

## **Urinary diseases and their treatment / by Robert Willis.**

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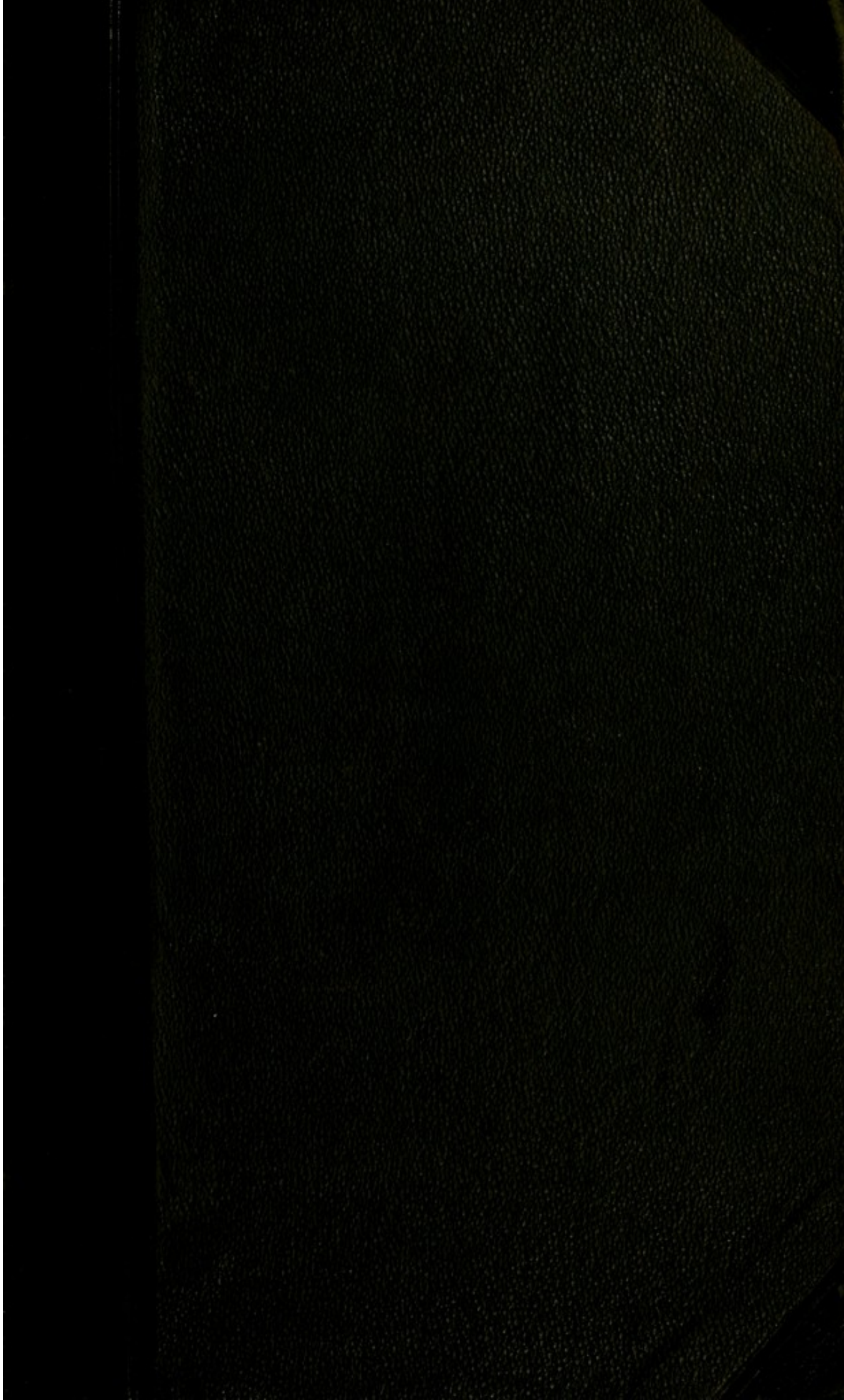
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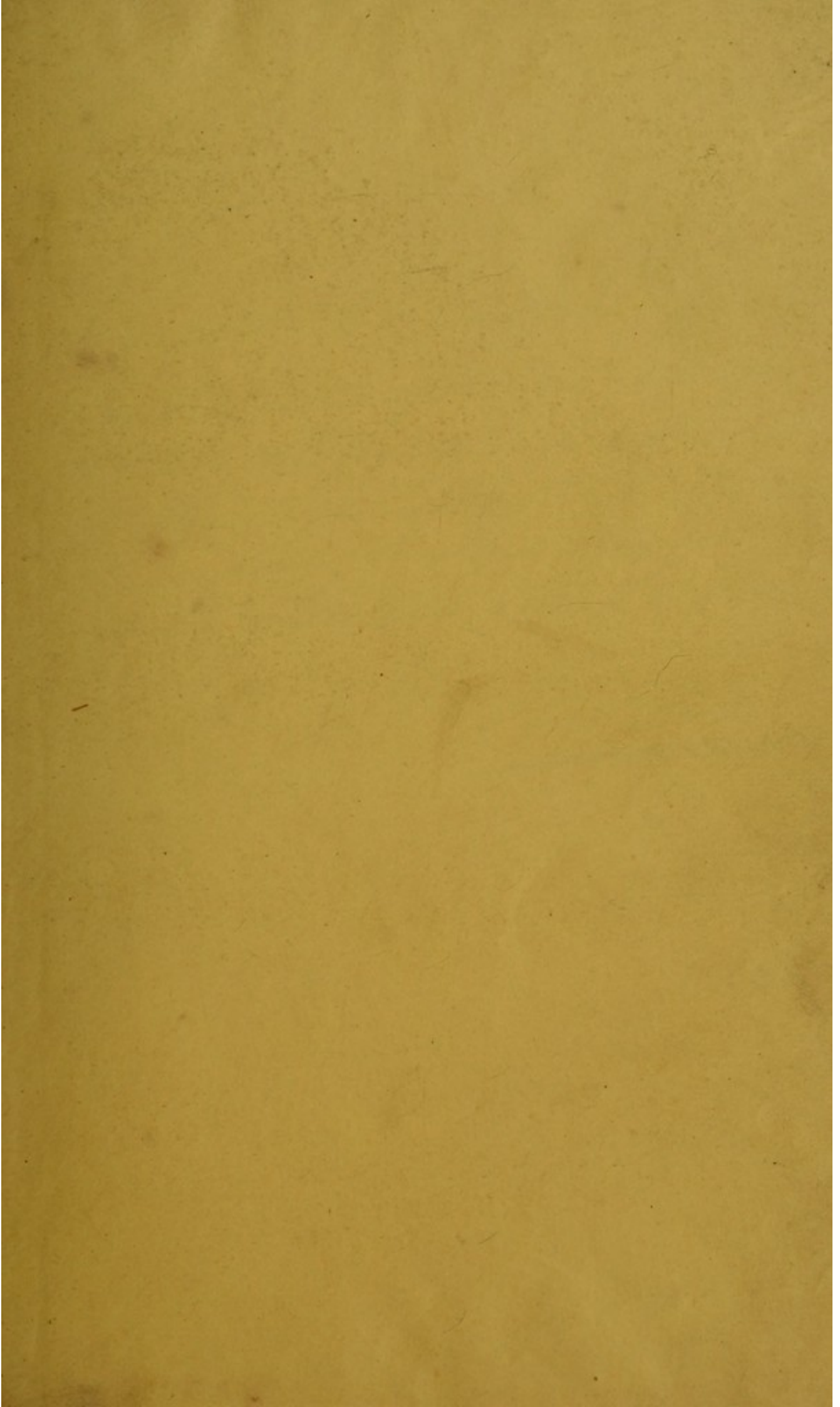


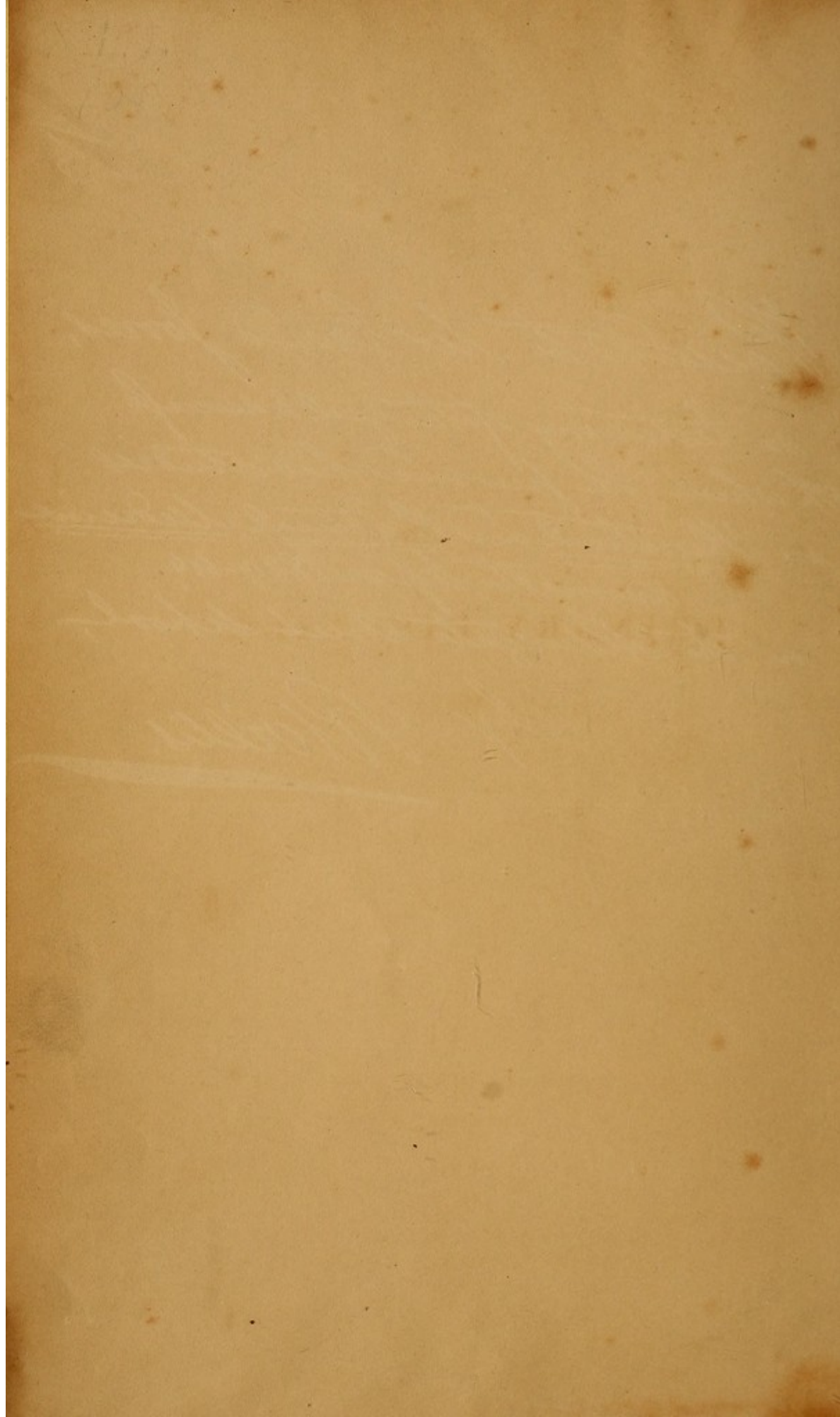
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Presented to Mr Edward Jones,  
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in Theoretical and Practical Medicine  
during the Session 1839-40  
in the Aldersgate Street School,  
by P. Willis.

31/6

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URINARY DISEASES,

&c.



PRINTED BY JOHN SCOTT,  
62 JOHN STREET, HOLLAND STREET, BLACKFRIARS ROAD.

# URINARY DISEASES,

AND

## THEIR TREATMENT.

BY

ROBERT WILLIS, M. D.

LICENTIATE OF THE ROYAL COLLEGE OF PHYSICIANS,  
PHYSICIAN TO THE ROYAL INFIRMARY FOR CHILDREN,  
ETC. ETC.

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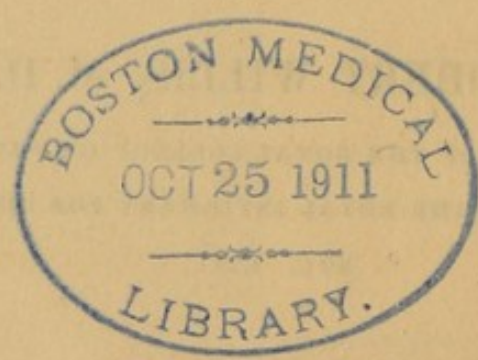
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1838.

URINARY DISEASES

THEIR TREATMENT

9196





TO  
JOHN BOSTOCK, M.D. F.R.S.  
ETC. ETC.

THIS WORK IS INSCRIBED,  
IN  
TESTIMONY OF THE HIGH RESPECT  
IN WHICH  
HIS CHARACTER AS A MAN,  
AND  
HIS LABOURS AS A PHILOSOPHER,  
ARE HELD,  
BY HIS FRIEND  
AND VERY HUMBLE SERVANT,

R. WILLIS.

JOHN BOSTON, M.D. F.R.S.

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## P R E F A C E.

My object in the following pages, has been to give a comprehensive and connected view of the *Functional Derangements of the Organs which secrete and excrete the Urine*, whether primary or secondary in their nature, and of the *medical and dietetic Treatment adapted to their different Forms*. As among the most frequent and formidable of the immediate consequences of certain disordered states of the renal secretion, I have also included a particular consideration of *Stone in the Kidney and Bladder, and of its Remedy by Medical Means*.

A few years have added largely to our knowledge both of the physiology and pathology of the kidney; and every step in advance, has made the necessity of studying the qualities of the urine in almost every one of the diseases with which the body of man is afflicted, more and more apparent. Under the guidance of science, too, and particularly of recent discoveries in animal chemistry, the examination of the urine, an art but lately held in merited contempt, has assumed a character of the highest importance to the practical physician. If it have been deemed of moment to ascertain the qualities of the alvine evacuations—the mere residue, the undigested and unavailable portions of the food,—it must surely at once be seen that it is of paramount importance to determine the condition of that secretion, which contains the re-



crementitious matter of the blood, and in its constitution presents an index, as it were, of the state of all the functions whose sum composes The Life. Urinary diseases are besides in themselves, and considered abstractedly, subjects of peculiar interest and importance. They are of very common occurrence, extremely rebellious in their nature, and most fatal in their effects. They are, farther, very far from being generally understood ; of all the well-worn pathways of medical literature, there is probably no one less trodden than that which leads to a knowledge of the forms, tendencies, and medical treatment of Urinary Diseases.

Much has undoubtedly been done in this department of late ; but what exists lies widely scattered, is little accessible, and, without connexion, is even less available for practical purposes. I have gathered these fragments together, and striven to arrange them into a whole, under the lights afforded by physiology, reflection, and experience. The entire subject, it will be seen, I have handled less as a chemist and experimenter, than as a pathologist and practical physician ; but I have still supplied the necessary instructions for testing each variety of morbid urine, and of ~~each~~ morbid product occurring in its constitution, the knowledge necessary for this purpose being among the number of accomplishments indispensable to whosoever would treat urinary diseases with discrimination and success.

25, DOVER STREET,  
October, 1838.



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## EXPLANATION OF THE PLATES.

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PLATE II. Represents calculi of the bladder of different kinds that had been acted on by the bicarbonated alkaline mineral waters of Vichy. *Fig. 1.* Is a nucleus of a lithic acid calculus discharged from the bladder after a course of these waters; the patient who voided it having at a former period been upon the eve of submitting to the operation of Lithotrity. *Fig. 2.* Is a piece of a lithic acid calculus, *d* before, *c* after twenty-five days exposure to the action of the alkaline water, during which it lost above seventy-two per cent. of its original weight. *Fig. 2.* A portion of an ammoniaco-magnesian phosphatic calculus, *f* before, *e* after exposure for eighteen days to the action of the Vichy water, in the course of which it lost more than forty-five per cent. of its first weight. *Fig. 4.* Another ammoniaco-magnesian phosphatic calculus, *h* before, *g* after exposure to the action of the same water for twenty days, during which it lost nearly seventy-two per cent. of its weight.—*Vid.* p. 302, *et seq.*

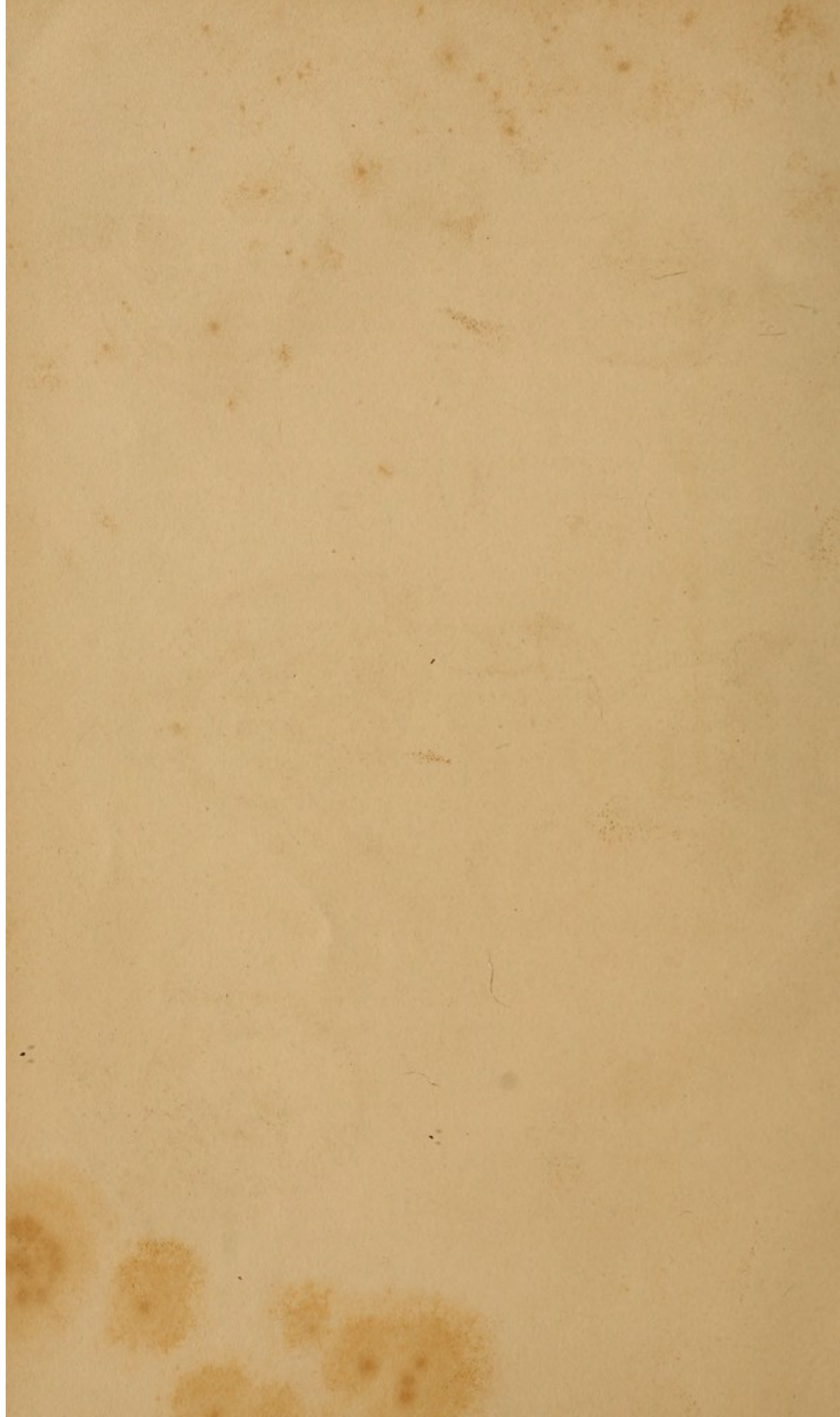
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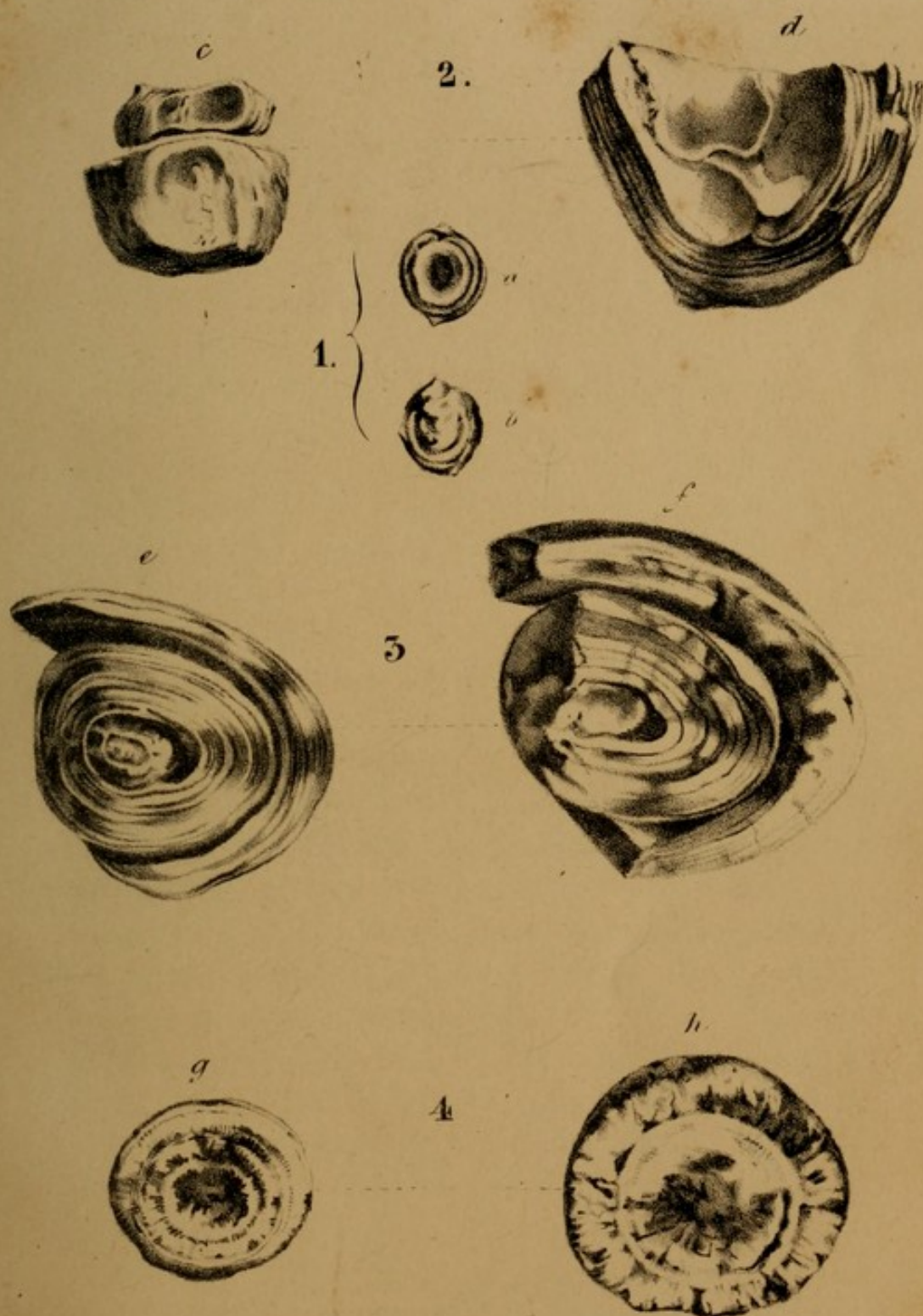
- Page 59, eleventh line from bottom, *for less read generally more.*  
71, eighth line from bottom, *for and soon read and so on.*  
71, tenth line from bottom, *dele the a after the word surely.*  
133, third line from bottom, *for herbiferous read herbivorous.*  
158, eighteenth line from bottom, *for are read were.*  
361, fifth line from top, *for resource read recourse.*  
372, first line of note, *for urino read urina.*  
373, third line from bottom, *for ENEURESIS read ENURESIS.*  
386, eighth line from top, *for deceased read diseased.*

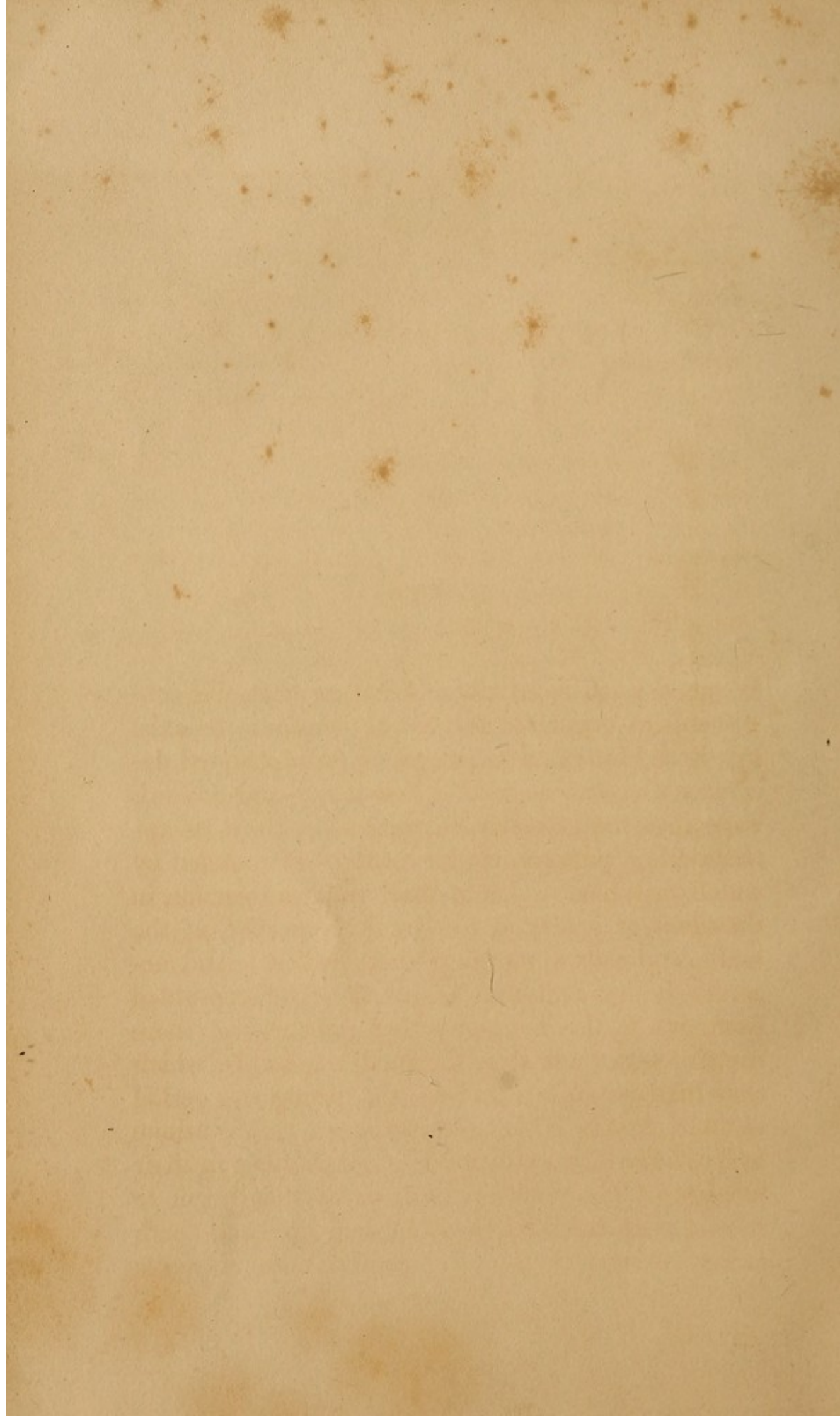














## INTRODUCTION.

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### PHYSIOLOGY OF THE KIDNEY; NATURAL CONSTITUTION OF THE URINE.

