⁿasmuch as Phosphorus is one of those Elements which enters into the Composition of the Nervous tissue. I attribute this ill success to the fact, that we are not yet familiar with all the constituents of the Nervous tissue or we are with the blood ~~we do~~ we know in what proportion they exist in the former; so that were Phosphorus the only Element that was deficient (as we know the Iron is absent in it & normal amount in Chlorosis & Anemia) we might by substituting the deficiency, expect much benefit. It is probable however, other Elements beside Phosphorus may be wanting. Then as we do not know

unmerited, arise from purely Chemical causes, we can only expect a favourable result of treating them accordingly; having already given several examples under the Pathological division of the subject, I need not dwell here for any length of time.

The two following are equally applicable: - We have seen the necessity of the Element - Iron - being a constituent of food, for we find those who subsist on articles of diet, not containing any appreciable quantity of it, are liable to be affected by Chlorosis; the Cause is here known & we administer Iron to effect a removal of the disease.

Again in all Chronic diseases, which affect the digestive or nutritive powers, Emaciation occurs, because the Oxygen of the air, no longer absorbed, burns off the tissues & wastes them. This explains the good effects of Cod liver oil & other oil matters, such as Olive oil, butter & Cream, which constitute respiratory food.

Many diseases which would not yield to ordinary treatment have been cured by means of a Chemical agency, for which

what these other elements or constituents may be, we shall do far better to introduce hermon substance into the system in the form of food acting on the principle "herwi heruoreum". - Phosphorus is undoubtedly a most important element in the animal as well as the vegetable world. Liebig says we can't think without Phosphorus!!! —

Besides these individuals treat all diseases of the hermon system indiscriminately with Phosphorus, as though that were the only & sole element. Disappointment obvious results. -

Mankind may be thankful - I refer to Electro-
galvanism, by the agency of which Paralysis,
 Neuralgia, Chronic Rheumatism, Amenorrhoea
 & other nervous disorders arising from
 various causes have been temporarily relieved
 or altogether removed.

There is an Essay or Pamphlet by Dr. William
 Lunning, in which he shows "The value of
 Electro galvanism in the treatment of Con-
 stipation & other affections of the Di-
 gestive Canal" & the results which have
 followed the use of it are assuredly not to
 be overlooked & he shows it is indispensable in all
 those conditions, where the muscular tone of the
 Stomach is deficient in Energy.

Chemistry moreover has conferred a benefit
 on Medicine by the discovery of new remedies
 & adduced which would almost exhaust
 the Catalogue of the Materia Medica.

And it is only by processes of recent discovery
 we are enabled to separate the active prin-
 ciple of various Drugs, from those obstruc-
 tive of our wished for aim, & by means
 of reagents we are able to keep them for a
 length of time in order to be subservient to our
 Uses.

It also frequently furnishes rules for the administration of Remedies, by the view it affords us of their Medicinal actions, & the precautions which it enforces, for their combination.

In the Doctrine of Miasmas & Contagions, in the detection of deleterious Effluvia & their destruction or removal, Chemistry is not the less applicable. These important subjects are amply & most ably treated of by Liebig in his Animal Chemistry.

We appear to consider, that the causes of noxious Effluvia & Miasmata of every description, take their origin from the accumulations of putrefying Animal & Vegetable substances.

Now although Contagious disorders, under such circumstances, are undoubtedly propagated, still I believe, it is not yet fully proved that they do take their origin, from decayed animal & vegetable substances, & for the present, this suggestion of Liebig must be received cum grano salis, leaving it as well as other matters of doubt, for future investigations to decide.

The subject of Mineral Waters offers a beautiful field to the Medical Chemist, but it is so well known, even to those unconnected with the Medical Profession, that Chemical Analysis is required to ascertain the Constitution & Therapeutic Characters of the various Species, that we will not dwell on this Application of Chemistry. We now proceed to notice the 3rd Division of the Subject, but will be comprised in a very few words.

III. Histology.

This term signifies that branch of Medicine which relates to the study of the Tissues of organised bodies.

So that it is both essential to the Botanist as well as to all those who are engaged in microscopic investigations & no one could carry on their observations satisfactorily or I may say with any degree of perfection without a knowledge of Chemistry, as it alone solves many differences which the Histologist would otherwise be apt to overlook.

Let us take a few examples:-

The mere microscopic examination of the albumen of Egg would not lead us to form such notions of the development of Membranes from it, as a drop of oil would do.

And regarding the composition of certain microscopic particles as the fatty & the albuminous &c. we would be left in the dark; whereas, the Reagents of Heat & Ether will detect the one of these from the other.

Moreover the distinction between certain cells or also fibres can only be known by their behaviour with acetic acid & water &c.

Thus much will, I trust, suffice to show the value in this department of Medicine.

The next & last division of the subject to be briefly considered is:-

IV. Forensic Medicine.

Forensic Medicine or Medical Jurisprudence, is that science which treats of the legal proceedings, in reference to Medicine. Here the Applications of Chemistry are so numerous & obvious, that it will be sufficient, I think, if I merely quote what Dr. Flower says on the subject:-

"By means of the aids wh^{ch} Chemistry affords is the Medical Jurist often enabled to convict the guilty, or enjoy the supreme satisfaction of succouring the innocent & oppressed & allowing the poor victim of popular calumny to recover his liberty and to preserve his life, to vindicate his fame & to avert ignominy from his memory. Never was the native dignity of our Profession soar higher than when we realize those awful & beneficent privileges. Then the ignorant scoffer is made to reverence the supremacy of science & the moulding & adorning that knowledge is power. And here nothing short of an extensive acquaintance & familiarity with Chemical research is available for the Medical Jurist.

The evidence of Orfila proved the existence of arsenic in the body of Laffarge, after less experienced Chemists failed to detect its presence.

Professor Lehmann in his "Methodological Introduction" gives an admirable catalogue of instances both in Medicine & Science.

Having now concluded all that perhaps should
 be said on this subject (though certainly not all
 that could be said or even what I could have my-
 self wished / I must conclude my paper
 by an apology already offered viz: that
 I have merely satisfied myself & I trust others
 who may have perused this humble production,
 of the extreme importance of Chemistry in
 Medicine. My chief object in having se-
 lected this subject having arisen from
 the levity & indifference with which many ap-
 pear to regard this Science & esp. "Chem-
 istry in its Applications to Medicine".

M. Elliott.

March 1855.