It would seem to be a law of nature that the constituents of organized bodies only continue to exist by virtue of perpetual change, of uninterrupted decomposition and renewal. Vegetables and animals have alike the necessity imposed upon them of appropriating portions of the matters surrounded by which they live. This of itself implies rejection in the same, or nearly in the same, proportion of the matters already composing their bodies. And accordingly we find that of all the food consumed from day to day by plants and animals, no more remains with them than the small amount by which they increase in size and weight during the period of their growth. This once completed, they continue to live for a term, with but slight variations in their masses. Old age and natural decay then begin to rob them of the store they had laid up; and death at last consigns them to the ground, there to make



restitution of the little that the powers of life had still kept abstracted from the influence of those chemical affinities which now seize upon and unite their component principles into new combinations.

The food of plants and animals consists of these ultimate elements—Hydrogen, Oxygen, Carbon, and Azote; otherwise of water, and variable proportions of carbon and azote. Carbon and water are the proper food of plants; and save in some instances, azote is not present as a constituent of their organization. Carbon and water also suffice as food for a large proportion of animals; but azote is a necessary ingredient in the composition of their bodies. Food is appropriated in one of two ways: among vegetables it is always by imbibition through the root; among animals, according to the place they occupy in the scale of creation, it is either absorbed from the surrounding media, or it is assumed as an act of volition, transmitted to a pouch, where it undergoes certain changes that fit it for the uses of the system, where its nutritious particles are absorbed, and whence its insoluble and innutritious portions are in due season expelled. In this way is the assumption of fresh matters provided for. The rejection of effete particles is accomplished in one of two especial ways, and by one or two appropriate pieces of apparatus, according to the nature of the element to be got rid of, and the place of the being considered, in the scale of creation. Among vegetables, carbon is the prime element of nutrition and composition, and therefore of rejection also; and we find an ample provision of apparatus in the leaves, by which their systems are freed from the effete



particles of this substance which they contain. Among animals, carbon and nitrogen, if not universally and alike elements of nutrition, still are they both universally elements of composition ; and accordingly we observe not only an apparatus for purging off the carbon, as among plants, but one in addition for abstracting the nitrogen. A *lung*, or something analagous to it, is the apparatus in reference to the carbon, a *kidney*, that in reference to the nitrogen. The lung and the kidney, consequently, taken together, constitute the apparatus of rejection among animals. It has long been known that no animal could survive continued abstraction from the access air ; that the elimination of carbon, effected by the contact of the atmosphere, was necessary to its existence, and that an organ or means of some kind for effecting this object was as universal as organisation itself. Recent researches have also shown that we descend very low in the scale of creation before we lose traces of a kidney or apparatus for freeing the system of nitrogen. The lung, and from their magnitude alone, evidently important Malpighian canals in Insects, have been found to secrete, and even to contain calculi of, uric acid. The same substance has also been discovered in the matter elaborated by the *saccus calcareus*, the *organe de la viscosite* of Cuvier, of Mollusca ; and as in the case of the lung, when we have lost traces of a concentrated and special organ that might be called a kidney, we find evidences of a means diffused through the system for accomplishing the important end of azotic purgation.



It is highly interesting to be aware of the fact, that the principles excreted by the lung and the kidney represent very nearly the sum of those introduced as aliment. The food of animals may in fact be regarded as finally decomposed by the action of the animal organism into carbonic acid and urea. The experiments of M. Chossat\* upon this matter are of the highest interest. He showed that the quantity of solid urinous excrement was in harmony directly with the quantity combined with the quality of the food taken. Each ounce of farinaceous aliment, bread, yielded regularly 9.9 grains, each ounce of albuminous food 13.6 grains, and each ounce of fibrinous food 17.3 grains of solid urinous excrement. They therefore stood to each other in the power to produce solid urine, in the ratio of 5.7.9. When like weights of these different kinds of food deprived of water were taken, the differences in the proportion of urinous excrement yielded by each were still more striking; each ounce of dry bread, for instance, then produced from sixteen to nineteen grains, each ounce of dry albumen seventy-three grains, and each ounce of dry fibrine seventy-six grains of solid urine. Whence it follows that the quantity of azote contained in the food is a principal element determining the amount of solid excrementitious urinary matter. M. Chossat found, in fact, that ten-elevenths of all the azote ingested with the food were discharged by the kidney.

These experiments show the importance of the kidney in the animal economy in a new point of

\* Journal de Physiologie, tom. v. p. 65, Paris, 1825.



view; they demonstrate matters that were but vaguely imagined before; they absolutely place the kidney in the same rank with the lung, among all the superior tribes of creation, and render ample reason for the serious disturbance of the health that ensues upon any implication of its function.

The important organ, whose first duty it is thus to purge the system of azote, the kidney, in its anatomical structure consists essentially of a congeries of straight tubes in its medullary, and of an intricate of convoluted tubes in its cortical portion. These tubuli seem to anastomose freely together, especially in the cortical substance. They terminate towards the periphery of the kidney, in cœca or blind canals, in the same manner as the tubuli seminiferi of the testis; they converge in the tubular structure, anastomose, become fewer in number, and finally end in pointed papillæ, which being received into funnel-shaped cavities called calices or infundibula, these in their turn open into a pelvis or receptacle, and this into the ureter. The convoluted tubuli of the cortical, and indeed of the medullary substance also, are the immediate seat of the secretion of the urine, which, according to Mueller,\* is poured out by their whole internal surface, not by their extremities only. They are everywhere surrounded by minute currents of blood, which circulate in the capillary net-work of vessels that fills their interstices, and is extended over their external surface. A portion of the fluid element of the

\* *De Glandularum Secernentium Structura*, fol. Berl. 1830; and *Physiology*, by Baly, p. 454.



blood, thus brought into intimate contact with the proper structure of the kidney, has been supposed to permeate the delicate parietes of the uriniferous canals, suffering in its transit a chemical change; or the superfluous water and effete matters contained in the blood generally, have been held to be attracted and separated from it by the peculiar agency of the secreting canals.

Rollo long ago held that the kidneys were *separating* rather than *secreting* organs. Recent observation would lead to the conclusion that they were both the one and the other. The blood circulated through the kidneys contains some of the constituents of the urine ready formed; others of these seem to be engendered in the kidney. We are indebted to Prevost and Dumas\* for the important discovery that urea exists in the blood independently of the action of the kidney. They demonstrated the presence of this substance in considerable quantity in the blood, after the extirpation of both kidneys. They obtained twenty grains of urea from five ounces of the blood of a dog which had had both of its kidneys extirpated two days previously; and from two ounces of the blood of a cat, under similar circumstances, they procured as many as ten grains of urea. These experiments have been repeated several times, and their accuracy is fully determined. Nay, it is not necessary to extirpate the kidneys to have evidence of the presence of urea in the blood; it is sometimes enough to have them diseased, and per-

\* Biblioth. Univers. de Geneve, tom. xviii. p. 208.



forming their function amiss, to obtain demonstration of the fact.

The presence of uric acid ready formed in the blood has not been demonstrated. The occurrence of concretions consisting of urate of soda, in remote parts of the body among gouty subjects, however, favours the supposition that it also exists there, that it is another of those substances which are merely separated, not produced by the kidney. But it seems dangerous to push this idea of separation too far. Researches in minute anatomy by the aid of the microscope, tend to reduce all glands to a parity of structure; they all seem to consist of a congeries of canals, or of racemiform sacs, plentifully bathed with blood; and secretion at length comes to be a mere transudation through the parietes of these sacs or canals. There must, however, be something peculiar in the structure of different organs, that escapes even the microscope; for divers changes induced in the blood that has been in contact with divers structures—assuming diversity of structure to exist on the testimony of the naked eye—as proclaimed in the dissimilar products of such contact, is an indisputable physiological fact; the general circulating mass of blood, by its contact with the tissues at large, from *arterial* becomes *venous*; bile is produced in the liver, not urine; urine in the kidney, not bile, and so on. It is not legitimate or philosophical, therefore, to maintain hypothetically the existence of all the constituents of the urine in the blood. The elements necessary for the composition of these exist there, but no more. The distinguishing ingredients of the urine, in fact, only make their



appearance under the influence of the nerves distributed immediately to the kidney, as we shall see presently.

Nevertheless, it remains true, that many of the substances which accidentally impregnate the urine must have been present in the blood before they made their appearance in the recrementitious fluid. They were taken into the stomach, absorbed into the system, and became constituents of the general circulating mass of fluid before they made their escape by the kidney. I would not even allude to the childish hypotheses that have been proposed, and even very lately defended, with regard to channels of direct communication between the stomach and the kidney. The rapidity with which diluents and a variety of saline, aromatic, and colouring matters make their appearance in the urine, is readily explicable when we take into account the rate at which absorption is known to take place from the stomach and intestines, the velocity of the circulation, the great relative magnitude of the renal artery, and the immense surface for secretion presented by the whole of the uriniferous tubuli taken together. One important part of the renal function would even appear to be that of freeing the system from superfluous water, and from such substances as, having gained access by the lacteals along with matters more profitable, are found, either noxious, or, at all events, useless in the economy, and must therefore be again got rid of. The kidney is the outlet provided for these; by virtue of its vital electivity it seizes them entangled in the circulating fluid, and expels them as intruders.



The kidney is, however, any thing but a mechanical strainer to the system. Its office only takes place under the influence of the nervous centres generally, and particularly of the nerves distributed to it. Injuries to the brain and spinal cord, if they do not cause the entire suspension of the urinary secretion, at all events alter its characters. After dividing the spinal cord in a dog opposite the last cervical vertebra, Krimer\* found the urine as clear as water, and containing considerable acid impregnation, but extremely little animal matter. The destruction of the medulla oblongata, the same physiologist found to be followed by the instantaneous suspension of the urinary secretion, a fact which had been observed by Brodie† to follow decapitation employed along with artificial respiration. Krimer farther observed that when the eighth pair of nerves was divided, the urine became albuminous, and showed no trace of certain matters conveyed into the stomach, which ordinarily very soon make their appearance in that fluid, a fact which had been already observed by Dr. Naveau.‡ When these nerves were simply irritated, or partially compressed by a ligature, the urine became watery, and of low specific gravity; and though it contained acids and salts in abundance, it showed but faint traces of any of its distinguishing animal matters. When the great sympathetic nerve was divided in the neck, he found that the urine became

\* Physiologische Untersuchungen, 8vo. Leipz. 1820.

† Philos. Trans. 1811.

‡ Diss. Circa Urinæ Secretionem, Halæ, 1818.



alkaline, turbid, of greater specific gravity than wont, and loaded with albumen. Several of these results of Krimer have been called in question by Brachet,\* and the whole question requires revisal. When the renal nerves are destroyed or divided, there can be no doubt of the secretion of urine being entirely suspended. This fact has been most satisfactorily demonstrated by the experiments of Mueller and Peipers; the access and egress of the blood to the kidney may be provided for, and made as free as ever, but no urine is formed. This is about as much as is positively known concerning the influence of the nerves on the secretion of the urine.

The product of the renal function among the higher animals is the URINE; a fluid of most heterogeneous constitution, but to which the distinguishing character may be assigned of containing matters into the composition of which azote enters in very large proportion. The azotic or nitrogenous compounds present themselves in two principal forms, as *urea*, and as *uric acid*. One or other of these substances, or the two together with water, may be viewed as the essential constituents of the urine; all the rest of its contents are probably in a greater or less degree accidental.

In man the urine in health is transparent, has a citrine or amber-yellow colour, a peculiar aromatic odour that is not altogether unpleasant, and a bitter, saline, and somewhat pungent taste. Its

\* Rech. Exper. sur les Fonctions du Syst. nerv. ganglion, 8vo. Paris, 1837.



qualities vary greatly at different times; sometimes it is nearly colourless, and apparently free from every other than a slight saline impregnation; at other times it is of a rich ale or wine-brown colour, and possesses all its peculiar properties in perfection. The urine presents these varieties in perfectly healthy individuals; they constitute what has been called the *urina potus*, and the *urina sanguinis*, i.e., the urine which is elaborated shortly after meals of light unstimulating food, with which considerable quantities of fluids have been taken, and the urine, which is eliminated after the process of digestion has been completed, and the system is at work appropriating the fresh supply of nutriment that is streaming into the general circulation with the chyle; the kidney being employed in the same proportion, freeing the body of matters changed by the vital chemistry of the tissues, effete, and no longer fitted to form an element in the organism.

The *quantity of urine* secreted, varies greatly, as well at different times in the same individual, as habitually in different individuals; but it is regularly in the ratio of the food—the meat and drink, consumed: he who eats and drinks largely will pass a large quantity of urine; he who is abstemious and temperate will void less. The quality of the food also influences the quantity of urine formed: it is, for instance, much more abundant when vegetable matters are used as food, than when animal substances are consumed. From thirty to forty ounces may be about the average quantity passed by men during a temperate state of the air; women, and especially women in the upper classes of so-



ciety, void much less urine than men; a circumstance depending on their generally more abstemious mode of living.

The *specific gravity* of the urine varies with its quantity, and also with the quality of the food consumed. Among healthy men the *urina potus* will often be found of no higher density than 1.005 and sometimes even less. On coming out of a cold bath, in which he had remained long immersed, M. Chossat observed it as low as 0.0016 at 60° F. The *urina sanguinis* frequently attains the density of 1.030 and even of 1.033. I have never seen it above 1.033. M. Chossat, however, in the course of his observations, had more than forty times seen it higher. The greatest density he ever witnessed was 1.038, at about 60° F. Writers differ very much in their estimates of the *average density* of the urine. Prout believed that from 1.010 to 1.015 might be about the average density; any such estimate as from 1.015 to 1.025 is certainly much too high for the latitude of London. My observations would lead me to say that the average specific gravity of the urine among grown individuals generally, could not be estimated more closely than 1.015. If children be included, an estimate somewhere about 1.012 will, I believe, be found very near the truth. Densities below 1.012, I should incline to speak of as *low*; densities above 1.020 I should certainly regard as *high*. But it is next to impossible to come to any conclusion on this point. The density of the urine in fact is influenced by so many varying circumstances—temperature, kind of food, quantity of drink, state of the alvine evacuations, &c. that we



are only in a condition to judge of the point in each different individual instance. M. Chossat found the mean density under a vegeto-albuminous regimen in his own person to be 1.012; under an albuminous regimen it was 1.015; under a vegeto-fibrinous and a wholly fibrinous regimen 1.023 and 1.024.

*Solid matters of the urine.*—It is by no means difficult to make an analysis of the urine in regard to the *quality* of its various ingredients; it is very much the reverse when the *quantities* of these ingredients come to be severally considered. The truth of this statement must be apparent when it is known that the analysis of the urine still generally quoted, even by especial writers on the subject, is that of Berzelius, and is as old as the year 1809. The only somewhat recent attempt to go over this ground again with which I am acquainted, is that of Du Menil.\* As a term of comparison Dr. Christison† has given a qualitative analysis of the urine of a healthy individual, of specific gravity 1.029, which was voided to the extent of about thirty-five ounces daily. Of this urine the solid contents amounted to 67.7 per 1000. Of these 55.2 were urea, extractive matters, and animalized acetates, soluble in alcohol; 11.1 alkaline muriates, sulphates and phosphates; 1.0 earthy phosphates, and 0.4 mucus.‡

\* Journal de Physiologie de Magendie.

† Edinb. Med. and Surg. Journal, vol. xxxii.

‡ This must be regarded as the analysis of a specimen of urine of unusually high specific gravity; the quantity of the matters soluble in alcohol being in particular considerably above the average. Thirty-five ounces, or 16800 grains of such urine would contain about 1120 grains, or two ounces, two drams, and two scruples of solid matter. Now, if we assume thirteen grains



The matters discovered in the urine by Berzelius, and their quantities, are as under:—

Urea	-	-	-	-	30.10
Uric or lithic acid	-	-	-	-	1.00
Free lactic acid	-	-	-	}	17.14
Lactate of ammonia	-	-	-		
Extractive matter soluble in alcohol	-	-	-		
Extractive matter soluble in water	-	-	-		
Mucus of the bladder	-	-	-	-	0.32
Sulphate of potash	-	-	-	-	3.70
Sulphate of soda	-	-	-	-	3.16
Phosphate of soda	-	-	-	-	2.94
Phosphate of ammonia	-	-	-	-	1.65
Phosphate of lime and magnesia	-	-	-	-	1.00
Chloride of sodium	-	-	-	-	4.45
Hydrochlorate of ammonia	-	-	-	-	1.50
Silica, or silicic acid	0.03.	water	-	-	933.00

of solid urinous excrement as the produce of each ounce of mixed vegetable and animal food, which is not far from the truth, this would imply the consumption of above eighty ounces of solid aliment in the course of the twenty-four hours, which is two, three, and even four times more than is generally taken. Both Berzelius and Dr. Christison must, I imagine, have selected for examination a portion of the urine which is voided from five to six hours after the assumption of a hearty meal of mixed vegetable and animal food, when its specific gravity is at the highest, and it has all its distinguishing characters in greatest perfection. I have found such differences in the relative quantities of the matters soluble in alcohol and in water, that I believe it to be no more possible to fix on any absolute standard, in regard to the ratio of the animal matters to the salts, in the urine, than to fix on any term as a measure of its specific gravity. This must be apparent when it is seen that in Dr. Christison's analysis, the animal matters are to the salts nearly in the proportion of five to one; in Berzelius's they stand to each other nearly in that of three to one; whilst Dr. Bostock has, if I remember rightly, estimated them as existing in the ratio of about five to four. The result depends greatly on the strength of the alcohol employed.



*Urea*.—The discovery of this, the chief and most remarkable constituent of the urine, is generally ascribed to Rouelle, who certainly described a mass under the title of *Saponaceous Extract of Urine*, of which urea must have been a principal ingredient. This extract, however, was a very impure urea. Nevertheless, Rouelle was acquainted with several of the properties of this substance, particularly its capacity of being resolved into carbonate of ammonia by dry distillation. The honour of the discovery of urea *per se* more properly belongs to Cruickshank,\* who examined its properties particularly, and first informed us of its power to combine with acids, especially the nitric acid, and with them to form saline compounds.

Urea, when pure, is in the form of delicate, silvery, acicular crystals, colourless, scentless, and having a cool nitre-like taste, mixed with something of pungency. In dry air it undergoes no change by keeping. In moist air it attracts humidity, and melts into a syrupy fluid, but is not decomposed. It is soluble in less than its own weight of water at 60°F., and in all proportions in boiling water. Alcohol, of 0.816 density, takes up a fifth of its weight of urea at 60° F., and its own weight at the boiling temperature. Urea shows neither acid nor alkaline reaction, and its specific gravity is 1.32. At 248° F. pure urea melts, but is not decomposed; if the temperature be raised a little, however, it begins to boil, and is resolved into carbonate of ammonia, which sublimes, and cyanic acid, which remains behind,

\* Appendix to Rollo on Diabetes, 1797.



if the heat be carefully regulated. If the heat be suffered to rise, the cyanic acid is also decomposed, hydrocyanic acid being evolved, which passing over and combining with a portion of the carbonate of ammonia, engenders a quantity of urea again.

The elementary composition of urea is as follows:

Nitrogen	-	-	33.37
Carbon	-	-	19.97
Hydrogen	-	-	6.65
Oxygen	-	-	26.65

That is, it consists of 4 proportions of nitrogen, 2 of carbon, 4 of hydrogen, and 2 of oxygen, as is expressed in the annexed formula of this substance,— $N^4 C^2 H^4 O^2$ . One of the most interesting discoveries of modern chemistry, is the fact that this nitrogenous animal product may be formed artificially. When a quantity of cyanate of silver is treated with a solution of hydrochlorate of ammonia in water, a double decomposition takes place; chloride of silver, which is perfectly insoluble, falls to the bottom, a quantity of cyanate of ammonia remains in solution; this is readily obtained in the solid crystalline form by careful evaporation, and in elementary composition agrees exactly with the urea obtained from urine.

*Uric, or lithic acid.*—This is the second peculiarly nitrogenous matter, or rather *form* of nitrogenous matter, characteristic of the urine. For its discovery we are indebted to Scheele, who gave it the name of *lithic acid*, from having found it as a constituent



of urinary calculi. Uric acid is not so invariable a constituent of the urine of the higher classes of animals as urea. Coindet of Geneva even went the length of regarding it as the product of a morbid state of the urinary secretion in the human subject. The urine of healthy men, however, would really seem to contain a very small quantity of lithic acid. The quantity increases immensely in certain disturbed states of the system. The urine of some of the lower tribes of animals, birds and serpents in particular, contains a very large quantity of this acid, and very little if any urea. The immense beds of the excrement of sea-fowl, called Huano, that cover the surface of certain rocky islets in the Southern ocean, and are carried off to the main land of America as manure, consist almost entirely of lithate of ammonia. The excrements of the boa constrictor and other serpents are principally composed of lithate and super-lithate of ammonia.

When pure lithic or uric acid appears in the form of shining white slippery plates, without taste or smell, reddening moistened litmus paper feebly, all but insoluble in cold, (10,000 parts of water at 60° F. will not take up one of lithic acid,) and little less so in boiling water; insoluble in alcohol and ether. Subjected to dry distillation, it suffers decomposition; a large volume of hydrocyanic acid and some carbonate of ammonia being evolved, and a quantity of urea appearing, formed apparently by the combination of a portion of the hydrocyanic acid with some of the carbonate of ammonia which had been produced. A carbonaceous matter remains in



the matrass. Uric acid in its elementary composition consists of

Nitrogen	-	-	33.37
Carbon	-	-	36.00
Hydrogen	-	-	2.36
Oxygen	-	-	28.27

That is of 4 proportions of nitrogen, 5 of carbon, 4 of hydrogen, and 3 of oxygen, a constitution which is thus expressed in the shape of a formula,  $N^4 C^5 H^4 O^3$ .

When the very sparing solubility of lithic acid is considered, it becomes an interesting point to determine how or by what means the quantity of this substance which urine often contains, is held dissolved. I have entered so fully into the matter in the Chapter on Lithic states of the Urine, that I but allude to it here. There is one circumstance, which may probably influence the solution of this substance, which has received less attention than it deserves; and which I now find I have myself overlooked in the proper place; it is this: that the combination between the lithic acid and the water must take place at the *moment of nascence*. It is familiarly known that several chemical combinations can only be effected by presenting the combining elements to one another in the nascent state. When the urine contains any lithic acid dissolved, the deposit of this substance from the menstruum is a mere question of time; sooner or later it always happens. The recent researches of Leibig and Woehler have rendered it probable that lithic acid is a compound of urea and



a substance itself composed of cyanogen and carbonic oxide, a substance, which, by the action of certain reagents, (superoxide of lead,) and probably also by the deranged operation of the kidney, is converted into oxalic acid, and the peculiar matter found in the allantois of the calf, allantoin. \*

*Lactic acid and lactate of ammonia.*—Lactic acid would appear to be one of the products of the peculiar spontaneous decomposition that goes on incessantly among the matters composing the bodies of animals. It is indeed a product of the spontaneous decomposition of a considerable variety of organic substances, vegetable as well as animal. Berzelius found it in large quantity in the muscles, from whence, as it appears in the urine; he supposes it to be principally derived. Lactic acid is probably a necessary constituent of the urine, one of the effete matters which it is the business of the kidney to separate from the general circulating mass, and to reject from the system. The free acid of the urine is held by Berzelius to be the lactic. Dr. Thos. Thomson, however, says that he had in vain endeavoured to ascertain the presence either of the lactic acid or lactate of ammonia in the urine.† The lactic has sometimes been confounded with the acetic acid, which some distinguished chemists have admitted among the constituents of the urine.

*Extractive matters soluble in alcohol and in water.* The urine of all animals possesses colour of greater or less intensity, generally a shade of greenish or

\* Vide Poggendorff's Annalen, B. 41. p. 561.

† Art. Calculus, Cyclop. of Practical Medicine.



brownish yellow, and a peculiar odour. These qualities it owes to the presence of a peculiar matter, which does not appear hitherto to have been so particularly studied as the part it probably plays among the elements of the urine might be held to require. The disposition of the urine to undergo spontaneous decomposition would seem to depend on the presence of this odorous and colouring principle—this *urodmechrome*, as it might be called. The capacity of the urinous menstruum to hold its lithic acid dissolved seems also to be increased materially by the agency of this peculiar matter.

*Mucus*.—This is a purely accidental addition to the urine, and is derived from the lining membrane of the canals and cyst with which the fluid is in constant contact between the moment of its formation and that of its discharge.

*Sulphates, Phosphates, Chlorides, &c.*—The salts with inorganic acids and bases, must be mostly held as accidental, though they are very regular constituents of the urine. The elements of all of them are regularly introduced with the food; some of them are even essential constituents of the body, such as the phosphate of lime, and this, like every thing else that enters into its composition, requires to be perpetually renewed. Sulphur is an element of two in particular among the grand constituents of animal bodies, namely, the albumen and the fibrine; phosphorus is another, and probably a more uniformly diffused element. These simple substances in the process of their separation by the kidney seem to be combined with oxygen, and to make their appearance as acids. The alkaline sulphurets ad-



ministered by the mouth, certainly make their appearance in the urine in the state of sulphates. The *bases*, soda, potash, lime, magnesia, and ammonia, are all, save the last, introduced from without. The ammonia is probably a product, either of the chemistry of the system generally, or of the kidney in particular.

*Carbonic Acid*.—This is a very constant element of the urine, which is not particularized by Berzelius. Among the lower animals it occurs familiarly combined with lime. In man it would also seem to aid essentially in holding the earthy phosphatic salts in solution. Some have doubted whether the carbonic acid were actually a constituent of the urine or not, and have referred to Woehler's experiments as decisive against this point. I do not read Woehler's account of his inquiries in this way; he merely states that he did not detect carbonic acid in larger quantity in the urine of one who was taking water charged with carbonic acid, than in the urine of one who was not using any drink of the kind. I have found carbonic acid in urine generally; particularly in that which was highly acid and contained lithic acid in considerable quantity.

*Silica* is a purely accidental ingredient in the urine, and is probably introduced with the water used as drink.

The constituents of the urine under deranged states of the system, form part of the proper subject of the following treatise. The first important step towards a right understanding of these morbid principles of the urine, was made by Scheele in the



year 1776, in his discovery of lithic acid as a constituent of urinary calculi. In 1797, Dr. Wollaston published his paper "On Gouty and Urinary Concretions," in which he made us acquainted with the true nature of the *Chalk stones* of gouty subjects, and the elementary composition of three new species of urinary calculi, namely, the calculus of the *mixed phosphates of ammonia, magnesia, and lime*, of that of the *oxalate of lime*, and of that of the *phosphate of lime*. In this year also were published Mr. Cruickshank's observations on the urine in various diseases, as an appendix to the second edition of Dr. Rollo's work on Diabetes. These observations of Mr. Cruickshank appear to have attracted a good deal of attention over Europe; I find them noticed or translated in most of the Continental periodicals of the time. In 1799, Fourcroy and Vauquelin published their paper on urinary calculi, going over the ground already trodden by Scheele and Wollaston, but only adding a knowledge of one new calculus, that, namely, of the *urate of ammonia*, to those previously described. In 1810, we again find Dr. Wollaston in the field, he having in this year discovered and described a calculus of a peculiar substance, capable of combining equally with alkalis and acids, which he named *cystic oxide*. In his "Essay," published in the year 1817, Dr. Marcet described two new calculi, the *xanthic oxide* calculus, and the *fibrinous* calculus. Although boasting of no new discovery, the year 1821 is remarkable for the publication of Dr. Prout's work, entitled, "An Inquiry into the Nature and Treatment of Diabetes, Calculus," &c. (2nd Ed. 1825.) In Dr. Prout,



the whole subject of urinary calculi, and the states of the urine connected with their formation, as well as various other interesting particulars, may be said to have met with a master. The name of Dr. Bostock also requires particular and honourable mention in this place. His contributions to the *Chemistry of the urine* in various pathological states of the system, stand almost alone in the annals of European medical literature, during a long series of years. He is the proper and immediate successor of Mr. Cruickshank in this field of inquiry; and I cannot but see that his labours preserved in a great measure the entire subject of urinary pathology from the unmerited oblivion into which it had fallen; they certainly assisted in an eminent degree in fostering this into the fair and very questionable shape it has now assumed. The analyses of the urine and other fluids, which form part of Dr. Bright's important work, entitled, "Reports of Cases, &c." are all by Dr. Bostock, who has the honour of having been the first to discover urea as a constituent of the blood in cases of diseased kidney. He speaks of it as "an animal matter, possessing peculiar properties, being partially soluble in alcohol and acted on by nitric acid in the same manner as urea."\* The caution of the philosopher alone prevented him from calling this matter "possessing peculiar properties, &c.," by its proper name. That it was urea has been amply confirmed by Dr. Christison,† who found it in considerable quantity

\* Reports, &c. vol. i. p. 84.

† Edinb. Med. and Surg. Jour. vol. xxxii. p. 285.



in the blood of several patients labouring under dropsy, with albuminous urine.

In noting the characters and qualities of the urine in disease, it were of great consequence to the progress of accurate information on the subject, that something like uniformity of plan were followed by observers generally. Dr. Bostock\* has proposed a plan or formula for this purpose, which seems to comprise almost everything that can be desired. With some slight modifications and additions, this formula includes,—1. The designation of the circumstances under, and the time at which, the specimen of urine considered was voided; 2. Its quantity, and the quantity voided during the preceding twenty-four hours; 3. Its external characters,—colour, odour, transparency, or turbidity; 4. Its specific gravity, and the average specific gravity of the whole of the urine discharged during the previous twenty-four hours; 5. Its state in regard to acidity, neutrality, or alkalescence; 6. The amount of solid contents per cent.; the respective quantities of the extract soluble in strong alcohol, and in water being distinguished; 7. The effects of heat, of nitric acid, before and after the application of heat, of corrosive sublimate, and ferrocyanate of potash; 8. The amount of precipitate thrown down by ammonia, and by oxalate of ammonia; 9. The nature of the deposits, when any; 10. The nature of the spontaneous changes undergone within twelve hours, and of those that take place in the course of two or three days.

\* Royal Med. and Chirurg. Society's Trans. vol. iii. 1838.



THE following Table constructed by Dr. Henry, of the quantity of solid extract contained in the pint (16 oz.) of urine of different specific gravities from 1.020 to 1.050, is frequently useful in enabling us without the trouble of evaporation, to determine the amount of solid excrement discharged with the urine, from the quantity combined with the specific gravity of the fluid, and is therefore added in this place.

Specific Gravity at 60° F.	Solid Extract in a Wine Pint in grs.	Solid Extract in Wine Pint in oz.			
		oz.	dr.	scr.	grs.
1.020	382.4	0	6	1	2
1.021	401.6	0	6	2	1
1.022	420.8	0	7	0	0
1.023	440.0	0	7	1	0
1.024	459.2	0	7	1	19
1.025	478.4	0	7	2	18
1.026	497.6	1	0	0	17
1.027	516.8	1	0	1	16
1.028	536.0	1	0	2	16
1.029	555.2	1	1	0	15
1.030	574.4	1	1	1	14
1.031	593.6	1	1	2	13
1.032	612.8	1	2	0	12
1.033	632.0	1	2	1	12
1.034	651.2	1	2	2	11
1.035	670.4	1	3	0	10
1.036	689.6	1	3	1	9
1.037	708.8	1	3	2	8
1.038	728.0	1	4	0	8
1.039	747.2	1	4	1	7
1.040	766.4	1	4	2	6
1.041	785.6	1	5	0	5
1.042	804.8	1	5	1	4
1.043	824.0	1	5	2	3
1.044	843.2	1	6	0	3
1.045	862.4	1	6	1	2
1.046	881.6	1	6	2	1
1.047	900.8	1	7	0	0
1.048	920.0	1	7	1	0
1.049	939.2	1	7	1	19
1.050	958.4	1	7	2	18



The method of using this table is abundantly simple. Supposing a patient is passing twelve pints of urine of specific gravity 1.033 in the course of the twenty-four hours ; one pint of this urine is seen from the second column to contain 632 grains of solid extract. Twelve times 632 are 7,584, which reduced into ounces, drams, and scruples, by dividing by 480, 60, and 20, make 15 ounces, 6 drams, 1 scruple, and 4 grains, or nearly 1 pound and a third of solid extract every day.





## PART FIRST.

### FUNCTIONAL DERANGEMENTS OF THE KIDNEYS, AND THEIR IMMEDIATE CONSEQUENCES.

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#### CHAPTER I.

MORBID STATES IN WHICH THE SECRETING FACULTY OF THE KIDNEYS IS EXALTED, AND THE MENSTRUUM AND READILY SOLUBLE PRINCIPLES OF HEALTHY URINE OCCUR IN ALTERED ABSOLUTE OR RELATIVE QUANTITY.

SECTION 1.—*Of the discharge of Urine which is characterized by deficiency of solid matters generally,—*  
HYDRURIA.

THE kidneys, as one of the two principal sluices by which superabundant fluid is discharged from the body, are frequently called upon for an extraordinary display of their office, which, under healthy conditions of the system, they answer in a manner that is truly wonderful. Indulgence in large quantities of watery fluid, unless the skin be in a state of singular activity, is necessarily followed by a corresponding, or something like a corresponding, discharge of urine. The persons who drink their eight, ten, or twelve half-pint tumblers of mineral water every morning, necessarily and certainly void nearly as many half pints of urine in the course of the



day. A *diuresis*, or flow of urine of this kind, cannot of course be looked upon as a disease; on the contrary, it is the salvation of the drinker: the secretion is beneficent; it is secondary and subservient to the wants of the system, and the urine contains all its distinguishing ingredients, but diluted with a large proportion of water.

Sometimes, however, we meet with instances of diuresis in which an increased disposition to secrete on the part of the kidney has the lead, as it were, in the phenomenon—in which the kidney is not at work to drain the system, but the system is at work to supply the kidney. This state of things was observed and remarked upon very long ago, and it is to be found described in books under several names, such as *Diuresis*, *Diabetes insipidus*, *Polyuresis*, and *Polydipsia*, from the thirst that attends it, &c. Among the many remarkable histories of this malady which I have met with in the course of my reading, is that of a small artizan, aged fifty-five, who came into the Hôtel-Dieu of Paris to be treated for a bruise of his knee, from which he speedily recovered. The uncommon thirst of this man, and the incessant calls he had to make water, attracted attention, and it was found that from the age of five years he had had a constant thirst upon him, and been affected with a diuresis commensurate with his thirst. From the age of sixteen he had not drunk less on an average than two bucketfuls of water daily. During the ten days he remained in the Hôtel-Dieu, he consumed on an average thirty-three pounds of water every day, often swallowing two litres (above two quarts) at a draught; his solid



food was about one pound and three-quarters, and he seems also to have had a little wine. His evacuations daily were about thirty-four pounds of urine, and, at the most, one pound of feces. Yet this man looked and seemed well; he possessed the ordinary strength of a little man of fifty-five; he was the father of several children, and suffered no inconvenience save from the necessity of drinking, and voiding his urine so frequently. The urine scarcely exceeded pure water in specific gravity. Reduced by evaporation and having yeast added, it gave no sign of fermentation. The urine was certainly quite healthy, only very much diluted.\* Several interesting cases of the same kind were collected by Dr. S. F. Simmons.† A woman aged 40, and the mother of many children, had suffered from continual thirst and the discharge of a profusion of fetid urine since the time she was a child. Compelled to quit her father's house on account of the quarrelling to which her large consumption of water gave rise, she came to Paris and entered into service. Here the increased quantity of water that was used in the family attracted attention, and it was found that the servant girl was in the habit of drinking two or three pailfuls of the pure element every day. A shoemaker having paid his addresses to her, she contrived to conceal her infirmity from him till after the marriage, when of course he discovered the real worth of his bargain, and found that all his earnings were not sufficient, in the depth of winter, to buy his wife

\* Case reported by M. Boissat, in the *Recueil period. de Sedillot*, tom. lxxx. p. 164.

† *Med. Facts and Observations*, vol. ii. p. 73.



water, so that he had to collect and melt snow and ice from the house-tops for her use. This woman enjoyed very good general health. Dr. Desgranges\* has given several cases of the same kind. One man at the age of thirty-two had been affected with diuresis and thirst from the age of four years, and had at one time been in the habit of drinking eighteen bottles of water daily. Another young man, until he had a pleurisy at the age of eighteen or nineteen, had been the subject of a similar infirmity; but a blister applied to the chest for the inflammation having continued to suppurate for the space of twenty-five days, he had found himself cured of his extraordinary thirst and diuresis. The same writer quotes a case from an American Journal in which a young man aged twenty, stout, active, and in the enjoyment of good health, was in the habit of consuming six gallons, or forty-eight pints, of water, and passing a commensurate quantity of urine every day.

The copious discharge of limpid watery urine on the conclusion of the hysterical paroxysm, and even the occasional diuresis under which subjects of nervous and excitable temperaments labour, are also to be referred to this head of hyperuresis, or hydruria. The qualities of the urine in hysteria appear to vary considerably. Mr. Cruikshank† found it to abound in saline, but to contain hardly any extractive matter, (urea and colouring matter.) Nysten,‡ again, detected a considerable quantity of urea, but little

\* Ann. de Montpellier, tom. vi. p. 156.

† Rollo on Diabetes, 2nd ed.; and Tilloch's Phil. Mag. vol. ii.

‡ Rech. de Phys. et de Chimie Pathol. 8vo. Paris, 1811.



of the peculiar oily extractive matter; the lithic acid and salts he reports as in health. The case in which Peschier\* analysed the urine, generally quoted as one of hysteria, certainly belongs to another category. This urine was poor in urea, and contained much chloride of potassium. My own experiments would lead me to infer, that in hysterical urine, generally speaking, the characteristic ingredients were not essentially altered in their quality or relative proportions, although they are in very small amount, when their ratio to the menstruum is considered. I have always been able to detect urea; and if any salt has appeared to me more abundant than another, it has been the chloride of sodium. When the urine can scarcely be discovered to differ from spring water, by the areometer, the presence of common salt is still often to be detected by the taste, and I have never seen a solution of the nitrate of silver fail to produce considerable turbidity in hysterical urine even of the lowest specific gravity; but its distinguishing ingredients are always in such small proportion, that its specific gravity is not more than from one to two or three in the thousand higher than pure water.

The urine voided by many nervous subjects in such profusion in the earlier part of the day is of the same general description as in hysteria. I have sometimes found its specific gravity as low as 1.002; but by careful treatment these two parts were ascertained to consist of urea and the earthy and alkaline salts nearly in the proportions in which they exist in health. The kidney is not peculiarly affected in

\* Journ. de Chimie Med. tom. ii. p. 234.



these cases, and it was not to be expected that its secretion would be materially altered. This organ but participates in the excitability or irritability of the system at large, abundant evidence of which we have in the hurried pulse, more rapid breathing, higher mobility of the muscular system, increased susceptibility to impressions, impatience of the bladder of the slightest distension, &c. In the afternoon this nervous state subsides; at the principal meal of the day the body is fortified by nourishing food, and probably some wine; the general irritability abates; the kidneys and bladder become quiescent, and the same individual who was tormented all the morning with a call every half hour to relieve his bladder of not more than three or four ounces of urine at a time, will now sit for five or six hours without the slightest inconvenience, and then void ten or twelve ounces of fluid at once. If the urine now passed be examined, it will often be discovered, although mostly pale-coloured, to be of unusually high specific gravity: I have found it as high as 1.033 at 60° Fahrenheit, and containing such an abundance of urea that it yielded a plentiful crop of crystals of nitrate of urea without any preliminary concentration. On standing, this urine almost always deposits the phosphatic salts; in from twelve to twenty-four hours it becomes covered on the surface with an iridescent pellicle; and by and by its reaction is alkaline, although when voided it was acid.

Of the same character is the diuresis under which men as they advance in years are known occasionally to labour. “*Urinæ cupiditas præter consue-*



tudinem jure habetur inter morbos senectutis," says Heberden.\* This is a point which has not received the attention it deserves from more recent observers. Nevertheless it is a very common occurrence in declining years. The frequent calls to empty the bladder experienced at this time of life are indeed familiarly enough known; but the frequent micturition as connected with an augmented flow of urine has too generally been overlooked; the circumstance having still been ascribed to irritability of the bladder, and remedial measures directed against this mere consequence of a morbid state instead of being pointed at the morbid state itself. I have met with several instances of this kind of hydruresis. To illustrate the features of the affection, I shall mention one in particular, the subject of which died at the age of seventy-two.

The diuresis under which the gentleman alluded to laboured at the time of his death, had existed for many years, during the three or four last of which he was accustomed to pass regularly between six and eight pints, and often as many as ten and twelve pints of urine in the course of the twenty-four hours. He had always three or four, and sometimes more, calls to make water in the course of the night. The urine was at all times very pale in colour, and quite transparent when passed; nor did it almost ever become turbid in cooling. It had little odour, but what it possessed was of the proper urinous character. It reddened litmus paper even some time after it had been passed. Its specific gravity varied from 1.006 to 1.012. The solid were, therefore, in very

\* Commentarii, cap. De Urina.



small proportion to the liquid parts; but they were of the usual kind, being made up in nearly equal proportions of urea and extractive matter soluble in alcohol, and of the ordinary earthy and alkaline salts, among which the phosphates greatly predominated. This urine concentrated, and set aside with yeast showed no symptom of fermentation, and therefore contained no sugar.

The most remarkable constitutional symptoms observed were languor and disinclination to take exercise, for there was not much actual debility. The appetite was not increased at any time; for the last two years of the gentleman's life it was decidedly impaired. Besides the usual diluents at meal-times, of which he partook freely, this gentleman had always a large carafe of water on his table, which he emptied and had replenished once and again in the course of the day. There was little emaciation even at the last, and, save the listlessness and languor mentioned, no bodily illness; but the temper was affected, and there was a good deal of perverse peevishness and discontent both with the world at large and with more immediate relatives and friends; the intellectual faculties were never implicated; they only ceased their energetic and harmonious manifestations when the spirit that actuated them had fled.

There can be no doubt but that such a state of things must hasten the natural decay of the body. The rest broken every hour to satisfy a call to void the bladder were alone sufficient to influence the health most prejudicially. The diuresis of men somewhat advanced beyond the middle period of life is, there-



fore, a symptom which ought not to be neglected. The disease may indeed go on for years, in some cases, without apparently affecting the general health, ; but it always tells on the system in the long run ; and the prognosis, though it may not be immediately, is never otherwise than remotely, unfavourable.

In the present state of pathological knowledge it is impossible to say upon what peculiar morbid condition of the system generally, or of the kidney particularly, the elaboration of a large quantity of watery urine depends. I have no hesitation in saying, however, that it is intimately connected with the nervous temperament. All who have suffered from it, within the sphere of my knowledge, have been men of mind, possessed of keen sensibilities, and highly impressible nervous systems.

With regard to the *treatment* of this hydruresis, under whatever circumstances it occurs, the indications are general in so far as the correction of aught amiss in the constitution at large is regarded, particular as they bear upon the preternatural activity of the kidney. Disturbance, it is certain, never occurs in the functions of any one organ of the body without the system generally feeling the effects of this in a greater or less degree. As the first and great means we possess of controlling morbid action, the functions of the stomach and alimentary canal are to be carefully attended to. The diet must be nicely regulated, in order that all the food taken may be properly digested and assimilated : and no more fluid should be allowed than is imperatively required to allay feverish sensations of thirst. The



greater the quantity of fluid consumed, the more are the kidneys required to free the circulating mass from superfluous water ; and organs kept in a state of constant excitement often end by acquiring a habit of acting in excess. Let the kidneys, therefore, have no more work put upon them than under ordinary circumstances they would find no difficulty in performing. As a powerful means of lightening the labour of the kidney, the due performance of the cutaneous function must be secured. In almost every form of diuresis that occurs, the skin is known to be in a withered and unperspiring state. This must be remedied by the use of the warm bath and flesh brush, the bath being taken every day or every other day, the brush diligently employed night and morning ; and further, by adopting warmer clothing than it is the fashion in this country even for the aged to wear.

With regard to medicines, these must be for the most part selected from the class of anodynes and tonics ; as much of some mild aperient, too, as will secure the due action of the bowels, is indispensable. Probably there is no better compound under circumstances of the kind we have in view than a mixture of rhubarb and aloes, in combination with extract of hyoscyamus, which will be found to accomplish more than one of our indications. Mercurials seldom do good in an irritable state of the system like that which accompanies great discharges of watery urine. Their use, even in the way of alteratives, can be very well dispensed with. Narcotics, and of these the chief, opium, are often of signal service in allaying the irritable condition that



is proclaimed by hydruresis. To the youthful we prescribe these remedies with reserve; but among the aged we can use them freely. In the case of the old gentleman I have detailed, tincture of opium, even in small doses, had always the effect of lessening the flow of urine, in abating the thirst, in procuring quiet nights, and in increasing the strength; but being a dabbler in physic himself, he never could be prevailed upon to push the medicine far enough to give a decided check to the disease, which I believe might almost at any time have been done, and his life thereby prolonged.

Of tonics, the infusions of bark, gentian, and quassia, in conjunction with the carbonate of iron, will be found the best suited to these cases, and may always be prescribed with an assurance of proving beneficial.

SECTION 2.—*Of the discharge of Urine which is characterized by a deficiency of Urea*,—ANAZOTURIA.

A COPIOUS discharge of urine characterized not merely by a relative but by an absolute deficiency of urea, the peculiarly azotic principle of this fluid, although by no means an uncommon occurrence, has either been overlooked or altogether denied by pathological writers. It is, however, one of the many forms of disordered renal function which has been spoken of under the title of *Diabetes*, or *Diabetes insipidus*. Almost all the cases of *diabetes* reported as cured, I believe to have belonged to this head. The urine is passed in great abundance; it is limpid, of a very pale straw-colour, or altogether colourless,



and has a very slight, faint odour. When first voided, it shows weak acid reaction or is neutral; it rarely precipitates within twenty-four hours, but cannot be kept for any length of time without undergoing change; it becomes faintly ammoniacal, and covered with a fine creamy pellicle on its surface, which shows the minute pearly-white crystals of the ammonia magnesian phosphate.

This form of morbid urine I have reason to believe occurs even frequently among the indifferently tended children of the poor. I have at this moment three children under my care at the Royal Infirmary for Children, affected with urinary diseases, two of whom present the form of malady to which I have ventured to apply the title of *Anazoturia*. The one of these children is a boy three years and a half old, and has been weakly from his birth. His extremities are emaciated, but he has a large, soft, protuberant belly. He is spiritless, and disinclined to move and play about. His appetite is voracious, and his thirst incessant. The poor little fellow will drink nearly a pint of water at a time if allowed, and is not satisfied with less than about four pints in the course of the day and night. He makes water in considerably greater quantity; which was to have been expected; for he has a constant craving for food, and cries until he is indulged with every thing he sees—meat, bread, potatoes, cabbage, and raw lettuce. The bowels are constipated, and the feces present pieces of undigested aliment, particularly potatoe, carrot, &c. The urine first brought to me by the mother was so free from every one of the sensible properties of urine, that I insisted it must be the rinsings of



the bottle, returned into it by mistake; but I soon satisfied myself that I had the veritable urine of the child, by getting him to make water before me. This urine did not differ in appearance from common water; it was quite limpid, absolutely colourless, all but free from odour, and neutral when passed. It became in the slightest possible degree opalescent or milky after standing ten or twelve hours. In specific gravity it corresponded as nearly as possible with distilled water; at first I even thought it lighter, but this was from trying it with a new hydrometer, the scale of which I immediately discovered to be set about a degree too low. Brought to the boiling point it let fall no precipitate, a few bubbles of air (probably carbonic acid gas) being disengaged. No effect followed the addition of a solution of oxalic acid. Caustic potash caused the subsidence of a few flocculi; 1000 grains evaporated slowly left but a fraction of a grain of residue, which appeared to consist entirely of mucus, lithate of ammonia, and the phosphatic salts; but it must also have contained a small quantity of urea and colouring matter; for the urine kept during two days in a temperature of about 65° Fahrenheit, became very faintly ammoniacal. The quantity of residue I had to deal with was too small to enable me to speak with greater detail.

To the head of anazoturia I refer cases of the following description. A man forty-one years of age had laboured under a preternatural discharge of urine, accompanied with thirst, gnawing at the pit of the stomach, depressing sensations of languor, &c. for a period of twelve years; the average quantity



of urine passed at the time he was first seen amounted to between six and seven quarts, but had been larger. This urine was of a pale straw colour, somewhat opaque, and nearly without smell. It contained but about one-fiftieth (instead of one-thirtieth) part of its weight of residue, only one-tenth (instead of one-half) of which consisted of urea, the phosphatic salts especially being in the same proportion redundant. \* In a case related by Dr. Stosch, † where the symptoms were thirst, gnawing pain at the pit of the stomach, emaciation and weakness, the urine passed in the course of the day amounted to from four to six quarts. It contained no sugar, but hardly showed a trace of urea, or indeed of any of the ordinary constituents of the urine. This patient recovered and relapsed, but finally recovered completely under the use of the liquid laudanum of Sydenham and an infusion of quassia and rhubarb. M. Peschier's case, already referred to, (page 5,) was also one of anazoturia. The patient, aged 26, had long laboured under an irritation of the stomach and bowels, and was in the habit of voiding on an average from ten to twelve pounds of urine daily. This urine was of a very pale citrine colour, had little smell, and reddened turnsole paper. It was chiefly remarkable from containing a very small quantity of altered urea, a little albumen, and less chloride of sodium, but far more chloride of potassium than usual. ‡ Ninety

\* Bostock, in *Mems. of Med. Society of London*, vol. vi.

† *Versuch einer Pathologie u. Therapie d. Diabetes Mellitus*, 8vo. Berl. 1828.

‡ It is very possible that the salt which was here taken for



ounces of this urine yielded but 1095 grains of solid residue. The same quantity of healthy urine of average specific gravity would have given upwards of 3000 grains. Mr. Macgregor's \* cases of *diabetes insipidus*, I presume, were of the same kind. The complaint had gone on for years, attended with excessive thirst, weakness, and emaciation. The quantity of urine passed daily was large; its specific gravity was under 1.003. The whole quantity voided daily was calculated to contain, in the one case 310 and in the other 400 grains of urea; the average quantity of this substance voided by a person in health being 428 grains. The exhibition of opium in these cases lessened the thirst, and brought the specific gravity of the urine up to 1.012. But the symptoms recurred on the medicine being left off. One at least, if not both of the cases recorded by that excellent practical and very learned physician, Dr. Graves of Dublin, † are also, I believe, instances of the anazoturia. They both occurred in labouring men twenty-five and twenty-eight years of age, of intemperate habits. There was much thirst, and gnawing pain at the pit of the stomach, great loss of strength, depression of spirits, anaphrodisia, &c. In the one the urine amounted to eleven pounds, specific gravity 1.008; and in the other to from twelve to fourteen pints, specific gravity 1.004,

chloride of potassium may have been chloride of ammonium, the presence of urea causing the latter substance to crystallize in cubes, and the salts of ammonia reacting in the same manner as those of potash on the solution of platinum, which was the test employed to discriminate between the vegetable and mineral alkali by M. Peschier.

\* Lond. Med. Gazette, vol. xx. p. 224.

† Dublin Journal, vol. vi. p. 72.



in the twenty-four hours. It was limpid, and of a pale straw-colour in each; and in the one did not contain more than from two to three parts in the hundred of solid residue. It was not sweet in either, and not albuminous. In the second it was deficient in the lithates, redundant in the phosphates, and the urea is reported as natural, which made me hesitate about placing the case here; nevertheless, as the characters of the disease were those precisely of the malady generally, I have let it stand. Both of these patients improved greatly, and gained weight under the use of the compound powder of ipecacuanha, the vapour bath, and nitric acid. The specific gravity of the urine was brought up to the standard of health in the one, in the other it was still below the proper standard, viz. 1.010; but when these patients left the hospital, they both felt strong and well. The case which presented itself in the Hull Infirmary,\* and in which the quantity of urine passed daily was as many as twenty pints of the specific gravity 1.004, was also probably of the kind we are considering. The patient is reported to have improved under the use of cream of tartar and nitric ether; but probably the animal diet upon which he was put, and the infusion of quassia which he took subsequently, had the largest share in his recovery. The specific gravity of the urine when he left the Infirmary was 1.015.

These cases have many features in common. They were all characterized by thirst, gnawing sensations at the pit of the stomach, white furred tongue, constipated bowels, and a parched state of the skin. There

\* Snowden, in Med. Gazette, April 22, 1837.



was also more or less of emaciation, considerable loss of strength, and generally great depression of spirits in all. The hyperuresis in this class of cases is, therefore, a much more important symptom than in those where it occurs without obvious implication of the functions of nutrition ; there is unquestionably disordered assimilation at work here, and the altered nature of the renal secretion is but one indication of a deeply-seated constitutional malady which deserves our most anxious consideration. Formidable diseases dependent on, or at all events accompanied with, disturbance in the functions of the kidney will, I make no doubt, be one day commonly discovered in a much earlier stage than they have yet been seen, when the state of the urine comes to be inquired into as a matter of course, and is held of as much significance in many instances as that of the tongue or of the pulse. In the cases in which I have seen the disease among children, and I am only familiar with it there, it has always seemed to me to be intimately connected either with the irritation of teething, or a disordered state of the stomach and bowels consequent upon weaning and the use of improper food.

Even with the feeble light we possess to illuminate us in regard to the tendency of the *anazoturia*, we see it as unfavourable. Some of the apparent cures have been only of temporary duration ; others, however, seem to have been permanent. Dr. Stosch met his patient, who by the way was a female, by accident, some months after he had ceased his attendance, looking so fat and well that he hardly knew her.

The treatment must be directed to the restoration



of the functions of the stomach, bowels, and skin ; to the suppression of the habitual excitement under which the kidney labours, and to the confirmation of the strength generally. These indications plainly point to gentle aperients, and to the use of tonic, diaphoretic, and anodyne medicines. Aloes and rhubarb, the infusions of calumbo, gentian, and quassia, and the compound ipecacuanha powder, are the particular medicines that generally agree best in these cases. The diet should be light and nourishing, and made to consist principally of farinaceous articles and animal food. Slops should be avoided. Toast-water slightly acidulated with the muriatic or nitric acid, but taken in no larger quantity than is found indispensably necessary to allay thirst, will make the best drink.

SECTION 3.—*Of the discharge of Urine which is characterized by a superabundance of Urea,—AZOTURIA.*

AN increase in the quantity of the solid matters naturally contained in the urine is known to occur occasionally to every one. Free action of the skin and high living, with wine in moderation, will at any time cause the urine to be secreted of a deeper colour than usual, and with a much larger proportion of its saline and peculiar animal ingredients in solution, than it contains under ordinary circumstances.

A peculiar morbid state of the renal secretion characterized not only by a considerable increase in the quantity of fluid elaborated, but a great



increase in the quantity of urea it holds dissolved, has been observed in some cases to be permanent and habitual. This is another of the morbid states that has been described under the name of *diabetes* or *diabetes insipidus*. In this form of malady the quantity of urine secreted is usually large, the fluid is transparent and commonly light coloured, although it has been seen so dark as to resemble a mixture of porter and water\* it exhales a faint but proper urinous odour, and shows acid reaction with litmus paper; its specific gravity is commonly high, varying at different times of the day between 1.018 and 1.035; the specimens of the highest density yield crystals of nitrate of urea on the addition of nitric acid after a few hours' rest, without the assistance of concentration; the others require a certain though still a small relative amount of concentration before they can be made to furnish crystals of this substance. The density of urine, that might be styled ureous, however, would not appear to be necessarily great. There is, for instance, an "analysis of a specimen of anomalous urine" in the 19th volume of the Medical Gazette, by Mr. Rees, of which the specific gravity was only 1.008; nevertheless, the amount of urea in relation to the other solid ingredients appears to have been large, for of the fifteen grains of solid extract yielded by 1000 grains of this urine, 10.2 grains were urea. The disease here was obviously a variety of the hydruria.

The increase in the quantity of urine poured out by the kidney, is of course accompanied by unusu-

\* Prout, Inquiry, &c. p. 55.



ally frequent calls to relieve the bladder, and these calls have been observed to have this peculiarity about them, that they are singularly urgent when they supervene; a circumstance obviously connected with a generally irritable state of the system, particularly manifested in this instance by a corresponding degree of irritability of the bladder.

The symptoms of constitutional disturbance which accompany the secretion of ureous urine are those that commonly attend upon any excessive drain from the system—loss of strength, feelings of languor, a greater or less degree of emaciation, &c. The emaciation and debility, however, do not usually show themselves in a very marked degree, at least in the earlier stages of this disease. Some degree of thirst is very constantly present, and there is often a sense of sinking, and complaints of an uneasy gnawing pain at the pit of the stomach. Patients labouring under it have been observed to have a kind of hollow-eyed anxiety of expression; \* a cast of countenance which I believe to be common to most of the diseases characterized by a too copious secretion of urine variously altered in its qualities. They are generally men of spare habit, and I have always seen them men of nervous temperament, who from their youths upwards had been more or less troubled with unusually frequent calls to make water. Men who had lived freely in former years, who had been in the habit at one time of indulging in spirits, wine, and other fermented liquors, and especially men who had abused their sexual propensity, have been observed to be the usual subjects of the form of com-

\* Prout, l. c. p. 53.



plaint we are considering. Excesses in youth have very truly been characterized as drafts at a long date upon bodily comfort and chance of life. Nevertheless, temperance and the utmost steadiness of conduct give no immunity from attacks of azoturia. I had lately under my charge an artisan, thirty-seven years of age, one of the most temperate and properly conducted men alive, who was reduced to extremity through illness brought on by exposure to cold, the most striking feature of which was the voidance of large quantities of a clear, pale-coloured urine, as many as five quarts having sometimes been passed in the course of the day. The quantity was less when he came to consult me, but it was still considerably more than proper, about five pints being voided in the twenty-four hours. Three specimens of this urine, voided the last thing at night, during the night, and the first thing in the morning, were of the following densities, 1.028, 1.024, and 1.022. They all showed acid re-action, were of a very pale straw colour, and had a faint urinous smell. None of them let fall any deposit except a little mucus, after standing twenty-four hours. A few drops of nitric acid, added to a little of the two specimens of highest density, mixed together in equal proportions, was followed after some hours by the formation of an abundance of crystals of nitrate of urea; 500 grains of the same sample, slowly evaporated, yielded 36 grains of solid extract, of which 25.5 grains were urea, animal extracts, and salts, soluble in strong alcohol; 7 grains chlorides, sulphates, &c., soluble in water; 3 grains earthy salts, principally phosphates, and .5 mucus. Children, too, are beyond all doubt



the frequent subjects, and often, because it is overlooked or its nature mistaken, the victims, of this disease. \*

Ureous urine has been observed to alternate with other morbid states of the same fluid, with the albuminous and saccharine particularly, and also with that in which the phosphatic salts are copiously elaborated. I believe it to be the common precursor, as recent inquiries have shown it to be the general attendant, of the mellitic diabetes, as well as the state into which that formidable disease passes under the influence of treatment of a certain kind. A ureous state of the urine has also been found to accompany several forms of acute disease. Thus the urine of a young man labouring under peritonitis was found on analysis to contain one-third more urea than healthy urine.† In certain continued fevers, too, of bad type, the urea often becomes disproportionately abundant in the small quantity of urine then discharged, and it is under such circumstances that the kidney seems occasionally to separate the elements of urea under other and very remarkable forms, namely, carbonate of ammonia and hydrocyanic acid, which I shall mention by and by in two of the sections of my Fourth Chapter.

Instead of being absent in the urine of patients affected with the honey diabetes, as was long supposed to be the case, urea has, with the progress of chemistry, been demonstrated to be present, first in

\* The profession, so far as I know, are indebted to Dr. Venables for directing attention to this circumstance. *On Diabetes, &c.* London, 1825.

† Nysten, *Recherches de Chimie et de Physiologie pathologiques.* 8vo. Paris, 1811.



a *certain proportion* (Dr. Henry), then in *as large a proportion as in health*, (Mr. Kane), and finally, under certain circumstances, in *considerably larger proportion* than in health (M'Gregor). Mr. M'Gregor, for example, found a patient labouring under diabetes mellitus, who had undergone no treatment, passing 1013 grains of urea daily, the quantity emitted by a person in health being but 428 grains; a second patient was found to be passing 945, and a third 810 grains of urea every day. In a patient fed on beef and water exclusively for three successive days, as many as 43 grains of urea were obtained from each thousand grains of urine; the same quantity of healthy urine rarely contains so much as 30 grains.

Intimately connected, therefore, as the ureous diathesis appears to be with the mellitic, it still differs from this in many essential particulars. In the first place, the urine contains no new, and, as it may be termed, foreign ingredient, a very important matter. And then the constitutional disturbance is not of the same rapidly wearing description; there may be thirst, but it is not generally excessive; the appetite is rarely very much increased, it never becomes voracious and insatiable, and the skin seldom assumes the parched and withered state so characteristic of the proper mellituria, or honey diabetes; above all, it is much more under the influence of remedial measures. In a case which occurred to Dr. Elliotson, and which was thought to be diabetes mellitus in the first instance; the urine from 16 pints in the 24 hours, was reduced in the course of a fortnight to two pints, mainly through the effect of opium, and ultimately the patient got well, though he



continued subject to occasional relapses. In one of Dr. Prout's cases, though the patient's general health was greatly improved under a course of constitutional treatment, this seemed to have very little influence on the peculiar malady; but a bitter infusion with the addition of potash and tincture of opium, had an immediate effect, and controlled the inordinate and abnormal action of the kidney in a very remarkable manner, so that this patient also recovered, though like the former, he remained subject to relapses, which, however, always yielded to a repetition of the old remedies.\* A female, aged fifty, had laboured for some time under a diuresis, so that she passed as many as 10 pints of urine in 24 hours. The urine was of a pale colour, and nearly transparent; it had a faintish odour, reddened litmus, and was of the specific gravity of 1.034. The residuum left after evaporation did not seem to differ from that of healthy urine, but it was greatly more abundant, for it amounted to about  $9\frac{1}{2}$  ounces daily, which is fully  $8\frac{1}{4}$  ounces more than in health. This patient recovered completely under the use of chalybeates.† Most of the cases of *diabetes* reported as cured by authors, were undoubtedly cases of Azoturia, or ureous urine.‡ The case which I had lately under my own care did well under the use of an infusion of quassia, and a pill containing equal parts of the compound rhubarb pill and the compound powder of ipecacuanha, five grains of each being taken twice a day. The patient, in three weeks

\* Op. cit. p. 54.

† Bostock, in Med. Chirurg. Trans. vol. iii. p. 107.

‡ See particularly Dr. Venables' Treatise on Diabetes passim.



from the time I saw him, had gained immensely in appearance ; his usual strength and spirits had returned, and his urine, under the regulated diet he followed, was in smaller quantity, and much less troublesome to him, than it had been for years.

If taken in time, therefore, the ureous diathesis is not to be regarded as fraught with the formidable consequences which might be apprehended. The proper functions of the kidney are not so much *altered* as simply *increased* ; the organ is but in a state of erethism which requires subduing, and which may be subdued, in order to have matters again brought into a natural train.

The above view, in fact, accords with the results of experience in the treatment of this form of disturbed renal function. The system under its influence will even be found to bear bleeding, both generally and locally. When any thing like uneasiness in the lumbar region is complained of, cupping from the loins should not be neglected ; and this, succeeded by blistering, bitter tonics, chalybeates and opiates, in conjunction with a regulated diet and attention to the state of the bowels and skin, seems adequate to control the disease, even after it has existed for some considerable time unnoticed, or with its actual nature overlooked.

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The physical and chemical investigation of the varieties of morbid urine comprised in this chapter, is to be undertaken on the same principles. The general appearance, degree of transparency, disposition to deposit, odour, &c. are to be noted. The



specific gravity is then to be ascertained, a piece of knowledge easily procured by means of an instrument,—hydrometer or urinometer, sold in the shops for the purpose.\* A given quantity of the urine, say 1000 grains, is then to be slowly evaporated, at a temperature not exceeding 160 or 200 degrees of Farenheit, till it ceases to lose weight. The quantity of extract being ascertained by weight, the proportion of the solid matters to the water will become exactly known. The extract is next to be digested with strong boiling alcohol, (sp. gr. .833) which will take up the urea and salts (the lactates) which are soluble in alcohol. What is dissolved is to be poured off; what remains is to be washed once or twice with a little fresh boiling alcohol, which is to be added to the first. The alcoholic solution is then to be reduced by slow evaporation to the consistence of extract, or till it ceases to lose weight, and its quantity ascertained. The saline mass which was insoluble in alcohol, is to be treated with distilled water at 60 degrees Farenheit, two or three times, and the different solutions being added together and evaporated to dryness, the quantity of saline ingredients,—the soluble chlorides, and alkaline phosphates and sulphates, will be discovered. The insoluble matters, consisting principally of the earthy phosphates which remain on the filter, being dried, are to be weighed. They are afterwards to be digested with caustic potash; and being dried and weighed again,

\* Those I have used I had of Elliott, 112, High Holborn. The most convenient apparatus for evaporating urine with which I am acquainted is Dr. Arnott's ingenious and admirable stove. I have reduced many pounds of urine by its means, the fluid never having exceeded the temperature of 100 degrees Farenheit.



the quantity of mucus or other animal matter will be estimated by the loss of weight, if any, which is sustained. This is as much as is required for medical purposes. For every information requisite in conducting a more minute analysis of the urine, I beg to refer to the excellent treatise of Mr. G. Rees, entitled, "On the Analysis of the Blood and Urine in Health and Disease." 8vo. London, 1836.



## CHAPTER II.

MORBID STATES IN WHICH THE SECRETING FACULTY OF THE KIDNEY IS LESSENERD OR ABOLISHED.—ANURIA (ISCHURIA RENALIS, CULLEN ; PARURIA INOPS, GOOD).

IN direct contrast with the states of renal function just described, are those now about to be considered. Instead of being preternaturally active and pouring out extraordinary quantities of urine, more or less abnormal in its nature, the kidneys occasionally exhibit a diminution or actual suspension of their secreting power, and then we have either very little or no urine at all prepared. The title under which this suspension or abolition of the secreting office of the kidney is usually spoken of in this country, is *Ischuria renalis* ; but as ischuria means an impeded discharge of urine, I prefer adopting the title Anuria, which expresses perfectly the distinguishing feature of the disease, to that of Ischuria, which I shall have occasion for besides in its legitimate sense by and by.

We are familiar with the partial and temporary suspension of the function of the kidney in the course of most acute diseases. In febrile states of the system, and in inflammatory affections of individual organs particularly, the secretions in general are interrupted, and that of the kidney suffers among the number. Under such circumstances, only very small quantities of urine, and these highly coloured and strongly impregnated with saline in-



gredients, are formed, which are passed at very distant periods. A patient labouring under a severe attack of pneumonia, will scarcely pass a few ounces of fiery urine once a day, sometimes not once in two or three days, and instances are said to have occurred in which no urine was voided for as many as fifteen days.\* Such a symptom is always of very inauspicious import. After severe surgical operations, too, the secretion of urine is often greatly affected. When the suppression continues for any length of time, the case will almost certainly end unfavourably. The anasarca that succeeds scarlet fever probably depends mainly and immediately on deranged function of the kidney. The urine is generally all but suppressed in the earlier stages of the attack, and the albuminous state of the fluid gives strong assurance that such is actually the case.

A condition of the renal function, and of the urine elaborated, having precisely the characters above enumerated, but without the local mischief, or preceding inflammatory fever to account for it, is a circumstance which is occasionally observed. This occurs most frequently among young children, and has been well described by a pathological writer of high repute on the continent,† under the title of *Urodialysis neonatorum* (*Harnscharfe der Kinder*). I have myself met with the complaint oftener than once. Infants affected in this way, void very small quantities, often only a few drops at

\* Fosbroke, *On certain Pathological Relations between the Kidneys and other Organs*, 8vo. Cheltenham. 1825.

† Professor Schoenlein, *Allgemeine Pathologie u. Therapie* b. iii, s. 232, also by Jahn, *Verwandschaft der Greises-und Kinderkrankheiten*, in *Hecker's Annalen*, b. xii. s. 129.



a time, of extremely high coloured urine, which stains the linen of a deep reddish yellow. It seems to be passed with great pain, and very much as if it were molten metal, the little patients drawing their legs up to their belly, and crying bitterly as it comes away, and it very obviously scalds the surfaces over which it passes, and excites inflammation in the mucous lining of the bladder and urethra, as appears by the increased quantity of mucus which before long begins to be excreted along with the urine. With such a state of things, there is, of course, more or less of febrile excitement associated. The skin is hot and dry, the thirst is increased, and the bowels are obstinately constipated; the feces are only voided in the shape of little rounded masses like marbles; the digestion, too, is obviously impaired, and the breath smells strongly of vinegar. As in so many other urinary affections, the skin in this one is generally irritable, and the seat of eruptions of different kinds. It is always kept whole with great difficulty; wherever two surfaces are in contact, they almost certainly inflame, and by and by pour out a thin, sharp, fetid fluid, which causes the mischief to spread. Sometimes the cutaneous affection assumes a more determinate form, and appears as psydracious pustules scattered over different parts of the body; these break, and give rise to superficial and often very troublesome sores, especially in the groins, axillæ, folds of the neck, &c.

A state of disease in which the urinary organs are particularly and prominently affected, very analogous in its characters to that just described as occurring in infancy, is occasionally observed among persons



in the decline of life (Urodialysis senum, Harnscharfe der Greise, Schoenlein). The disease makes its attack very insidiously, constipation of the bowels being one of the most remarkable symptoms during the earlier stages, three or four days together always elapsing before there is any call to stool. The skin is at the same time rough and dry; the digestive powers are weakened; the appetite fails, or is very irregular, and acid eructations generally follow meals. The tongue is commonly covered with a white fur, yet it has been observed to be clean, though red, in which case the disease was accompanied with severe cramp of the stomach.\* The thirst is always increased. As in infancy, the skin is apt to be peculiarly and extensively affected in this Urodialysis of the aged. It is sometimes excessively itchy, and on close inspection appears to be covered in parts with the papular eruption which characterizes one of the forms of prurigo; or otherwise the eruption has the character of the form of urticaria, which has been described by nosological writers under the title of *Epinyctis pruriginosa*. Another remarkable feature with which the diminished action of the kidney among the aged is sometimes accompanied, is severe pain in the thighs, legs, or lower extremities generally.

Along with these symptoms, which are more or less urgent in different cases, the quantity of urine secreted becomes smaller and smaller; that which is formed is also observed to be progressively higher and higher in its colour, until it appears of a deep brown. The excretion of the fluid, as in infants, is attended with much pain; there are constant calls

\* Naumann, Handb. d. Med. Klinik, b. vi.



to void it, and only a few drops are made at a time ; its passage along the urethra, too, excites scalding sensations, and the fluid is so fiery that the skin of the prepuce and insides of the thighs is excoriated and made sore by its contact. The urine under these circumstances often lets fall a copious sediment of lithic acid and the lithates, and has been even observed to contain gravelly concretions.\*

The disease now described has many of the characters of a general constitutional affection. Among the aged it probably depends either on an erratic gouty state of the system at large, or on an arthritic inflammatory condition of the kidney in particular ; the implication of the kidney is almost certainly not primary and idiopathic, but secondary and symptomatic. This form of the disease might be called *Anuria pyretica*. The very remarkable disease, however, which in this country we designate by the name of *Ischuria renalis*, and which I propose to call by the title of *Anuria*, or *Anuria apyretica*, does not appear to be commonly or necessarily connected with any kind of general constitutional disturbance in the first instance, but to have its beginning, and to derive all its striking characters from lessened or suspended action of the kidney. It is certainly proper and distinct from any other local or general affection of the system.

Anuria or renal ischury generally makes its attacks in the midst of apparently perfect health. Like the pyretic or febrile form of the disease, it occurs at all ages, but also much more frequently in young children, and in persons above fifty or sixty

\* Naumann, l. c. p. 93.



years of age. In the adult the symptoms of the disease in the earlier periods are those merely of impending illness: the patient makes little or no water, and feels anxious, restless, and out of sorts, to use a vulgar phrase, without being able to say exactly what ails him. Closely questioned, indeed, and his attention directed to particular parts, he will own to some degree of uneasiness, occasionally to some degree of pain in the lumbar region, which now and then strikes round the flanks, and seems even to possess the abdomen pretty generally. A certain degree of nausea now begins to be complained of, and this before long very commonly proceeds the length of causing vomiting, which continues afterwards to form one of the most constant and troublesome symptoms of the malady. There is at the same time very generally associated a singular degree of torpor both of mind and body, marked by disinclination to motion and to occupation of any kind—the patient has mostly a dull and abstracted look, unless when immediately engaged by those about him. When questioned as to his state, he says he feels very well; and it is generally only when particularly interrogated that he remembers it must be very many hours since he passed any urine. The pubic region is examined, and is found without fullness or pain. To have assurance that the bladder is not distended, he is requested to make water; after some delay, he probably passes a spoonful or two, probably he cannot with all the good will in the world void a drop. A catheter is now introduced into the bladder, to be quite certain that there is no mistake, and half an ounce, a few drops, or not a single drop of urine is discharged.



The practitioner, now fully aware of the imminent danger in which his patient is placed, speaks of the necessity of instant and active measures for his relief, the propriety of which is not at all obvious to the uninitiated; for the pain or uneasiness complained of at first, has probably subsided, the pulse is not accelerated, and though there may be some sickness and a good deal of depression, these are not commonly considered as symptoms of any great moment. But the patient at this stage begins to be affected with drowsiness, and is observed to wander and to talk incoherently; often, too, he eructates frequently, and is apt to be worried by the hiccup. The drowsiness increases, and in the course of a day or two, goes on to coma. By and by convulsions come on; these recur again and again, and before long the life of the patient is at an end.

The progress of the disease, and the intensity of the symptoms, vary considerably in different instances. In the generality of cases, coma occurs about the fourth or fifth day from the time when the secretion of urine is totally suspended;\* and the fatal termination usually happens after the lapse of a few days more. But the secretion of small quantities of urine, which takes place from time to time in some cases, seems to relieve the system in some sort, and then the disease may go on for a much longer period than it ever does when the function of the kidney is completely annihilated. Under these circumstances anuria may only prove fatal after an interval of several weeks; or, time being allowed for the employment of the proper remedies, it may finally be

\* Abercrombie, in *Edinb. Med. and Surg. Journ.* vol. xvii. p. 212.



brought to a favourable issue. There is a remarkable case related by Dr. Laing, of Fochabers,\* in which not a drop of urine was secreted for between nine and ten days at least, yet in which the patient ultimately recovered completely. Other cases are on record in which the secretion of urine is said to have been suspended for much longer periods. Dr. Parr, in his Dictionary, for instance, mentions one incidentally and without any details, in which no urine was secreted for six weeks; Haller† speaks of a patient who made no water for a space of twenty-two weeks; Dr. Berres‡ gives the very interesting details of a child twelve years of age, in whom there was scarcely a drop of urine voided during more than half a year; but the most wonderful case of all is that which Dr. Richardson§ has described, in which the patient, if one who was strong and well might be so called, at seventeen years of age had never made water in his life! Innumerable other instances might be quoted of a similar kind.

Whether the generally imperative business of urinary purgation was really suspended in all or any of these cases, may very reasonably be doubted. Nature is very arbitrary in her requirements, and never either makes or suffers any real exception to her laws: the kidneys exist with an obvious office, and the performance of this office, we may be quite certain, is indispensable to the continuance of life.

\* Edinburgh Medical and Surgical Journal, vol. x.

† Biblioth. Med. Pract. tom. ii. p. 200.

‡ Med. Jahrb. d. Oesterr. Staats. Neue Folge, B. iii. S. 300.

§ Philos. Trans. for 1713. p. 167.



Animals which have survived the immediate effects attending the extirpation of both kidneys uniformly die; and unabated true anuria is inevitably and speedily fatal. In some of the cases which have continued for a great length of time, the histories of which can be relied on, the disease has evidently depended, not on paralysis of the secreting function of the kidney, but on some impediment to the escape of the urine duly elaborated. Such was the nature of the case recorded by Dr. Berres referred to above. The urethra was so small that only a fine catgut bougie could be introduced into the bladder, and the ureters could be traced of the thickness of a man's arm, extending on either side of the spine, from the region of the kidneys down to that of the bladder; they could even be felt by the finger *in ano* approximating, and at the point where they must have terminated in the bladder. It is just possible that as a little fluid came away in this case by the sides of a fine bougie left in the urethra, more may have passed naturally than the father of the child was willing to acknowledge. The extraordinary case of his son was probably a source of some gain to him. The unexpected departure of this man from the place where he was probably too closely observed by Dr. Berres, and the very sudden and perfect recovery of the child which took place from such a malady, are also calculated to throw suspicion over the whole of the circumstances. When we see a man labouring under anuria, regularly reduced to extremity in three or four days, how is it possible that any one should go on living for six or seven months and make no water? In Dr. Richardson's case the



ureters in all probability ended in the great intestine, and the urine, reduced in quantity by the abstraction of a certain proportion of its watery constituents, came away with the fæces, just as it does in birds and the monotremata.

With the explanations of such cases that have been grounded on the assumption of vicarious discharges of urine by other organs, I feel free to own my total dissatisfaction. I do not believe that any one organ in the human body can discharge the office of any other. The secretions of particular organs being retained, indeed, the whole body, solids as well as fluids, will show traces of their presence. The duct of the gall-bladder being obstructed, the roots of the nails and whites of the eyes soon become tinged with bile, and the blood and the urine yield its peculiar principles to chemical reagents. The urine not being discharged, the mucus of the mouth and the perspiration may acquire a urinous taste and odour. But that the axilla, umbilicus, mamma, external ear or stomach, ever took on themselves the function of the kidney, and secreted ounces, pints, or quarts of urine, I conceive never to have happened, and hold such an occurrence by the fiat of the Creator in establishing a particular organ for the secretion of urine to be impossible. Since general physics and the laws that regulate the functions of organized beings have been more widely and more carefully studied, extraordinary and miraculous occurrences have greatly diminished in number, and such as do now present themselves at distant intervals are very commonly discovered to be deception. The gentry who pretend to per-



ceive colours by the sense of touch, who live for years without taking food, who pass no fæces and make no urine, are all found out sooner or later to be impostors, and those who believed them to have been of easy faith. When we read, therefore, of the discharge of quantities of unmixed urine from the umbilicus, ear, mouth, &c. we naturally and safely discredit the facts, however respectable the testimony upon which they are announced,—Mrs. Mary Tofts gave birth to innumerable rabbits, if the testimony of one of the very respectable members of the medical profession of his day be but taken. I have heard of a poor girl who habitually vomited fæces well formed, and moulded by the cells of the colon ; but she swallowed them previously.

Among the more remarkable cases of vicarious discharge of urine which have occurred recently may be enumerated, among others, the one related by so respectable an authority as Dr. Hastings.\* In this case the umbilicus was the seat of the discharge. Another very singular instance of the same kind will be found related at length by Dr. Lyncker, in the volume of the *Gazette Medicale de Paris* for 1836. In this instance the discharge took place from the mamma. The third and last case I shall allude to, occurs in the *Recherches de Physiologie et de Chemie Pathologiques* of M. Nysten ; here the discharge of urine was accomplished by vomiting. In the first account in the ‘*Recherches*,’ the case is given without comment ; but M. Nysten afterwards felt himself bound to make the *amende* in regard to the whole narration, and to own

\* Midland Medical and Surgical Journal, No. IV.



that he had been imposed upon by the patient. In a recent number of the Edinburgh Medical and Surgical Journal, Mr. Laycock has published a paper upon what he calls *Ischuria hysterica*, which may be translated "Ischuria simulated by hysterical women," in which he showed by dint of close watching, that the young woman who was made the subject of particular observation, was imposing upon her medical attendants.

Where there is the most obvious and urgent necessity for vicarious discharge of urine, as in cases of retention from obstruction of the ureters, and from obstacles at the neck of the bladder and in the course of the urethra, we do not observe any such fortunate occurrence taking place. The subjects of these vicarious discharges are mostly hysterical women, or they are loiterers in hospitals, *malingerers*, as our army medical officers call them, whose motives for practising imposition may sometimes be divined, but are often perfectly unfathomable; in fact, there is in many instances no motive beyond the simple disposition to act in the way they do; their conduct is the result of an uncalculating impulse, and may be regarded as a kind of insanity of some of the sentiments (the love of notoriety, and the disposition to conceal of the Phrenologists, if such feelings exist, which I rather fancy they do) with which the poor creatures are not themselves aware that they are afflicted.

Anuria has been observed in subjects of all ages. Willan\* saw and has left us the histories of several unequivocal cases of the disease occurring among

\* Medical Facts, vol. iii. also in Miscellaneous Works.



children. Abercrombie\* also observed it among infants affected with diarrhœa and some degree of fever. I have alluded to the account of the malady as it occurs in early life, by Shoenlein and Jahn. In my own practice at the Royal Infirmary for Children, I have had frequent occasion to see cases of Anuria of the kind they describe, and which I would name Anuria pyretica, generally among very young children; but the disease has always appeared to me to be connected with and dependent on derangement of the alimentary canal and nervous centres; it seemed to occur but at the last, and as the consummation of a long train of formidable antecedent symptoms. This also appears to have been the form of the disease which Dr. Klose had always encountered in his practice.† It was, therefore, different from the idiopathic affection with which we are more familiar, as it presents itself in adults, but which also occurs in its pure and unmixed form in early life, as the following interesting case observed by Dr. Sachse‡ amply proves. Dr. S. was desired to see a child aged fifteen months on the 1st of July, 1833, on account of a suppression of urine, the child being reported not to have made a drop of water during the preceding five days. Dr. S. found this child stout, well grown, and to all appearance in good health. The region of the bladder was neither swollen nor painful, the bowels were regular, the sleep tranquil. The region of the kidneys could

\* Op. Cit.

† Nieren-Anurie der Neugeborenen und Greise, in Preuss. Med. Zeitung, No. XLII. 1833.

‡ In Preuss. Med. Zeit. No. XXXIX. 1833.



be pressed into deeply, as could also the whole abdomen, without exciting any symptom of pain. The body was not hot, the face not flushed, the tongue not dry, the pulse was natural,—there was no sign of fever. This child had already, on occasion of cutting some teeth shortly before, had a suppression of urine that lasted for four days. There were now four teeth ready to cut the gum. The gums were rubbed with honey, and the belly had hot fomentations, and what was equivalent to a hot poultice applied to it. Camphor liniment and hyoscyamus were rubbed into the spine. Various medicines were prescribed internally, squills and salt of tartar, decoction of uva ursi and seneka root, manna and saltpetre, milk of sulphur and calomel. July 5th (10th day of the disease) the region of the stomach now appeared swelled; that of the bladder remained quite natural. There was restlessness, but no fever. The skin was moist, but without any urinous smell. 10th (15th day) the child was bloated in the face and extremities, the integuments under the eyes looking like clear bladders of water. He was still free from fever, and the four teeth were above the gum. The child was now plunged several times into cold water. 16th and 17th (21st and 22nd days) convulsions and vomiting. 18th (23rd day of the disease) death. Unfortunately permission could not be obtained to examine the body. In the forty years of his professional life Dr. Sachse had not met with any parallel case. Halford,\* in all the cases he encountered, observed the disease in corpulent men between fifty and sixty years of age. I lately saw the disease run

\* Trans. Royal Coll. of Phys. of Lond. v. vi.



its ordinary fatal course in spite of every thing that could be done, in a man about seventy. I believe it may, and does occur, at all ages, although it is certainly much more rare in infancy than after the meridian of life is passed.

It is generally difficult to refer an attack of anuria to any particular cause. Exposure to cold is probably the one to which the disease may most commonly be immediately ascribed. Occasionally it is evidently induced by external violence, and that done to parts remote from the organs immediately and particularly affected, namely, the kidneys. Thus in a case which occurred to Dr. E. F. Smith of New York,\* the patient, a servant girl, slipped upon the ice, and struck her pudendum violently against a piece of board. The urine first voided after this accident was bloody, and had undoubtedly been contained in the bladder at the time of the fall. During the succeeding eight days, the whole quantity of urine discharged did not exceed half a pint, and during the last four of these days not a drop was either discharged naturally or evacuated by the catheter. The symptoms were those of anuria well marked. Under the judicious treatment of Dr. Smith, the patient recovered. The urine on its re-appearance was transparent and natural.

Sometimes the disease with all its characteristic features would also appear to be induced by a cause that may be regarded as in some measure tantamount to violence, namely, by calculous concretions lodging within the pelvis of the kidney, or impacted in the upper part of the canal of the ureters. In the

\* In Lond. Med. and Phys. Journal, vol. xxiv.



latter case, when a calculus obstructs the ureter at or shortly after its exit from the pelvis of the kidney, the disease is unquestionably a form of Ischuria or retention, in the first instance; the secreting function of the kidney is not implicated, the escape of the urine only is prevented; but the obstruction continuing, the kidney soon suffers in its proper office; the poison to the system, which it is the business of the kidney to eliminate, is not discharged, and the disease is turned into true anuria. Of this form of the malady there are several very interesting examples recorded. Those for which we are indebted to M. Gaultier de Claubry and to Dr. Brown, deserve to be particularly noticed. In M. Gaultier's\* case, the patient had suffered previously from several attacks of nephritic colic, which were followed and relieved by the expulsion of calculous concretions from the bladder. From the night between the 15th and 16th, to the middle of the 25th of October when he died, the patient did not void a drop of urine. What is remarkable, too, and very unusual, he preserved his intellectual faculties unimpaired through the whole course of his illness; the day before his death he even gave vent to some bon-mots, and permitted himself to jest upon his own deplorable condition. Neither does he seem to have suffered from the coma, which is so constant a symptom of the disease under which he laboured. There was no fever, and a disagreeable sensation, rather than any positive pain in the right ilio-lumbar region, was all that was complained of. There was total inappetence, constant sickness, and occasional vomiting; and

\* Rec. period. de Sedillot, tom. lii, p. 376.



about the middle period of the disease, severe pain, referred to the knees and calves of the legs, and some anasarcaous infiltration of the scrotum and tops of the thighs. The weakness and prostration became extreme; the patient when moved complained of faintness, but at other times declared that he suffered nothing. He expired on the 25th at mid-day, not having voided any urine for 225 hours—nearly nine days and a half. On opening the body after death, the intestines were found distended with flatus; the epiploon was soft, and yielded readily under the fingers; the liver was natural. The kidneys were found imbedded in a large quantity of fat of a peculiar appearance, for it was arranged in pellets, felt hard, as if affected with incipient scirrhus, and presented a considerable resemblance to a conglomerate gland. The left kidney was of the natural size. Its ureter was small, contracted, and quite empty. The substance of the kidney was of a very deep colour, of great consistence—so hard that it creaked under the knife like cartilage, and so dry that not a drop of moisture could be forced out of it by strong pressure. The infundibula were filled exactly by four calculi, which together weighed  $81\frac{1}{2}$  grains. There was only about half a thimbleful of turbid fluid between these calculi and the papillæ. The right kidney was much smaller than the left, and not so firm in its texture, nor of so deep a colour, being rather of a sallow aspect. The pelvis contained a single calculus, of the same shape as the cavity, which plugged the orifice of the ureter exactly. Its substance was as dry, however, as that of the left kidney. The bladder lay deeply behind the pubis, contracted,



its walls half an inch thick, and containing about a spoonful of sero-mucous fluid. The calculus of the right kidney consisted entirely of lithic acid, with a little sub-phosphate of lime intermingled. The four extracted from the left kidney also consisted of lithic acid externally, but each contained a nucleus of oxalate of lime.

The subject of Dr. Brown's \* observation was a strong healthy man, a sergeant-major in a regiment of horse. On the 28th October, this man felt himself rather unwell. On the 29th, when first seen, he spoke of feeling himself *much swelled*, and stated that he had not made any water for six-and-thirty hours. On examining the abdomen carefully, no distension could be discovered. A catheter passed into the bladder brought away no urine; but on the 30th and 31st, 1st February, 2nd, 3rd, 4th, and 5th, when he sank and died comatose, small quantities, varying from three quarters of a pint to four ounces, amounting altogether to about thirty-five ounces, were discharged. The symptoms throughout were unequivocal of the proper anuria, and the treatment was judicious and active. On dissection the right kidney was found with marks of high inflammation, and the pelvis ulcerated. Two inches down the ureter, a concretion of lithic acid resembling a small kidney-bean in size and shape, was discovered obstructing its canal. The left kidney was also inflamed, but no part of it showed a trace of ulceration; the ureter on this side was obstructed by a calculus about an inch below the renal pelvis, in the same manner as that on the right. Dr. Abercrombie

\* Edinburgh Med. and Surg. Journal, vol. xix.



believes that anuria may occasionally supervene upon gonorrhœa when the discharge is suddenly checked.

Of anuria occurring among infants, I have already spoken, rather as a consequence of pre-existing general or more particular intestinal or cerebral disease, than as truly idiopathic and primary in its nature. I do not deny, however, that anuria may sometimes present itself in the earlier periods of life as an original malady. The first of the three cases detailed by Willan,\* would certainly lead to this conclusion; although this excellent writer strangely enough, and from a single dissection, seems inclined to refer the disease in every instance to inflammation of the mesentery; notwithstanding the fact that in the case referred to there was neither tenderness nor distension of the abdomen, nor high fever, nor any one of the symptoms that constantly accompany inflammation and gangrene of so peculiarly sensitive a membrane as the peritoneum.

The morbid appearances discovered in the bodies of those who have died of anuria, have been of different kinds. Generally speaking, the kidneys have been found with the appearances of inflammation, and redder than natural; sometimes their substance has been drier and much firmer than it is in a state of health. In some cases one kidney has been observed to be much enlarged, the other being reduced in size, and either of cartilaginous hardness or preternaturally vascular. Occasionally these organs seem to have been less the seat of active disease themselves, than the adipose and cellular substance

\* Willan, l. c.



amidst which they lie imbedded. This was particularly the case in the instance I have quoted from M. Gaultier, as also in one of Abercrombie's cases, where the adipose tissue behind the left kidney, besides bearing traces of active inflammation, was in one place quite black, and as if gangrenous. Similar appearances have been observed in many other instances.

Occasionally the morbid changes exhibited by the kidneys appear to have been the effect of the mechanical irritation of calculi, or of gravel filling their pelves, as the antecedent symptoms of the disease were undoubtedly caused by the impediment to renal secretion offered by these foreign substances. I have already spoken of this circumstance occurring in two cases in the adult. In the body of a child which died with symptoms of anuria, but preceded by diarrhœa, aphthæ in the mouth, cough, strabismus, stupor, and convulsions, Mr. Fosbroke\* found the kidneys very vascular; the papillæ, in particular, projected through the infundibula, and were of a bright red colour; the pelves and ureters at the same time contained a quantity of sabulous matter and tenacious mucus.

The liver has been found inflamed and partially softened in some cases of anuria; and it is worthy of observation, that instances of jaundice occasionally present themselves, which terminate unexpectedly in coma, without any great urgency of symptoms, just as we see matters come to pass in anuria.† Effusion into the ventricles, and upon the surface of

\* Fosbroke, l. c.

† Abercrombie, l. c.



the brain, is another morbid appearance often found in connexion with suppression of the functions of the kidney. The fluid in these cases has sometimes had a distinct urinous odour. The effusion in adults would appear generally to be a consequence of the interrupted renal function. Among children, on the other hand, the cerebral symptoms commonly precede the suspended secretion of urine, so that the anuria is but one in the train of symptoms which accompany the formidable disease entitled Acute Hydrocephalus.

The proximate cause or essence of the disease in anuria appears to be a paralysis of the secreting parts of the kidney. The pathology of the disease, however, is still extremely obscure. We do know of a period in the extra-uterine life of man, when the function of the kidney appears to be in complete abeyance. This is immediately after birth. It is not uncommon for new-born infants to be twelve, twenty-four, thirty-six, and even forty-eight hours without passing any water;—the function of the kidney has not been established. The same state in a greater or less degree occurs during the course of certain acute derangements of the system. Finally, from peculiar causes affecting the kidney in particular, we have its secreting office suspended or abolished, so as to constitute the disease we are now discussing.

The cure of anuria rests entirely on rational empiricism. In entering on the treatment, we must have especial regard to the circumstances in which the disease has arisen, and to the causes that may appear to have produced it. The subjects of anuria



are mostly robust men from fifty to sixty years of age, although it also occurs considerably later in life, and exposure to cold is the cause to which, in the majority of instances, the attack is immediately ascribable. Experience has shown that the most powerful means we possess of taking off the *spasm*, as Dr. Cullen has it, which occurs in the vessels of internal organs, as the first stage of inflammatory diseases, and is especially induced by cold applied to the surface of the body, is general blood-letting. And this is, in fact, the measure upon which our principal reliance is to be placed in anuria. Practised early in the disease it rarely fails to give relief; and when the malady has existed for some time, the propriety of the measure is made abundantly evident by the buffed and inflammatory state of the blood abstracted. In aid of the general depletion, cupping glasses should be freely applied to the lumbar region, so as completely to unload the vessels that are locally congested. As a most powerful auxiliary to these measures, a succession of large blisters, which deserve our best reliance in this disease, and ought never to be omitted, should be applied on either side of the fleshy mass constituting the sacro-lumbales muscles. It will be better to heal these blistered parts up as quickly as possible, to remove the deadened cuticle by fomentation and gentle rubbing, and then to apply a fresh blister to the place, than to keep the excoriated surface open. The action of the cantharides appears to be positively useful in anuria; and exhibited internally, the Spanish fly has even been recommended as a kind of specific in the disease.

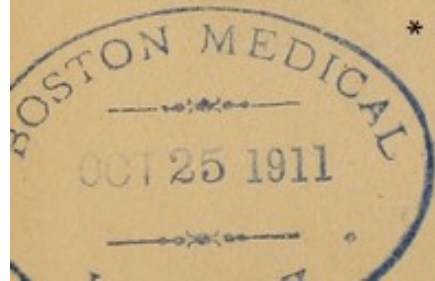


Next to general and local blood-letting, according to circumstances, and free blistering always, the most important matter is to excite the action of the bowels, and, should it be needful, of the skin. A dose of calomel and compound extract of colocynth in the shape of a pill, followed by half a dram of the compound powder of jalap in infusion of senna, should be immediately exhibited; and the common saline draught, combined with small quantities of antimonial wine, and infusion of digitalis in pretty free doses, administered from time to time.

By these united means, the kidneys, under ordinary circumstances, and likewise under those of the especial nature that engage us, will often be found, with gentle solicitation from bland diluents and the use of the warm bath, to resume their office. Such, at least, in looking over the cases of proper anuria that have terminated favourably, is the treatment which I find to have been usually followed. It is consistent with all we know of the pathology of the disease, and is farther sanctioned by experience.

Another and, in some sort, specific plan of treatment has, however, been recommended by very competent authority—Dr. Elliotson.\* This consists in the exhibition of the turpentine and more acrid diuretics, especially cantharides. Cantharides have undoubtedly a very powerful and peculiar effect on the kidneys; and I am not prepared to say that some cases of anuria may not have done well under the use of this active medicine; but as the able practical physician just mentioned does not say that

\* Lectures reported in Med. Gazette.





he had seen any of the cases upon which his recommendation of cantharides as a specific is grounded, we may be allowed to doubt whether the recoveries which took place were a consequence of its administration.

When we have any clue to suspect the presence of gravel or calculi in the pelves of the kidneys, or impacted in the course of the ureters, as the cause of the disease, which I have imagined might sometimes be derived from feelings of distension or swelling, such as were complained of in the first period of Dr. Brown's case, it would be proper to associate with the means already recommended, copious dilution with fluids holding the bicarbonate of potash or soda in solution, such fluids being calculated to act on the lithic acid of which renal and ureteric calculi so commonly consist. The vapour and hot air bath would almost certainly be found powerful auxiliaries under the same circumstances. Emetics also, which have been strongly recommended in the treatment of anuria generally,\* might be prescribed with an especial prospect of proving useful in that form of it, to which peculiar reference is now made.

\* By Lieutand, *Synops. Praxeos Medicinæ*, t. i.



## CHAPTER III.

MORBID STATES, IN WHICH THE URINE CONTAINS IN EXCESS, AND AS PRECIPITATES CERTAIN INGREDIENTS THAT OCCUR NORMALLY IN SMALLER QUANTITY, AND IN SOLUTION.

PERFECTLY healthy urine in the human subject scarcely lets fall any precipitate save a slight mucous cloud, until it begins to be decomposed by standing. But very trifling and transient disturbances of the system suffice to destroy this criterion of healthiness in the product of the renal function. In fact, we cannot have our circulating and nervous systems stimulated by company, nor the organs of digestion called upon for an extra effort by a little more wine, and a somewhat fuller meal than usual, without observing the urine next day to be of a high colour, to become turbid after it has stood for some little time, and by and by either to let fall a powdery precipitate of various shades of colour, or to deposit a quantity of reddish-brown crystals on the bottom and sides of the utensil. Sedimentary urine, however, is observed to be the attendant upon a considerable variety of continuous morbid states of the system generally, as well as of the kidney in particular. The sediments, moreover, are by no means always of the same nature as those presented in the accidental circumstances mentioned; they differ entirely in their appearance and chemical composition, and are even indices of dissimilar and very opposite pathological conditions.



Sedimentary urine may be conveniently spoken of under two distinct heads, in conformity with the two principal orders of salts which form the precipitates, and, as it happens, with the two distinct states of constitution with which they are severally associated: First, that in which the lithic acid and the lithates, especially the lithate of ammonia, form the precipitate; and Second, that in which the phosphatic salts, namely, the ammonia-magnesian phosphate, and the phosphate of lime, compose the deposit.

SECTION 1.—*Of the Sedimentary Urine in which the deposit consists of the Lithic Acid and the Lithates,*  
—LITHURIA.

OF all the kinds of sedimentary urine this is by far the most interesting and important, in as much as upon its occurrence depends certainly in two cases in three the first step in the formation of urinary calculi, or stones in the kidney and bladder.

The urine from which the lithic or uric acid is deposited in the shape of crystals, as frequently happens, is commonly of a high colour, having something of the tint of a rich golden-coloured sherry wine. It has what may be styled the peculiar sensible properties of urine, in an eminent degree, the deep colour alone bespeaking the abundance of the principle upon which these depend; for both urea and uric acid uncombined with the colouring and odoriferous matter of the urine, the *urodmechrome*, as it might be called, are colourless, and without



smell. It is not necessarily of very high specific gravity. I have often found urine which was depositing, or had deposited lithic acid abundantly, of the density of 1.018, 1.020, and 1.022. It is quite bright when passed, and generally communicates a sensation of comfortable stimulation to the urinary passages as it is voided. Sometimes this sensation is exaggerated, and then the urine feels hot to the urethra. It is only as the fluid cools that the crystalline particles of the lithic acid make their appearance; and as they subside quickly, have themselves a certain degree of transparency, and principally increase in size after they have reached the bottom and sides of the utensil or recipient; unless they are extremely abundant, they do not cause any very great diminution of transparency in the fluid.

When collected by decanting the supernatant urine, and dried, the lithic acid thus deposited appears in the guise of a parcel of brilliant crystals, which seem to be four-sided prisms, very like sea-sand or muscovado sugar in appearance, but drier and more gritty, of a brownish-red colour of various shades of intensity, being in some cases as dark as wainscot or mahogany, in others of a light brownish-yellow, and in some rarer cases nearly white. These crystals are very little soluble in water. Dr. Prout failed to dissolve 1 part of lithic acid in 10,000 parts of cold water. Dr. Henry, on the contrary, states that 1 part is soluble in 1,720 parts of water at 60° Fahrenheit, a discrepancy which Dr. T. Thomson \* very happily explains by supposing Dr. Henry's statement to express the *quantity* of lithic acid which

\* Art. Calculus, Cycl. of Pr. Med.



water can dissolve when the attraction of aggregation is destroyed;—Dr. Prout's the *power* which water possesses to destroy this attraction of aggregation. At all events, lithic acid is a very insoluble substance, so much so, indeed, that it has frequently been made a question among chemists to explain by what means it was held dissolved in urine in the quantity in which it frequently occurs in that fluid.

The explanation of this circumstance has been attempted in various ways. Proust\* was the first who maintained that the lithic acid of the urine existed in combination with ammonia, and was made soluble in the fluid from this circumstance. This explanation has been adopted by the most distinguished physiological chemist of the age, Dr. Prout, by whom the existence of free lithic acid in the urine is denied in toto. The ratio, indeed, in which lithic acid and water are commonly enough present in urine, namely, that of 1 to 1000, makes it impossible that solution could take place, even allowing the highest estimate of the solubility of lithic acid to be correct. According to Dr. Prout, it is always present in combination with ammonia, and occurs as a super-lithate of this base. But the simple fact that lithic acid in combination only with a little colouring matter, is constantly deposited from the urine, seems of itself a sufficient answer to this view; and farther it happens, unfortunately for its stability, that the addition of a solution of caustic ammonia to urine, is followed, in the first place, by the precipitation of the phosphates, and after the lapse of a few hours by that of the lithic acid also so

\* Annales de Chimie, tom. xxxvi.



completely, that an acid subsequently dropped into the filtered fluid causes no further deposit of this substance.\* Wetzlar, who particularly insisted on the above facts, in order to get over the difficulty presented by the insolubility of the lithic acid, himself maintained, that it existed in the urine in combination with soda. But lithate of soda is itself so extremely insoluble a salt, that the matter is not much mended by the supposition; besides, later researches in chemistry will not suffer it to be entertained, although it is interesting to know that a solution of lithate of soda will bear a considerable dose of lactic acid, the free acid of healthy urine according to the analysis of Berzelius, without undergoing decomposition.† By others, the lithic acid has been held to be rendered more soluble by the presence of the saline bodies which occur along with it as constituents of the urine. But direct experiment is against this notion. I have myself added the purified saline ingredients obtained from 1000 grains of urine, to the like, and even to half the quantity of distilled water, without finding that this solution had any greater power of dissolving lithic acid, or of holding it dissolved, than distilled water itself. Dr. Duvernoy,‡ of Stuttgardt, appears, however, to have solved this difficult question at last. He has shown, as the writer thinks in a very satisfactory manner, that it is upon the presence of the peculiar odoriferous colouring principle

\* Wetzlar, Beitr. zur Kenntniss des mensch. Harns. &c. Frankft. a. M. 1821.

† Wetzlar, l. c.

‡ Chemisch-medicinische Untersuchung des menschlichen Urins. 8vo. Stuttg. 1835.



of the urine that the solubility of the lithic acid, and even of the super-lithate of ammonia, mainly depends. This inquirer dissolved two grains of lithate of soda in between two and three ounces of hot distilled water. The addition of a few drops of an acid of more powerful affinity instantly caused the precipitation of the lithic acid in small crystalline plates. But on dissolving the same quantity of the salt in a like measure of fresh urine, Dr. Duvernoy found that he could add the stronger acid till the mixture reacted powerfully on litmus paper, &c., without the slightest immediate precipitation of the lithic acid taking place. It was only after the lapse of several hours that the fluid began to grow turbid, and the lithic acid to be deposited in the shape of crystals and impalpable powder. Again, he found that if to a saturated solution of lithic acid in boiling water so much of the proper colouring matter of the urine be added as will give to the fluid the hue of somewhat concentrated urine, the acid, instead of being precipitated as the mixture cools, will continue in solution long after it has become quite cold. Neither does the addition of a stronger acid to this compound fluid, even when cold, cause any immediate deposit of lithic acid; this only takes place after an interval of many hours.\*

It rarely happens that the lithic acid is deposited from the urine in the crystalline form described alone. The acid, still in state of comparative freedom from foreign admixture, often appears, to the naked eye at least, in the shape of an amorphous sediment of a tawny, reddish-brown, or brick-dust colour. Very

\* Op. Cit. p. 16.



commonly too, the lithate of ammonia, and occasionally the amorphous deposit which occurs simultaneously with the precipitation of crystalline lithic acid, or follows this shortly afterwards, consists almost entirely of the lithate of ammonia, a salt which in some cases is deposited from the urine in extraordinary abundance. The sediment here is generally more or less of a cream or very pale tawny colour; sometimes it has a red or pink hue of various shades of intensity, an appearance that is owing to the presence of a new principle, the nature of which seems to vary, and will be spoken of in another place. Occasionally the lithic acid combined with soda forms the matter of the sediment, which is then, for the most part, all but colourless. This last deposit has been most frequently observed in the urine of gouty subjects, a class of persons in which depositions of the same substance in the tendinous thecæ of the hands and feet are familiarly known to occur very commonly.

The deposits which occur in lithic states of the urine may be arranged according to their colour and state of aggregation, so as to be taken in at one view in the following manner:—

Red crystalline Sediment, composed of

Lithic acid and the colouring matter of the urine. The crystals are rhomboidal prisms, which in the field of the microscope, appear under the form of pretty regular lozenges, generally of a beautiful topaz-yellow colour singly. Vigla\* and Quevenne.

\* Etudes Microscopiques de l'Urine; L'Experience, tom. i. Janvier, 1838.



Lateritious, red, or reddish-brown Sediment, composed of Lithate of ammonia; purpurate of ammonia and soda; colouring matter of the urine; and occasionally an admixture of the earthy phosphates. Prout.

Lithic acid combined with the colouring matter of the urine. Vigla.

Yellowish Sediment, composed of Essentially of lithate of ammonia; a little lithate of soda, colouring matter of the urine, more or less of the earthy phosphates. Prout.

Lithic acid combined with less of the colouring matter of the urine, than in the preceding form of deposit. Vigla.

Pink Sediment, composed of Lithate of ammonia; purpurate of ammonia. Prout.

Almost wholly of lithic acid; some lithate of soda; an animal matter, and a little phosphate of lime. Quevenne cum Vigla.\*

The recent crystallographic and chemical analyses of the lithic deposits of the urine, by Messrs. Vigla and Quevenne, would consequently lead us to conclude that these deposits were less simple in their constitution than they were believed, or rather than they were found to be by Dr. Prout. They probably vary considerably in different cases.

Such deposits of lithic acid and its salts almost invariably take place on the termination of febrile paroxysms. They are, therefore, often observed to be critical; and their first faint indications are to be anxiously looked for in the course of severe inflammatory and bad febrile attacks. In the earlier stages of such diseases, the urine is scanty and high

\* Op. Cit. p. 194.



coloured, but does not deposite; at the height of the disease it often becomes neutral, sometimes positively alkaline, especially in typhoid fever; as the fit abates, or when it is about to abate, the urine resumes its proper acid qualities; by and by it shows a light cloud, which the microscope discovers to be caused by a crop of minute crystals of lithic acid; anon this cloud increases in density, and we can predict the decline of the disease with great certainty.

Independently of every thing like active febrile disease, however, the urine often shows a singular disposition to deposite the lithic acid and its salts. There are two periods of life at which this lithic state of the urine in one or other of its forms is more peculiarly apt to present itself; these are infancy, and the years between forty and sixty. These ages may, therefore, be regarded as directly predisposing to a lithic condition of the urine; whilst every circumstance that tends to occasion an increase or excess in the acid and saline ingredients of this fluid relatively to its quantity, may be viewed as immediately tending to cause a separation of these matters from the state of solution in which they ought always to exist. We have seen how nearly insoluble was the lithic acid itself, and how very sparingly soluble were its salts; the most soluble of these, the lithate of ammonia, still requires something like 480 parts of water to effect its solution; so that we have but to suppose the quantity of lithate of ammonia in the urine to be accidentally tripled, which often occurs, to have of necessity a portion of it thrown



down as a solid, the watery menstruum of the urine not being then in quantity sufficient to preserve the whole of the salt in solution.\* And then it happens that the affinity of the lithic acid for the bases with which it occurs combined, by which its solubility is somewhat increased, is so slight, that even the weakest of the acids, the carbonic, citric, acetic, &c. are powerful enough to dispossess it, and effect its precipitation in a concrete form.†

Now of all the causes that prove efficient in engendering lithic acid, none have been recognized more potent than indulgence in large quantities of animal and other kinds of nutritious food; and of all the causes that are known to be influential in promoting the separation of the lithic acid, either from the peculiar colouring matter or alkaline base combined with which it is rendered soluble and innocuous, there is none so powerful as the presence of a free acid in the body, whether introduced or engendered there.

These facts, in connection with preceding considerations, give a key to the right understanding of the whole of this most interesting subject; happily, also, they afford an indication of what is needful to be done in order to correct the morbid states with which an excessive production and a tendency to the deposition of lithic acid within as well as without the body are connected.

Do we not in fact see the infant living on a highly azotised and peculiarly animal food, which has further a singular tendency to acescency, pre-

\* T. Thomson, *Cyclop. of Pr. Med. Art. Calculus.*

† Thenard, *Traite de Chimie.*



cisely the two conditions requisite to the production and precipitation of lithic acid? Can we wonder, then, that urine which deposits lithic acid and its salts, should be common in infancy? especially when we add that the children of the poorer classes who are most obnoxious to this state of urine, independently of their immensely larger relative numbers, are peculiarly open to all the other influences that are held favourable to the inducement of deposition from the urine—such as exposure to cold in consequence of scanty clothing and indifferent lodging, and to derangements of the stomach and bowels from coarse and improper food.

Again, when we regard the age between forty and fifty, the next period in human life that is marked by liability to the precipitation of crystalline lithic acid from the urine, and cast an eye upon the men constituting that larger portion of the community who by manual labour earn their bread in the sweat of their brow, do we not see the influence of incessant toil beginning to be felt by the system about this time? Exposure to wet and cold has now withered the skin, coarse food has impaired the digestive powers, hard labour has blunted the sensibilities, and the frame which but a few years before seemed knit to endure for an indefinite period already shows symptoms of decay. Or, turning to another large class in society, composed of the men who by the exercise of their intellect are girt for the race of life, do we not see the struggle very generally concluded about or soon after the age of forty? It is now that men in professions and general business either discover that they have been using



undue exertion, and have suffered in body, or that they first begin to surround themselves with something more than the bare necessities of existence. The simple meal, hitherto hastily snatched at some lull in the storm of business, now no longer suffices; arduous labour both of mind and body craves relaxation, and long abstinence deserves indulgence. It is now that a man begins to dine in earnest, to entertain his friends, and in his turn to be entertained by them. The stomach is taxed to the performance of unusual duty, and not uncommonly taxed beyond its powers; the blood is fevered by strong drinks of every kind; the nervous system is excited by the presence of company, &c. &c. The pabulum of lithic acid is furnished to the kidney in abundance, febrile excitement leads this organ to exert its peculiar acidifying powers upon the matters presented to it, and imperfect digestion supplies an acid—all that was wanted to bring about the deposition of stone-ware, which now so frequently occurs. Happy if this take place without the body, and not within the pelvis of the kidney!

Nor is indulgence in large quantities of rich food and strong drinks efficient in promoting a tendency to the deposition of lithic acid merely from supplying the kidney in abundance with the materials for its formation. They are further influential in this direction from causing a positive decrease in the quantity of urine secreted. Not only are the saline and acid ingredients of the urine increased in quantity, but the menstruum in which they are carried forth of the system is diminished in amount. In infancy the deposition of lithic acid would un-



questionably be more frequent than it is, were it not for the state of copious dilution in which food is then taken. And it happens fortunately, perhaps, that the unnecessarily large quantities of highly nourishing food in which grown men are so prone to indulge, are mostly associated with pretty copious potations of different kinds; good eating craves good drinking, and wine, beer, and tea and coffee, are always swallowed abundantly to allay the fever which heavy meals of highly seasoned animal food never fail to engender. Still the urinary secretion even under these circumstances is rarely found to be regularly in the ratio of the liquid imbibed. Animal food and strong drink seem to have a positive repressing influence on the secreting functions of the kidney. Very little urine is passed for twelve or eighteen hours after a debauch in meat rather than in drink. During all this time the function of the kidney is nearly in abeyance, and the salts of the urine are separated *suspended* rather than *dissolved* in that fluid. It has been remarked, too, that carnivorous animals though they drink water freely make but very little urine in comparison with the herbivorous tribes, many of which, living on succulent vegetables, rarely drink at all, and yet pass large quantities of urine.\* A knowledge of this fact led Dr. Wollaston† long ago to propose that persons liable to gravel should follow a vegetable regimen; and Dr. Pearson‡ afterwards remarked that the calculous concretions of phytivorous

\* Magendie, Rech. sur la Gravelle, p. 25.

† Philos. Trans. 1797.

‡ Ibid. 1798.



animals never contained lithic acid, and followed Wollaston in recommending vegetable diet. The peasantry of Scotland and Ireland who live almost entirely on vegetable matters, often of the coarsest kind, and drink nothing but water, actually labour under a kind of diuresis in contrast with their brethren of England, who live on bacon, and cheese, and wheaten bread, and drink little but ale or beer; and lithic urine and its consequences are rare out of the towns both of Scotland and Ireland.

That *dyspepsia*, or bad digestion, in the ordinary acceptation of that term, is the most efficient cause of a lithic state of the urine, as has been so generally maintained, I cannot make up my mind to believe. My observation would lead me to say that there was a greater amount of weakness of stomach, characterized by heartburn and oppression after eating, in a single agricultural county in Scotland, than could be heard of over one half the surface of well-fed England. I have not found the urine of those who were habitual sufferers from dyspepsia, save on very rare and distant occasions, to deserve the epithet of lithic. I am, in particular, on habits of intimacy with two individuals, who in their persons present an epitome of all the symptoms of indigestion in their most painful and aggravated shapes, and the urine, in both cases, though always slightly acid when voided, is almost never high coloured, and seldom or never lets fall any deposit beyond the slight mucous cloud of health; when there is a slight precipitate in from twelve to twenty-four hours after the urine is passed, it consists of the lithate of



ammonia of a pale colour, and in the amorphous state, *i. e.* the crystals are so small that they require a magnifying glass to distinguish them.

That something else than simple indigestion is at work in inducing a lithic state of the urine and its consequences, calculous complaints, we have evidence in the fact, that whilst in the county of Norfolk one case of calculus occurs for every 21,000 of the inhabitants, and 10 and 12 operations for stone have for many successive years been annually performed in the Norwich Infirmary, the disease seems to be entirely unknown in the county of Hereford, no patient during more than 40 years having been received into the Hereford Infirmary labouring under stone, and no record of the operation of lithotomy ever having been performed within the bounds of the county being extant.\* In Devonshire, too, the disease of stone appears to be very rare.

We cannot suppose that the inhabitants of Norfolk are peculiarly or more than usually afflicted with indigestion, and that the natives of Hereford and Devonshire are peculiarly or more than usually exempt from this malady. Peculiar local and atmospheric influences, some of which are appreciable, combined with certain specialities of diet, a very large share of the blame being ascribed to the latter, seem to me adequate to account for the prevalence of calculus, the consequence of a previous disordered state of the renal function, as an endemic disease in particular districts. Norfolk, for instance, is very much exposed to the piercing wind that blows over England from the east, and this must

\* Smith in Med. Chir. Trans. vol. ii.



undoubtedly affect the skin to a very great degree, and thus influence the function of the kidney. In Norfolk, again, wheaten bread,\* hard dumplings or masses of imperfectly fermented dough mixed with fat bacon, and cheese, washed down with thin, hard beer, *i. e.*, a bitter infusion with a modicum of spirit and a considerable admixture of vinegar, constitute the diet of the inhabitants. In Herefordshire and Devonshire, the solid articles of sustenance are nearly of the kind mentioned as used habitually in Norfolk; the dumpling, however, is not so much of a staple, and in Devonshire broth is a common addition as an article of food. In both Herefordshire and Devonshire, however, the drink is different; cider is here consumed universally, and in large quantities, a beverage which, besides water, some acetic acid when old, and alcohol, contains a considerable quantity of malic acid and super-malate of potash. Now it is familiarly known that many fruits and their expressed juices, the cherry, the strawberry, and apple, among others, afford great relief in their season to persons labouring under gravelly and calculous complaints. Linnæus used to recover from his constitutional gout by indulging freely in the strawberry, and J. J. Rousseau, a martyr to the stone, always looked forward to the ripening of this fruit, as bringing with it his season of relief from suffering. I have somewhere read that Chelius of Heidelberg prescribed a diet of cherries to a patient labouring under lithic urine or gravel, with

\* "An unusually heavy meal of animal food or bread is invariably followed by a deposition of the lithate of ammonia from the Urine." Prout, Inquiry, p. 118.



the effect of freeing him from his complaint, and bringing the urine to a state in which it ceased to deposite. I have myself on two occasions prescribed the expressed juice of ripe apples, which is easily prepared, and may be procured at all times, with excellent effects in lithic states of the urine. The neutral, and even the super-salts of potash and a vegetable acid, as they exist in the juice of these fruits, undergo partial if not complete decomposition in the stomach; the acid probably escapes by the skin; the base is certainly voided by the kidney, with the effect of rendering the urine neutral, or positively alkaline, and so relieving the patient from his sufferings.

Such a drink as cider, therefore, is to be viewed as essentially different in its elementary constitution from the malt liquors so commonly taken as diluents in England. I believe vinegar as an article of diet, or disguised in malt liquor, as it invariably is when the drink is old, (and the connoisseur does not care to touch it until it has acquired some degree of hardness or acescency from keeping,) to be a most potent cause of the precipitation of lithic acid from the urine. In one of the districts of England where gravel and stone, and their antecedent, lithic urine, are extremely common, namely, in the poor country between Tunbridge-Wells and Lewes, the inhabitants are poorly fed, and look thin and sallow; but hard, *i. e.*, stiff puddings, and *hard, i. e.*, *sour* beer, are regular elements in their diet;\* and I have shown that in one of the two great cider counties of England, the effects of

\* Scudamore on Gout, 4th Ed.



lithic urine, namely, stone in the bladder, are unknown, whilst in the other they are exceedingly rare. I am at a loss to imagine upon what data Dr. Dobson\* asserted, that stone was common in cider counties. In some districts of the Continent, even where extremely thin and sharp wines are the ordinary drink of the community, as in the Prussian provinces on the Rhine, gravelly and calculous complaints are extremely rare.†

That particular articles of food or drink have immense influence in producing that state of urine which leads to the deposition of crystalline matters, consisting in the great majority of instances of lithic acid, or an acid very intimately allied to it, namely, the oxalic united with lime as a base, is, I think happily illustrated by the following fact, communicated to me by Dr. Joshua B. Flint, of Louisville, United States, in his recent visit to this coun-

\* On fixed Air, 8vo. Chester, 1778.

† It has often struck the writer, that the addition of a sufficiency of supertartrate of potash at the time of brewing, would give ale or beer the flavour of slight hardness whilst yet young and quite free from vinegar, and that even when it did become acescent from keeping, the mischief it occasioned would be materially lessened by so simple a medication. He even fancies that the inhabitants of Norfolk, acting on this hint, may one day find themselves delivered from the demon in the shape of a stone which now dodges them at the heels, Albeit no brewer himself, nor patron in his own person to brewers, he begs to give another hint in this place to brewers of malt liquors in general, always with a view to the health of the community; which is, that to each bushel of malt they add, before mashing, A HANDFUL OF COARSELY POUNDED GYPSUM. The fine wines of the Macharnudo Vineyard, at Xeres la Frontera, belonging to Don Pedro Domecq, probably the most perfect wines in the world, are all made with this addition. The sulphate of lime seems to have the power of preventing the production of acetic acid.



try :—Fifty years ago the city of Boston, United States, used to be noted for the frequent occurrence of stone ; there was then no practitioner of any name, who had not been repeatedly called upon to perform the operation for its removal. At the present day, however, there is but one practitioner, Dr. Warren, who has ever performed lithotomy, and this not more than seven or eight times in the course of a long and active professional life, and only in two instances upon resident inhabitants of the city. Calculus is now an extremely rare disease in Boston. This remarkable change Dr. Flint ascribes to the discontinuance of *punch* as a beverage. Fifty years ago punch was the standard drink with all classes, and on all occasions ; every one drank this compound of lemon-juice, rum, and sugar ; but at present no one drinks punch : a skilful hand at compounding a bowl is hardly to be found within the precincts of the city of Boston, tripled or quadrupled as it is in the number of its inhabitants from what it was half a century ago. Now it is quite certain that punch, of all the compounds taken into the stomach, is perhaps the most powerful in producing a state of urine which is followed by the precipitation of the lithic acid and the lithates.

No country in Europe suffered so much from gravelly and calculous complaints a century ago as Holland. One lithotomist is reported to have performed his operation at least 2000 times. At present calculus is not a very common complaint in Holland. The change is probably owing to the substitution of tea as a universal beverage for the spirits or spirits and water that used in former days



to be consumed in large quantities, and by all classes of the community.

Whilst I admit then to its fullest extent the influence of diet on the state of the urinary secretion, I am not prepared to say that this influence is engendered through any derangement of the digestive organs in particular, of the nature of that which we characterize under the name of dyspepsia or indigestion. It seems to me a subject of regret, that at the present day so many English writers should be found referring numerous and most dissimilar diseases to a single and similar source. The bias of one indisputably great man has communicated itself too widely in this direction. The digestive organs have had too much to answer for of late years; instead of being the beneficent instruments our forefathers regarded them, furnishing the frame with the pabulum needful to fit it for the discharge of high and onerous offices, they seem of late to have been looked upon as a kind of enemy in the camp, poisoning by their perverse operation the very sources of life, and throwing all the rest of the beautiful machinery of the body out of joint. But surely a indigestion is one thing, and gravel or stone another, and gout a third, and palsy a fourth, and tetanus a fifth, and chorea a sixth, and soon to the end of the chapter. Undoubtedly the digestive organs are simultaneously affected along with every form of general constitutional disturbance, as also with the particular derangements of each and every one of the separate systems of organs which make up the body; but because they suffer, and because their implication is forced in a peculiar manner on



our notice, and because we mostly apply our remedies through the channels they afford us, they are not therefore the causes of these disorders. Let us take one in particular, among the host of diseases which it is almost universally the fashion to regard as depending on a disordered state of the digestive functions—*gout*, and ask, What is the actual state of matters preceding and connected with an attack of gout? Up almost to the hour of invasion the individual is generally in a state of unwonted good health; the stomach is doing its duty with alacrity; the body is replete with nourishment, the mind with energy. This individual retires to rest contented with himself, and with every one else, thankful to God, we shall presume, for all his blessings, and promising himself much farther cause for thankfulness in renewed and repeated enjoyment of these blessings. He goes to sleep and is lapped in Elysium. But by and by he is disturbed by uneasy sensations in the hand or foot, and is aroused to consciousness, wondering what can be amiss. The local pain increases in severity; sleep flies his pillow; he becomes restless and ill at ease; his pulse is full, his mouth parched, his skin hot and dry; and the remainder of the night, begun under such favourable auspices, is passed in misery, the patient tossing from side to side of his bed, and finding a resting place nowhere. The healthy man has become suddenly diseased; there is no whole spot about him, no function in his body that is not disordered, and the physician must be summoned. Now, in whatever the disease that has been developed consists, the stomach has certainly had no more part in its production than the heart or



lungs, liver or spleen, unless, indeed, as a casuist might maintain, it has been doing its duty too well. A diseased condition of the system, the effect, in so far as we know, of repletion, has manifested itself, accompanied and constituted by quickened circulation, suppressed secretions, disturbed digestion, local inflammation, and the other morbid symptoms, which we are accustomed to group together and call by the name of gout.

It happens even thus with the deranged states of the renal secretion that are characterized by the deposition from its product, of the lithic acid and the lithates. The stomach becomes affected; but it is secondarily, and in consequence of disturbance of the system generally. Primary and habitual dyspepsia is for the most part accompanied by the discharge of pale urine that rarely deposits at all, and when it does the matter thrown down is of a kind which very rarely indeed concretes within the body so as to form gravel or the nucleus of a calculus.

The more sedentary habits that creep upon us as we advance in life, and the diminished necessity that is generally felt for using so much active bodily exertion as formerly, are farther causes of the occurrence of the lithic urine, so frequently met with as years roll on. Dr. Wilson Philip in his experiments\* found that other things being the same, the deposite of lithic acid from the urine was much more constant and copious when he kept himself close to the house, than when he went abroad and

\* Inquiry into the remote cause of Urinary Gravel. 8vo. Edinb. 1792.



used active exercise. Sir B. Brodie\* relates that a gentleman of his acquaintance never suffered any inconvenience from the free life he led in eating and drinking, so long as he took plenty of exercise, he being in the habit of rising early in the morning, walkingly lustily, and returning home to breakfast perspiring profusely. On a change of circumstances, however, in which he continued to eat and drink as before, but ceased to rise early and to take his long walk, he became subject to red sand in his urine, and to a scaly eruption of his skin. Some have even become obnoxious to the effects of the state of urine that engages us, namely, gravel and calculus, after a confinement of a few weeks' or months' duration on account of an accident. Thus Van Swieten relates that a man who had lain on his back for ten weeks in consequence of a fractured thigh, suffered an attack of nephritic colic shortly after his recovery, and by and by passed a small rough calculous concretion. Nor did the mischief end here, for the individual became subject to recurrences of this malady ever afterwards.

Another cause of a lithic state of the urine, and the deposition of the insoluble acid characterizing it, which was particularly insisted on by the late Mr. Earle,† is local injury done to the kidney or to the lumbar region. A more common consequence of injury to the lumbar region, is the state of urine which will be particularly described in the next section; it is that in which the phosphatic salts are

\* Lectures on the Diseases of the Urinary Organs. 2d Ed. 8vo. Lond. 1835.

† Med. Chir. Trans. vol. xi.



elaborated in preternatural quantity and deposited from the urine. Nevertheless, Mr. Earle has given several interesting cases, in which the lithic diathesis certainly followed injury to the region of the loins; and it is not unreasonable to suppose, that the effect of this may have been to induce in the kidney that peculiar morbid state which is marked by the formation of lithic acid in excess. In persons subject to the lithic acid diathesis, when it goes the length of a deposit within the body, we often have occasion to observe, that the uneasiness and pain complained of are confined to one side only. Were the malady entirely constitutional, both kidneys would be implicated; but gravelly subjects frequently go on for years, passing concretions from time to time from one kidney only. The state of the kidney in its individual capacity ought not, therefore, to be overlooked. This is an important hint, for which we are indebted to Mr. Earle, and which has probably been too much neglected in the medical treatment of calculous diatheses generally.

In his very ingenious Essay on Gravel, M. Magendie,\* among other causes tending to induce a deposition of solid matters from the urine, reckons a diminished temperature of the body, which he believes to be proper to the aged. By actual experiment he found the temperature of the axilla in men above 60 to be seldom above 36° C. or 96°.5 F. nearly. The urine projected upon the thermometer he found no higher than 30° C., about 86° F., or ten degrees of the latter scale under the temperature proper to the vigour of life. Ten degrees of tempe-

\* *Recherches sur la Gravelle*, 8vo. Paris, 1818.



rature must certainly have some influence on the solvent powers of the urinous menstruum. These experiments of M. Magendie have been confirmed by others reported by M. Chevallier,\* who remarked that the temperature of the urine in children was low, that of adults higher, and that of the aged again low. The urine of a healthy man aged 55 was no higher than 33° C, or 91°.5 F.

There is still another cause of the production and precipitation of lithic acid and its salts from the urine, the importance of which cannot be overlooked in numerous instances, and which is probably of more moment than all the others put together. This is the inherent peculiarity of constitution which all testimony concurs in showing to be of the same essential nature as that with which gout is associated. Gout, however, is itself very uniformly the creation of easy circumstances and over-indulgence of the animal appetites of hunger and thirst. The laborious poor are rarely its subjects, and in the savage state, where life appears to be passed in a perpetual struggle for means to satisfy the cravings of hunger, the disease is unknown. The two constitutions, the gravelly and the gouty, as they are so commonly and so intimately associated, undoubtedly derive their origin from the same source.

In addition to these *internal* causes, inducing that state of urine in which the lithic acid and its salts are deposited, it is impossible to overlook the influence of certain *external* circumstances which have unquestionably a very potent sway over the

\* Essai sur la Dissolution de la Gravelle. Paris, 1837.



same state of things. Among the principal of these is temperature. In lands and districts where the diurnal variations of temperature are small, calculous complaints, which may be said to be all but invariably consequences of a lithic state of the urine, are rarely met with. In latitudes and districts, again, where these changes are greatest, they certainly occur most frequently. Extensive annual variations of temperature seem to have less influence than sudden alternations of heat and cold from day to day, and great inequality in the temperature of the nights and days. Renal diseases of all kinds are very frequently referable to exposure to cold, and the state of urine in which lithic acid and the lithates are deposited is a common consequence of a chill of the body. The county of Norfolk presents generally an exposed and open surface; the alternations of temperature are great and sudden, and there is no district in England over which the east wind, the dread of the invalid and person of susceptible nervous system, sweeps more constantly or more searchingly than over Norfolk. Suppressions of the cutaneous exhalation, combined with the kind of food generally used, are in all likelihood the potent cause of those derangements of the urinary secretion, which lead to the superabundant elaboration, and deposit of some of its suspended, or dissolved but readily concrescible ingredients, within the body in that division of this country. Free action of the skin seems almost incompatible with the copious elaboration or deposition of lithic acid or the lithates. Dr. W. Philip, in his experiments



already referred to,\* observed that the most aced food, which, under ordinary circumstances, had the effect of causing a plentiful deposite of lithic acid, had no such influence when the due action of the skin was maintained by diaphoretics. Cold applied to the surface of the body does not merely increase the quantity of the watery menstruum elaborated; the solid matters are also augmented in a very considerable proportion, in the ratio, namely, of three to two.†

The immediate cause of the precipitation of the lithic acid, especially when this takes place within the body, has been variously accounted for. Those who maintain that the acid exists in combination with ammonia, by which it is rendered more soluble, explain the occurrence readily through the agency of the free acid, which is always present in lithic urine. This free acid, say they, dispossesses the lithic acid of the base with which it is combined, and causes it to precipitate. The soundness of this explanation, however, is very questionable. First, the lithic acid separated from an alkaline base in this manner, is thrown down in a pulverulent or amorphous form, not in distinct crystals, as we perceive it to be, and when its consequences are alone to be apprehended. Then, there are great doubts in regard to the nature of the acid which can be spared to have such an effect. Dr. Prout supposed the muriatic acid to be the agent; but this acid has never been shown to exist in the urine,

\* Op. Cit. p. 100.

† Chossat in Journ. de Physiologie, tom. v.



save already saturated with bases—ammonia, potash, and soda. The phosphoric acid has enough to do in holding the lime with which it is associated in solution. The lactic acid, the free acid of the urine according to Berzelius, has been shown by Wetzlar to be the least efficient of all the acids in causing the precipitation of lithic acid from its state of solution in the urine. Finally, it is all but certain that the explanation of the precipitation of lithic acid from the urine by the agency of any free acid is erroneous. If the lithate of ammonia often occurs in the urine, it is no less certain that the free and uncombined lithic acid occurs there too. It does not seem necessary to the writer to search so anxiously for a chemical cause of the phenomenon in question. It is enough to say that in certain states of the system, under the influence of peculiar disturbed conditions of the vitality of the kidney, a very insoluble principle is separated in large quantity by this organ, the natural consequence of which is, that its particles, at the moment of their formation, are attracted by their inherent electivity, and concrete into the crystalline forms that belong to them: the precipitation is a *labes vitalis*, an error of vitality in the secreting organ, the kidney.

The state of the renal secretion which is habitually accompanied by a deposition of the lithic acid and the lithates, though it may continue in many instances for a great length of time without prejudice to the individual, is always to be regarded as evidence of a morbid state, which may be fraught with consequences of the most distressing and ultimately disastrous kind. Unless timely means are taken to



avert such a catastrophe, it usually happens that the lithic acid begins at length to be deposited within as well as without the body. The individual then observes, that he passes gritty or sandy looking particles in his urine, and often only takes alarm when the mischief, which ought to have been foreseen and prevented, has happened, and he has become the victim of one of the most cruel diseases to which the body of man is subject, namely, stone in the kidney and bladder.

The treatment of the lithic diathesis is happily perfectly understood, and the effects of well chosen remedial agents combined with attention to diet, &c. are probably, under no circumstances, worthy of more implicit reliance than when they are directed against the pathological state which is characterized by the deposition of lithic acid from the urine. As a preliminary, the circumstances surrounded by which the patient lives, must be taken particular note of, and all in these that is known to induce or to favour the malady from which he is suffering, must be removed. If he be a man in easy circumstances, or at all events accustomed to live highly, to drink some strong wine every day, to pass a sedentary or inactive life, engaged with his head rather than his hands, &c. he must be made aware of the connexion between his state and the kind of life he leads. He must be induced to abandon his very full regimen, to restrict himself greatly in the article of wine, and to give more occupation to his muscular system, and less to his brain. The proper functions of the skin ought farther to be secured by a due quantity of warm woollen clothing, and



exposure to cold and piercing winds should be particularly avoided. All this being done a considerable step will have been made towards remedying the evil; indeed, it were fair to presume that a regulated life of the kind described, would almost certainly have prevented it from ever having occurred.

It is not always possible, however, to wait for the tardy effects of regimen upon the progress of disease; the symptoms are sometimes urgent; gravely deposition had probably taken place and was going on, before we were summoned, and to delay were to make our patient run the risk of the stone. The state of system tending to this conclusion must be immediately altered. The most speedy means we have of doing this, is to lower the tone of the system by blood-letting and brisk purgatives. General blood-letting is seldom necessary in the kind of cases we are considering, nor indeed is it well borne by the persons who are their common subjects. But local bleeding by means of cupping from the lumbar regions, to the extent of eight or ten ounces, I believe to be not only generally unobjectionable, but to be eminently serviceable in almost every instance. This should be immediately succeeded by the exhibition of a purgative dose of calomel combined with antimonial powder, the full effects of which will be secured by prescribing three or four drams of the soda tartarisata in infusion of senna, at the interval of an hour or two afterwards. These medicines ought to be repeated until the bowels are completely unloaded. The antiphlogistic regimen is meantime to be enforced; the patient should have nothing beyond



slops and light farinaceous food for several days. He may, however, be encouraged to drink freely of rice or barley water, and he may take the common effervescing draught,—half a dram of the bicarbonate of potash or soda saturated with fresh lemon juice, three or four times a day with great advantage.

Under this treatment the high tension of the system will give way; the pulse will be subdued in force and fulness, the alimentary canal will be unloaded, and the urine from being strongly acid, deeply coloured, and highly charged with readily concrescible matters, particularly lithic acid, will be rendered neutral or alkaline in its reaction, pale in colour, and copious in quantity, conditions exactly the reverse of those in which lithic acid is deposited, and indeed incompatible with its deposition.

In the first period of a plan of treatment of this kind, it is not uncommon to see a considerable quantity of crystallized lithic acid discharged from the kidney, an event which has been observed to follow with considerable regularity upon the use of some of the ordinary diuretics, such as the turpentine. Whether this discharge of lithic acid is to be regarded as critical, *i. e.*, as a kind of *materies morbi* eliminated from the system by the kidney, or as a simple expulsion from the pelves of the kidneys of a quantity of concrete foreign matter, has been made subject of question among pathologists. In some cases there seems little reason to doubt of the critical nature of the discharge; in others, it is obviously the effect of the mechanical and chemical action of the diluents that are so uniformly prescribed when red sand has been observed to be



passed along with the urine. Should any thing like uneasiness continue in the region of the kidneys, after the measures which have been specified have been enforced for some days, it may be well to try the effect of one or two doses of turpentine. If they have the effect of bringing away a quantity of sabulous matter, the relief experienced by the patient is always great; and the good effects of the medicine may be secured by the subsequent use of gentle aperients, diluents, regulated diet, &c. I do not know that serious mischief has ever actually happened from the attempts which are sometimes made, at all hazards, to induce such an elimination of lithic acid from the kidney, by combining the terebinthinate diuretic medicine with muriatic acid and opium. It seems to me just possible that a course of this kind might lay the foundation of a renal calculus, with all its immediate and prospective miseries. I can hardly conceive a case, therefore, in which I should be inclined to adopt it; certainly not one in which I should persevere with it longer than a day or two. We have better than purely empirical grounds to go upon in the treatment of such cases.

Should we be able to trace the morbid state of the kidney to local injury, should it even have supervened upon severe fatigue, in which the *reins* (the lumbar regions) were especially sufferers, as after hard riding, the affection may with benefit be regarded as being, to a very considerable extent, local in its nature. In this case, the repeated application of leeches or cupping-glasses to the loins, and then the insertion of a seton, will be proper, and



hardly fail to prove of service. Indeed as often as we observe repeated attacks of nephritic pain on one side, associated with a lithic state of the urine, we shall be justified in looking particularly to the state of the organ immediately affected ; and recent experience has shown that even the most deeply seated of the internal organs are very much more under the control of the remedial effects of counter-irritation than could readily, *a priori*, have been imagined.

The state of system which is proclaimed by the secretion of urine loaded with lithic acid, is one that is almost always much benefited by a course of mercurial alteratives and gentle aperients, continued for a considerable length of time. Four or five grains of the Plummer's or blue pill every other night, or twice a week, followed by a senna draught with Rochelle salts in the morning, will be found to have immense influence ; and with the regulated diet, principally consisting of farinaceous articles, and the other items in the treatment, which have been indicated, would appear to be possessed of power enough even to eradicate the disposition to the peculiar morbid state under discussion.

But there is another, and as it might be truly called, specific plan of treatment that ought not to be neglected in the lithic diathesis. This consists in the exhibition of the alkaline bicarbonates in a state of large dilution, or in a course of one of the mineral waters which contains a bicarbonated alkali among its saline ingredients. Sulphur is hardly if at all more potent against scabies, than the alkaline bicarbonates are influential against a disposition in



the urine to deposit lithic acid. Taken at proper times, and dissolved in plenty of water, these salts are perfectly innocuous, and may be continued for months, and even years, not only without injury, but in many cases with great benefit to the general health. From half a dram to a dram of the bicarbonate of potash or soda (the soda is probably the more german to the system) dissolved in from three quarters of a pint to a pint of thin mucilaginous fluid, should be taken two or three times a day according to circumstances, at periods as remote as possible from those at which meals are taken. Immediately before or immediately after a full meal, a large dose of either of these salts will not fail to interfere with the important process of digestion. Schwann\* found that they destroyed the peculiar faculty of the Pepsin or the digestive element. Administered at the distance of two hours before a meal, they are abstracted from the stomach and carried off into the torrent of the circulation long before any food is taken, and the digestive process goes on unimpeded by their presence in the blood. If the patient's circumstances permit him to leave his ordinary place of residence or business, and betake himself to a watering-place for a few months, he can do this to greater advantage in no circumstances than when he is labouring under a lithic state of the urine. Our own country is deficient in mineral waters that are peculiarly adapted to such a case. But on the continent they abound. At the head of the whole may be placed

\* Ueber das Wesen des Verdauungs-Processes, Berl.; also Mueller's Physiology Transl. by Baly, p. 545.



the waters of Vichy, in the centre of France. No mineral water known contains so much bicarbonate of soda as the hot springs at Vichy; an ordinary tumblerful holds in solution nearly eighteen grains of this salt; and two or three glasses taken at intervals in the course of the day, are often sufficient to maintain the urine in a neutral or alkaline state, nay, the mere soaking in a warm bath of the water is sufficient to produce the same effect.\* The waters of Mont d'Or, Carlsbad, Selters, Pyrmont, Obersalzbrunn, &c. have the same effect in different degrees; they each prove beneficial in such cases at all events. Where removal is inexpedient or impossible, we can supply the place of these natural alkaline waters to a considerable extent, by prescribing the bicarbonate of soda or potash in a proper quantity of thin barley water, or in simple water impregnated with carbonic acid gas.† Fifteen or twenty grains of the bicarbonate of soda, dissolved in two ounces of water, having a half-pint bottle of our ordinary soda water (water charged with carbonic acid gas) poured over it, makes an artificial mineral water that is extremely pleasant to the palate, and is taken freely by patients. Could we but subjoin the benefits of the country air, healthful exercise, and relaxation of mind, that are always understood as elements in a visit to a watering-place, we should

\* D'Arcet, in *Ann. de Chimie*, 1826.

† The following is the Receipt in the French Codex for the artificial Vichy water: Carb. of soda, 1 dram, 56 grains; chloride of calcium, 11 grains; chloride of sodium, one-third of a grain; sulph. of soda, 6 grains; sulph. of magnesia, 3 grains; sulph. of iron, one-third of a grain; water, deprived of air, 20 oz. carb. acid gas, 3 volumes and a half.



in general be able to dispense with a removal from home.

*Chemical examination of lithic urine, and its deposits.*

A known quantity, say 1000 grains of the urine, after it has stood for several hours, is to be poured upon a filter of fine bibulous paper, and the fluid separated from the solid parts. Another portion of the urine may be tested for any additional lithic acid it may contain, by having a few drops of muriatic acid added to it. The precipitation of the lithic acid may always be immediately secured by drying well and warming gently the glass vessel into which the urine about to be examined is poured, or by rubbing the inner surface of the vessel containing the urine after a few drops of acid have been added to it, with a rod of wood.\* The colour of the deposits is best ascertained whilst they are still wet upon the surface of the filter.† The fluid portion is to be treated in the manner already recommended at the end of the first chapter, (p. 25,) by which the amount and relative proportions of the principal classes of ingredients will be ascertained.

To examine the nature of the deposits, let a known quantity of any of them be boiled with distilled water, by which any alkaline lithates will be dissolved. The solution being evaporated to dryness, a portion of the extract should have a few drops of nitric acid poured upon it; this will occasion the

\* Wetzlar, l. c. who found he could obtain a deposite of lithic acid by this means, in many cases where the simple addition of an acid failed to produce it.

† Prout, l. c. p. 126.



solution with effervescence of the lithic acid and the lithates. The nitric acid solution being dried by the application of gentle heat, the pink colour characteristic of the purpuric acid (formed by the action of the nitric on the lithic acid) will be evolved, and this tint will immediately pass into a bright purple on the addition of a little caustic ammonia. By this means we detect lithic acid. Another portion of the extract being mixed with some caustic lime, if it contains ammonia, this will be discovered by the smell, or by approaching a rod dipped in muriatic acid to the mixture. A third portion of the extract must be burned over the flame of a lamp in a platinum spoon, and the residue tested for alkaline reaction. The nature of the alkali found, whether potash, soda, or lime, is discovered by urging the residue for a moment with the flame of the blow-pipe. If it be soda the outer flame will be coloured yellow.\* Potash and lime are distinguished by the solubility of the former in distilled water; or should the lime exist in the caustic state, when it forms an oxide of the base and becomes soluble, by passing a current of carbonic acid gas through the mixed solution, or adding a few drops of a solution of oxalic acid, it will immediately fall. The presence of the earthy salts—the ammonia-phosphate of magnesia, and the phosphate of lime, is known by the insolubility of the deposit in boiling distilled water, and by its ready solubility in dilute acids, from which the earthy bases are precipitated on the addition of an alkali. The relative proportion of the differently soluble

\* Rees, l. cit. p. 74.



lithates and the insoluble phosphates may be ascertained by digesting a known weight of the mixed precipitate in a sufficient quantity of attenuated caustic potash, or soda, which takes up the lithates, and leaves the earthy phosphates behind.

A recent great improvement in the analytic investigation of urinary deposits, introduced in the service of M. Rayer, and well described by M. Vigla,\* is the examination of these with the microscope. Some of the results of M. Vigla's investigations I have already given in the general view of the lithic deposits, and I shall have occasion in the course of this work to refer to others.

SECTION 2.—*Of Sedimentary Urine in which the Deposit consists of the Earthy and Earthy-Alkaline Phosphates*,—CERAMURIA.

WE have seen the existence of the lithic acid in a state of solution to be incompatible with the presence of a free acid in the urine. The earthy phosphates, on the other hand, and especially the phosphate of lime, are only held in solution by virtue of the excess of acid with which they are combined, or in consequence of the presence of some other free acid in the urine, which can in many cases be demonstrated to be the carbonic. The *neutral phosphate of lime*† is a salt to all intents and purposes insoluble. *Phosphate of magnesia*, another urinous

\* L'Experience, Nos. 12, 13, 26 and 27. Paris, 1837-38.

† Dr. Henry reckons the quantity at as much as half a grain to each ounce of healthy urine. Elem. of Chem. vol. ii.



salt, is not very soluble, requiring at least fifty times its weight of water to take it up. *Phosphate of ammonia*, indeed, is soluble enough by itself, but in combination with the phosphate of magnesia, as it always exists in urine, it becomes exceedingly insoluble. A slight excess of phosphoric acid, and, as it would appear, the presence of carbonic acid in some cases, put an end to the insoluble character of these salts; as super-phosphates or carbo-phosphates they become readily soluble, and are safely carried out of the system.

Like the lithic sediments, those consisting of the phosphates occur either in the crystallized or amorphous state. In the former case the crystals are white and glistening, and their formation is frequently accompanied with the precipitation at the same time of a certain quantity of the amorphous lithic sediment. A condition of the renal secretion in which the lithic acid is deposited would not appear to be incompatible with a ruddy complexion, a feeling of high health, and such a state of the bodily functions as does not debar from indulging the animal appetites of hunger and thirst. There is here a state of *hypersthenia*, as the older pathologists would have called it; if there be aught amiss, it is merely some slight dryness of the lips, and rather more heat of skin than occurs with perfect health. When the phosphates are habitually deposited, however, the state of matters is widely different; even the mildest form of the phosphatic diathesis, that, namely, in which crystals of the triple phosphate of ammonia and magnesia are formed, is never seen among the robust and ruddy. It is constantly preceded and



accompanied by such a degree of nervous irritability and general delicacy of health, combined in the vast majority of instances with so much disturbance of the digestive functions, that the appearance of an individual is mostly of itself a sufficient index of the form of urinary derangement under which he is labouring.

The phosphatic state of urine, when observed at an early period, is generally found to alternate with that in which the cream-coloured or pale-tawny amorphous lithic sediment occurs. By and by, however, and as the constitutional peculiarity with what it is associated becomes confirmed, the lithic deposits are observed more and more rarely; and, finally, when the constitution is completely broken up, they do not present themselves at all.

As might be presumed, the phosphatic diathesis presents different phases according to circumstances. When first induced in individuals of nervous temperament and delicate constitution, along with the low-toned symptoms of general disturbance, we observe more or less of uneasiness, rarely amounting to pain, in the back and lumbar region. The urine is invariably pale coloured when passed, and is as uniformly secreted in excess, so that there is almost always a certain degree of hyperuresis present as a distinct feature in the complaint. This urine is not uncommonly weakly acid when first voided; very frequently, however, it is neutral; and after the disorder has continued for some time, or is increasing in severity, it never fails to become alkaline. Its specific gravity varies greatly according to the period of the day when it is examined; I have



found it as low as 1,004 in the early part of the day, and as high as 1,033 about eleven o'clock at night, the time when I have always found the urine to possess the highest density. This urine passes much more rapidly than the decidedly acid lithic urine into putrefaction, when it exhales a most offensive odour, and evolves an abundance of ammonia.

It rarely happens that crystals of the phosphates are deposited within the body; when they are, it is always in cases of some standing, in which the kidneys and bladder are deeply implicated, and the urine, in consequence of this, is ammoniacal before it is discharged. It has been made matter of doubt whether crystals of the phosphates were ever deposited within the pelvis of the kidney. Such an occurrence is undoubtedly rare, but it has happened; gravelly concretions, composed of the triple phosphate and of the phosphate of lime every now and then present themselves, and there are few extensive collections of calculi in which several will not be discovered having one of these for a nucleus. The phosphates, however, are just as commonly met with encrusting or forming the outer laminae of urinary calculi, as they are rarely found composing their centres. When crystals of the ammonia-magnesian phosphate are discharged with the urine, they constitute what is called *white* sand, in contradistinction to *red* sand, which consists of the lithic acid.

Instead of showing themselves in the form of crystals, the phosphatic salts much more commonly occur as amorphous sediments, and with symptoms



of a far more distressing character than have been described above. A phosphatic state of the urine, however, can hardly be regarded as an original and idiopathic malady: it is very uniformly the sequence and complement, as it were, either of some serious general constitutional disorder, or of a state of great irritation, often of structural disease of one or other of the urinary organs. We therefore find it occurring among the unhealthy, ill fed, and worse clothed children of poor, ignorant, and profligate parents; or otherwise, when the heyday of life is gone, and the system is feeling the effects of an accumulating load of years, of over-exertion whether of mind or body, and perchance of excesses committed in earlier life, circumstances by each and all of which it is often apparently induced.

Local and accidental causes, however, seem in many cases to be intimately connected with the secretion of a urine that contains an excess of the phosphatic salts. Strains and injuries of the back, concussions, or more serious mischief to the spine from blows, falls, &c. have, in numerous instances, preceded and apparently caused this state of urine. Again, almost all the diseases of the external urinary organs which require manual interference, such as the introduction of catheters, bougies, &c.; irritable states of the bladder, induced by stricture in the urethra, enlarged prostate, the presence of a calculus or other solid foreign body within that cyst, are severally well known to be powerful causes inducing the kidney to secrete a urine that is overloaded with the phosphatic salts. These are points of great consequence to be borne in mind, a know-



ledge of which, indeed, is of paramount and primary importance to whosoever would duly understand and successfully treat the interesting class of complaints that engages our attention.

By whatever cause immediately induced, the habitual secretion of phosphatic urine is always accompanied with great irritability of system, and much disturbance of the general health. The functions of the stomach and bowels are constantly compromised; the appetite not only fails, but there is often a positive loathing of food; the stomach is flatulent; the bowels are constipated or purged, the evacuations in either case being of the most offensive and unhealthy description. The patient complains of listlessness and depression, there is not only a singular disinclination but an absolute inability to make any exertion. The state of weakness is progressive; the flesh wastes, and the features assume a care-worn and haggard aspect. The mind, too, suffers; the patient almost invariably becomes morose and selfish, or peevish and discontented; his whole character is changed.

The urine in this state of affairs is not only disordered in quality; it is often secreted in excessive quantity, sometimes to the extent that has been noticed under the head of hydruria. It is always pale-coloured, and if transparent when first voided, which, indeed, is rarely the case, it grows turbid as it cools, and lets fall an abundant precipitate of a white impalpable powder, consisting of the combined phosphates of ammonia and magnesia, and phosphate of lime. If brought to the boiling point, a flocculent deposit takes place, which has often been



mistaken for albumen, but which consists principally of the phosphate of lime, as is immediately made manifest by the addition of a few drops of nitric acid, which re-dissolve the precipitate and restore or give complete transparency to the liquid. On standing, it hardly ever becomes perfectly transparent. Even within a few hours it is covered on the surface with a delicate pellicle, which is often iridescent, and on the lower surface of which well-shaped crystals of the triple phosphate of magnesia and ammonia are rapidly formed and sink through the fluid when it is disturbed, or when they become so heavy as to break away from the film. The urine anon becomes ammoniacal, and then the deposit goes on still more rapidly than before. Sometimes it is alkaline even at the moment it is voided; in any case, and when the temperature is between 50° and 70° F. it is not long before it begins to putrefy, and to evolve ammonia in abundance.

This is another among the many disordered states of the urinous secretion, which I imagine has been spoken of under the title of *Diabetes*, with the epithet *chylosus*. The case of the old man of 70, mentioned by J. P. Frank,\* who, after having carried a heavy burthen, began to complain of pain in his loins, and to pass large quantities of milky-looking urine, would probably be rightly referred to the class of cases we are considering. The milky look of the phosphatic urine at the time it is voided in some cases, and the fact of its letting fall a flocculent precipitate, when exposed to the boiling temperature, are circumstances which have often led

\* Epitome de Curand. hom. morbis, tom. i.



to the supposition that it contained albumen. I had myself fallen into this error in one or two instances, and been led to think much more seriously of these cases, in which coagulation, as I conceived, of albumen occurred on the application of heat, than the event warranted. The mistake is at once detected by adding a drop of the muriatic or nitric acid, by which the precipitate is immediately dissolved, and the fluid rendered completely transparent.

In undertaking the treatment of the morbus phosphaticus, or rather of that disturbed state of the constitution which is accompanied by the secretion of phosphatic urine, particular attention must be given to the circumstances connected with which it exists, or by the agency of which it has been engendered. If the phosphatic urine be seen but as one among a host of symptoms denoting general constitutional disturbance, it must be met generally, if it be obviously an effect of some peculiar local irritation, it will require to be attacked on the side whence it comes. In every case an endeavour must be made to restore the tone of the system at large, which will be found constantly to have suffered in a greater or less degree; whilst the irritable state of the kidneys and urinary passages, that invariably forms so marked a feature in the disease, must be allayed, and each particular cause of disturbance connected with these removed as speedily as circumstances will permit.

The state of the stomach, the direct and usual channel through which the physician attempts to influence the system, is here, as in almost all other forms of disease, an object of the highest importance.



The regulation of the diet must precede and be made paramount to all kinds of medicinal means. The appetite as well as the powers of digestion are almost always in the same degree impaired, so that the patient is here little inclined to commit errors of *excess*; he must be no less particular in the matter of *quality*. The food must be of the lightest and most nutritious kind, qualities that are happily combined in farinaceous articles prepared with milk. Where these agree they seem to supply as bland and congenial nutriment to the shattered frame as can be devised. Most of the white fishes, as whiting, haddock, sole, and turbot, eaten in great moderation, are generally found easy of digestion. The white meats supplied by the poultry yard roasted, broiled, or boiled, are commonly recommended; they do not always agree so well, however, as some of the darker kinds of meat; I have known the flesh of a chicken cause flatulence, and become aced on a stomach that digested perfectly a small quantity of tender mutton of full age, well roasted or nicely broiled. There is no kind of food which gives such a feeling of renewed strength to a patient who has suffered from an irritable state of system, and the secretion of urine superabounding in the phosphates, as a slice of roast or broiled mutton. A pullet's egg softly boiled is among the most digestible, and also one of the most nourishing, articles used by man as food. The same article exposed to a high temperature in an oven, or long boiled as a component of a pudding, becomes extremely indigestible. A pudding for an invalid should be made with bread,



or flour that has been baked, and only very lightly boiled. The excessively *stale* bread commonly recommended to invalids and dyspeptics is a great error. Such bread crumbles in the mouth like sawdust, and seems to lie in the stomach as so much of that substance would do. Bread that is six or eight hours out of the oven,—a French roll within one hour after it has been drawn, is, according to my experience, far more easily digested, and also much more nutritious than that which is two days old; bread, however, must be eaten in moderation; a large quantity of this very simple substance will produce a fit of indigestion little less severe than turtle soup and pastry. Cocoa lightly made and free from oil is the best diluent at breakfast. Tea is always pernicious in irritable conditions of the system, and ought to be entirely renounced. Large quantities of fluid of any kind, indeed, are to be avoided in those states that are accompanied with deposition of the phosphates; the kidney is already in a state of erethism, inclined to do too much, and is not likely to be quieted by having any thing like heavy duty thrown upon it. Instead of the lighter French and Rhenish wines, which have been recommended by very high authority in this form of malady, but which are objectionable, as having a decided tendency towards the kidneys, and often a positive influence in augmenting the alkalescence of the urine, a glass or two of dry old sherry,\*

\* After some attention to this subject, which peculiar circumstances have afforded me opportunities of paying, I beg particularly to recommend the fine Spanish wine called Amontillado.



diluted with half as much or an equal quantity of water, will be found far preferable. The lighter wines with a full bouquet never fail to disagree with weak stomachs; there is something peculiarly indigestible in the principle on which the odour and flavour of these wines depend.

With regard to medicine, the bowels, which are so commonly sluggish and disordered, require to be kept gently open. One comfortable evacuation in the course of the four and twenty hours is just as indispensable as purging is pernicious. Rhubarb and aloes combined; rhubarb and senna, or castor oil in nicely adjusted doses by the mouth, and if need be an occasional glyster of tepid water to aid nature, will generally be found to answer the end of maintaining a soluble state of bowels. The present very prevalent custom adopted in England from our continental neighbours of using *lavements*, as a means of evacuating the bowels, ought not to be so much encouraged as it is. Nature sent us into the world without a glyster apparatus; and if the lower bowel be for a while hindered of its proper office, it will cease from its duty of expelling the matter accumulated within its cavity. There is no more certain mode of inducing torpidity of the bowels than to fall into the habit of depending on injections for their evacuation. Saline medicines of any kind are objectionable in the phosphatic diathesis.

That, and the other carefully made and most excellent wines, which are the produce of the vineyards of Don Pedro Domecq in particular, and of different other celebrated growers in the vicinity of Xeres, may be depended on, and are the proper cordials for invalids, whenever this class of medicines is admissible.



When the combining acid is of vegetable origin, the salt is decomposed, in part at least, in the stomach, and the base passes by the kidney, increasing the alkaline state of the urine; when of mineral origin, the compound excites the bowels to copious watery evacuations, which lower the patient and make matters worse. Mercury, which has done so much good in medicine, and so much mischief too, pushed to the extent of affecting the system specifically, is allowed to be most pernicious by the concurring testimony of all. As an alterative and in small doses, it would not appear to be positively injurious. But as there is not generally any clear indication for its use, and as an irritable state of the system under other circumstances is known to contraindicate its exhibition, it had better not be tried here. Mercury has no peculiar power in remedying derangements of the digestive organs, and not being useful it is noxious.

With due attention to every circumstance, by far the most valuable medicines we possess in that state of the system which is accompanied with the too copious elaboration and deposition of the phosphates, is opium. It is matter of tradition that the great John Hunter used often to ejaculate, "Thank God for opium!" Under no circumstances are we more bound to give the beneficent Author of the universe thanks for the virtue he has infused into the poppy, than when we are dealing with the cases that now engage our attention. Opium is here worth all the rest of the *materia medica*. The medicine may be used with an assurance of answering expectation, if it be but exhibited in such doses as



will ensure its full effect, and this effect be kept up by repetition at regular intervals. There is probably no better form for prescription than the drug in its natural state, or in the shape of the watery extract made into a pill. The common tincture of the Pharmacopœia with the addition of a few drops of muriatic acid, may be selected if the liquid form be preferred. The recently introduced salts of morphia, (especially the muriate, which is the one I have principally prescribed,) which are such elegant and generally advantageous preparations for narcotizing the system, seem less adapted to the particular cases under consideration, owing to their tendency in certain irritable habits to act as diuretics, a property which I have several times observed them to possess, almost in as marked a degree as digitalis and cream of tartar. Far from destroying the appetite, and enfeebling the digestion, opium, prescribed in the cases which are distinguished by the elaboration of phosphatic urine, will often be found to increase both the relish for food and the powers of the stomach to digest it; a fact which admits of easy explanation.

When we have succeeded in quieting the excessive irritability of the system by opiates, and provided in some sort against its recurrence and continuance by the regulation of the diet, open bowels, &c., we may begin the use of such general tonics as the bark, calumbo, gentian, &c., the preparations of iron, and the mineral acids. With these may be very advantageously combined some one or other of the articles which experience has shown to possess a kind of specific influence in allaying irrita-



bility of the urinary organs, particularly the uva ursi, pareira brava, and alchemilla arvensis. An extract of the uva-ursi, combined with extract of hyoscyamus or opium, according to circumstances, has been strongly recommended by Dr. Prout.\* The Ferrum sesquichloridum of the last London Pharmacopœia, or its tincture, is an excellent chalybeate; and when the phosphatic diathesis can be obviously referred to affections of the urethra, prostate, or bladder, the ferrum ammonia-chloridum, or its tincture, may be substituted, and will be found an invaluable medicine.

As a means of securing all the benefit to be derived from medicinal treatment of any kind, the patient should, as speedily as possible, escape from the atmosphere of a populous city, and the depressing influence of confinement in the midst of a town, where an invalid ever feels his hard plight most keenly—where he sees himself a withering limb upon the tree of society, a mere spectator where he was used to be a busy actor. Removal to the country has often of itself the happiest influence in restoring vigour to the shattered frame, and once the length of being able to take gentle exercise, which should be attempted at as early a period as is consistent with prudence, in the enjoyment of the air and sunshine, and seeing the world in the troop of kind attendants round him, the invalid is far gone who does not discover that there is still something left that he can live for, something to desire that is within his reach, and to be thankful for when it is

\* Op. Cit. p. 185.



obtained. Let us never lose sight of the blessed influence of hope, not only on the mind but on the body, in the treatment of disease. The sentiment is one of those additions to the merely necessary in our constitution, and intended by the good Creator for our solace and support.



## CHAPTER IV.

MORBID STATES IN WHICH THE URINE CONTAINS IN SOLUTION OR AS PRECIPITATES CERTAIN PRINCIPLES WHICH DO NOT OCCUR IN THE HEALTHY SECRETION, BUT APPEAR TO BE DERIVED IMMEDIATELY FROM ONE OR OTHER OF THESE.

AMONG the many interesting discoveries due to the continual advances of modern chemistry, is the fact, that by peculiar treatment many long series of organic elements may be converted one into another. The first step has even been made in forming some of these by the direct combination of their constituent or ultimate elements. Urea, for instance, the highly azotized and distinguishing proximate principle of the urine, has actually been formed synthetically by the celebrated German chemist Woehler.

If we set out from this peculiar organic principle, the ultimate composition of which appears to be 46,65 nitrogen, 19,97 carbon, 6,65 hydrogen, and 26,65 oxygen, ( $N^2 C^2 H^4 O^2$ ), and suppose the proportions of nitrogen and hydrogen to be lessened, whilst those of carbon and oxygen are increased, we shall have lithic or uric acid produced,—33,37 nitrogen, 36,00 carbon, 2,36 hydrogen, 28,27 oxygen ( $N^4 C^5 H^4 O^3$ ). Again, if we suppose the nitrogen, carbon, and hydrogen, to remain as in lithic acid, but the quantity of oxygen to be diminished to the extent of one atom, we shall have the



lithic or uric oxide (xanthic oxide Marcet,) produced —( $N^4 C^5 H^4 O^2$ ). Farther, if the nitrogen and carbon fall short, whilst the hydrogen and oxygen increase in relative quantity, we have another element of morbid urine formed, namely, cystine, (cystic oxide, Wollaston,) as appears by the composition of this substance, 11.85 nitrogen, 29.88 carbon, 5.12 hydrogen, 53.15 oxygen, ( $N C^3 H^6 O^4$ .) Another very remarkable quaternary compound, occasionally met with in morbid urine, is carbonate of ammonia, for the presence of which we should, without the lights afforded us by chemistry, be greatly at a loss to account. But when we know that the elementary composition of urea is identical with that of the cyanate of ammonia; that if one atom of this substance and one atom of water come to decompose each other, which readily happens, and that the product is exactly one atom of *carbonate of ammonia*, we have no difficulty whatever in explaining the occurrence in the urine of the volatile alkali combined with carbonic acid.

Occasionally, again, two of the elements of urea part company, as it were, with the other two, and enter into certain binary combinations that are also now and then detected in the urine, either alone, or accidentally conjoined with bases which they have encountered in the fluid. Thus the nitrogen and carbon uniting and separating themselves from the hydrogen and oxygen, give rise to *cyanogen* or bicarburet of nitrogen; and it is no less remarkable than indisputable that compounds of the cyanic acid, other than the cyanate of ammonia already mentioned, such as the *ferro-cyanate of potash* and



even *hydrocyanic acid* in a free state, are sometimes met with in the urine. It farther happens not uncommonly, especially in certain febrile states of the system, that the nitrogen and oxygen select each other peculiarly, leaving out of the question the carbon and hydrogen, and form *nitric acid*, which, acting on the lithic acid, is the source of the compounds that have been described under the titles of the erythric and purpuric acids. Finally, if the nitrogen and hydrogen part company with the carbon and oxygen, and leave these last to unite very nearly in the proportions in which the former occurs in lithic acid, the latter in cystine, we have *oxalic acid* produced,—39.99 carbon, 53.33 oxygen,—an occasional and very formidable constituent of the urine in certain morbid states.

Under other circumstances, the kidney seems to fall short of the acidifying property it possesses as part of its distinguishing function, and then the radicals of the acids which the urine contains present themselves in an uncombined state. It is in this way, probably, that phosphorus now and then appears in solution in the urine, so that the fluid is seen to be luminous when emitted in the dark.

It is even possible that the albumen which often shows itself as a constituent of the urine, in a form of kidney disease that has lately attracted much attention, may be derived from the urea. Making urea the standard of comparison as before, if the relative proportion of nitrogen be considerably lessened, whilst the portions of hydrogen and especially of carbon are much increased, we have the elements of albumen,—15.56 nitrogen, 49.75 carbon,



8.77 hydrogen, 26.78 oxygen. In other cases the albuminous principle contained in the urine is unquestionably derived immediately from the blood, as is proved by the passage along with it of the fibrine red particles and other constituents of this vital fluid.

SECTION 1.—*Of the discharge of Urine which contains the lithic Oxide.*—LITHOXIDURIA.

THE existence of the calculus described by Dr. Marcet, under the name of the *Xanthic Oxide* calculus, was, in some sort, called in question by Berzelius,\* who insinuates that in all probability it was nothing more than uric acid modified by accidental admixture. The accuracy of our late distinguished countryman, and his discrimination in separating from other calculi the one he described as consisting of xanthic oxide, have, however, been fully confirmed by some very recent researches of Liebig and Woehler.† It was known that Professor Langenbeck, of Goettingen, had extracted a stone of this substance, the chemical nature of which had been either investigated imperfectly, or else had not been made known by Stromeyer, who had also examined it. The calculus, or rather the three-fourths of it which still remained, were at once, on a request to that effect, placed at the disposal of the eminent chemists named by Professor Langenbeck. They

\* *Chemie.* par Esslinger, tom. vii. p. 427.

† *Poggendorff's Annalen.* Bd. 41, 1836.



found its chemical history to correspond in every particular with the account given by Marcet, and by a very beautiful elementary analysis showed, that the constitution of the xanthic oxide was the same as that of lithic acid *minus one atom of oxygen*; that these two substances were in fact two oxides of the same radical, the formula of lithic acid being  $C^5 N^4 H^4 O^3$ , that of the xanthic oxide, which they of course designate with the greatest propriety lithic or uric oxide, being  $C^5 N^4 H^4 O^2$ .

I am not aware that the uric or lithic oxide has ever been distinguished either in solution or as a deposit from the urine; but if we have concretions of this substance formed in the kidney, undoubtedly we shall also, with due attention, detect it in the shape of a sediment in the urine; and the subject is mentioned here in order that attention may be drawn to the point.

The lithic oxide may be expected to occur, associated with deposits of the lithic acid. We have, in fact, but to suppose the kidney to fall somewhat short of its acidifying powers, to have the lithic oxide instead of the lithic acid (the *oxide* instead of the *acid* of urea) produced.

SECTION 2. *Of the discharge of Urine which contains Cystine (cystic oxide) in solution or as a deposit—*  
CYSTINURIA.

THE peculiar substance discovered and described by Dr. Wollaston as occasionally constituting urinary concretions, under the name of Cystic Oxide,



has been several times discovered in urine, in a state both of solution and mechanical suspension. Dr. Prout found the urine, in a case in which the formation of a cystic oxide calculus was going on to be secreted rather copiously, to have a specific gravity of from 1.020 to 1.022, and to exhibit a yellowish-green colour. It was faintly acid, and contained very little lithic acid and urea. Its surface by standing became covered with a greasy-looking film, which was cystic oxide. A copious pale precipitate was thrown down by the bicarbonate of ammonia, consisting of cystine and ammoniaco-magnesian phosphate. In a case met with by Dr. Venables,\* in which renal calculi of cystic oxide had been passed, the urine, voided in medium quantity, was of a greenish-yellow colour, and had a slightly saline taste. Its smell was very peculiar, like that of the sweet-briar mingled with a fetid urinous odour. It slightly reddened litmus. Its specific gravity was 1.022. It had an oily consistency, and was slightly turbid from holding an impalpable powder in suspension. I have, myself, lately detected this substance in a case in which there never had been any renal concretion passed, nor was there reason to suspect that any existed. My attention was arrested by the greenish-yellow colour of the urine, its peculiar smell, and its somewhat oily appearance when passed. It reddened litmus paper very slightly, if at all; was of sp. gravity 1.030; did not coagulate by heat or nitric acid, and by standing became opalescent after thirty-six hours from the

\* Journal of Science and the Arts, vol. xxix. Jan, 1830.



presence of a fine pulverulent matter, part of which was deposited. Acetic acid threw down a pretty copious brown precipitate, which, collected on a filter, was found to possess all the properties of cystine. This urine held a considerable quantity of the phosphatic salts in solution, which seems common; it showed no traces of lithic acid; but I could not discover that it was deficient in urea; although the three writers who have given any account of a urine in which cystine was contained, are agreed that it was deficient both in urea and lithic acid.\* The best reagents for discovering cystine in combination with alkalis are the acetic, citric, or tartaric acid; in each of which it is insoluble. The bicarbonate of ammonia immediately throws it down from its soluble combinations with potash and soda.

SECTION 3.—*Of the discharge of Urine, which contains the Purpuric acid, and its Salts.*—PORPHURIA.

WHEN pure nitric acid, diluted with five or six times its weight of water, is poured upon a quantity of pure lithic acid, and heat is applied, the lithic acid is dissolved with effervescence, and if it be in excess, nearly the whole of the nitric acid is decomposed, with the evolution of equal volumes of carbonic acid and azotic gas. The solution when examined is found to contain a new acid, described

\* Vide, Stromeyer in Ann. of Philos. N.S. vol. viii. p. 146; Prout, Inquiry, p. 166; Venables' Journal of Science and Art, Jan. 1830.



by Brugnatelli\* under the name of Erythric acid, and by Prout,† who investigated its qualities particularly and determined its elementary composition, under that of Purpuric acid, from the fine purple colour which its alkaline and some of its earthy salts possess.

The processes which take place in our laboratories appear occasionally to occur in the kidney. This, at least, was Dr. Prout's opinion; for he detected the nitric acid in the urine, in certain febrile states, and he ascribed the red colour of the sediments of febrile urine, and the pink hue of the sediment of hectic and dyspeptic urine, principally to the presence of a purpurate, generally the purpurate of ammonia, occasionally the purpurate of soda. The accuracy of this view of Prout was some time back called in question by Vogel, then by Frommherz and Gugert, and finally by Berzelius, who concluded from his experiments, that the red and pink colours of urinary sediments were not caused by the intermixture of a purpurate of any base, but by the presence either of the ordinary colouring matter of the urine, or of a peculiar animal matter, which dyed the deposits in the manner of lakes.‡ This conclusion has been verified to their own satisfaction, by the Messrs. Brett and Bird,§ who found pink urinary sediments in several cases to consist of the lithates of ammonia, soda, and lime, free lithic acid, and a trace of the earthy phosphates, tinted by

\* *Giornale di Fisica*, &c. tom. xi. p. 177.

† *Philos. Trans.* 1818, p. 420, and *Med. Chir. Trans.* vol. ix.

‡ *Chimie par Esslinger*, tom. vii.

§ *Lond. Med. Gaz.* vol. xiv. p. 600.



a peculiar colouring matter, which differed in many essential particulars from purpuric acid, or any of the alkaline purpurates. Messrs. Vigla and Quevenne,\* again, found the "rose-coloured sediment of an acid urine" to consist almost entirely of lithic acid, with a little animal matter, probably of the nature of mucus, (the peculiar colouring matter,) some phosphate of lime, and some soda, which was undoubtedly united in the first instance to the lithic acid. Organic chemistry forms the Low-Countries of the science,—the proper theatre of difference and dispute.

Dr. Prout is too able a chemist, and too scrupulous an observer, not to have had good grounds for what he has published on this subject. The other names I have quoted are also warranty for the soundness of the premises upon which what is advanced is stated. We may conclude, therefore, that in some cases the purpurates are in all probability the chief colouring matters of urinary sediments, whilst in others the tints presented are undoubtedly due to the dyeing powers of certain colouring principles, of which several kinds, having various hues, are elaborated in different morbid states of the urine; of these we shall have occasion to speak by and by.

The depth of tint of the sediment would seem to depend in each case on the relative proportion in which the new or adventitious colouring principle of the urine, whatever its nature, and that which is proper to the urine, occur together. When both of these matters are abundant, the precipitate is of

\* L'Experience, No. 13.



a deep dusky or rich red ; where the new principle predominates, and the proper one is in moderate quantity or deficient, the deposite is of a rose or pink hue of various shades of intensity. Sometimes the accidental dye is present in the urine with little or no sediment,—conclusive evidence that in this case it is not a purpurate which gives the tint, all the purpurates being extremely insoluble salts.\* The urine is then observed to be itself of a fine pink colour when passed, and to remain so long after it has cooled.

The dusky red or lateritious sediment, which recent observations have shown generally to consist of lithic acid combined with an animal colouring matter, is the well-known herald of the abatement of febrile and inflammatory action in the system, and is always looked for anxiously in cases of danger by the attentive pathologist. The depth of tint of the sediment let fall under such circumstances, has even been observed to afford a kind of criterion of the intensity of the symptoms, the deep dusky red sediment showing itself during and especially on the abatement of high inflammatory fever in vigorous subjects ; the paler coloured and fine pink precipitates being associated with action of a less energetic kind, with the low fever of local organic disease, or hectic, as it is called.

A purpuric state of the urine (without regard to the nature of the colouring principle) in a less marked degree appears to be almost habitual to certain individuals of excitable and delicate constitution, among whom slight errors of diet, exposure to cold,

\* Berzelius, *op. cit.* vol. vii.



and even an ungenial state of the atmosphere, though no chill has been suffered, are observed to produce it. Probably the purest specimens of the bright pink sediment that are ever met with, are deposited from the urine of some dropsical subjects, and of those who are labouring under chronic visceral affections especially of the liver.\* There seems no reason, however, to conclude that visceral diseases are present as the causes of these pink sediments in every instance in which they occur; on the contrary, they are frequently observed accidentally in cases where there is no room even to suspect the existence of organic disease, and in which none certainly exists.

Occurring occasionally and in conjunction with obvious causes of general excitement, or of particular local derangement, a purpuric state of the urinary secretion is to be regarded as of just as much but not of more importance than accidental lithic states of this product. When it presents itself in a high degree, however, and habitually for any length of time, there are just grounds of alarm; a deranged condition of the general functions, depending in all probability on some latent organic mischief of a local nature, that may ultimately bring the patient's life into jeopardy, being indicated.

With regard to the treatment of those states in which the urine lets fall rose-coloured sediments, or continues of a fine pink hue without depositing, little need be said. The indications of cure are general and particular. In *general*, when the accom-

\* Prout, l. c. p. 125.



panying symptoms are those of febrile excitement, our attention must be mainly directed to these. When they have the character which we observe in the lithic diathesis, our plan of treatment would be adopted in harmony with the views exposed in the section on that subject in this work ; the diet would be regulated, the food being made to consist of farinaceous articles, and meats of easy digestion ; and the bowels would be freely opened with a dose of calomel and rhubarb, followed up by a neutral salt in infusion of senna. An alterative dose of blue pill or Plummer's pill might be prescribed at intervals, and febrile excitement allayed, and the renal secretion improved by the daily use of the neutral citrate of potash with a very minute addition of tartrate of antimony. To the saline medicine the tincture of hyoscyamus is sometimes added with advantage in irritable systems ; but this medicine I have often observed to produce more dryness of tongue, and for its sedative effects to be followed by a higher degree of subsequent fever, than are induced in many cases even by opium. Anodynes as a general rule are not to be insisted on.

In *particular*, it must be our business to discover whether any and which of the viscera or internal organs suffer, and also to distinguish the nature of the individual affection, to which appropriate treatment should of course be directed. The glandular system especially must be narrowly looked to, and its functions where faulty set to rights, or the attempt at least made to do so. When the digestive functions are disordered, our sheet-anchor will be regulated diet, proper exercise, and country



air. Violent medicine of every kind will do mischief.

The elaboration of a peculiar pink colouring matter would not appear to be connected with a state of things necessarily formidable in itself; so that when we have secured the proper performance of the various abdominal functions, we have probably done all that is really important in the case. I believe, however, that the formation of pink-coloured lithic deposits should always be held worthy of particular attention; I have observed at least one instance in which a deposit of this kind formed the nucleus of a stone in the bladder, and there is a figure extant of another.\* Every state of urine that is liable to be followed by such a disease as calculus cannot be held of too much importance.

I have spoken of pink sediments and rose-coloured urine under a separate head, in deference to Dr. Prout. The whole section might, however, with great propriety, have been placed in the one which treats of modifications of the colouring matter of the urine. The pink colouring matter will, in all probability, be found to constitute a mere variety of that by which the urine is occasionally tinted of a deep brown, of a green, a blue, or a black colour.

SECTION 4.—*Of the discharge of Urine which contains a Salt of the Oxalic acid,—OXALURIA.*

LITHIC acid, under the prolonged action of nitric acid and of chlorine, is partly converted into oxalic

\* In Brugnatelli *Litologia Umana*, No. XXXIV.



acid. Liebig and Woehler found that when lithic acid was boiled with the superoxide of lead it was resolved into urea, alantoin, carbonic acid, and oxalic acid. I have besides shown in the general remarks introductory to the different sections of the present chapter, that the proportion of carbon which exists in lithic acid, united to the proportion of oxygen which occurs in cystine, form as nearly as may be the combining quantities of the elements of oxalic acid. I do not, therefore, find any peculiar difficulty in accounting for the occasional existence of oxalic acid as a product of the renal secretion. It does not seem necessary to suppose that this substance should be introduced among the ingesta: its elements exist in urine, and the chemic art of the kidney may, and undoubtedly does, suffice at times to combine them into the compound in question. Nevertheless it remains true that certain articles of food, which are pretty generally used in some countries, contain oxalic acid; and the experiments of Woehler\* have put it beyond doubt that it is one of the few acids that make their way into the torrent of the circulation, and are then eliminated both free and combined with a base from the system by the kidney. The urine contained in the bladder of a dog, killed eight hours after having had two drams of oxalic acid mixed with a quantity of meat and bread given to it, was found to deposite a precipitate on cooling, which bore an exact resemblance to that formed by the triple phosphate. The clear urine mixed with a little of a solution of nitrate of lime gave a

\* Uebergang von Materien in den Harn, in Zeitsch. fuer Physiol. B. 1, S. 139.



farther deposite, having the same external characters. On examination both of the deposites were found to consist of oxalate of lime. The articles of food used by man which contain oxalic acid in largest quantity are the sorrel, (*Rumex acetosa*,) so much eaten by all classes in France, and consumed to some extent by the upper ranks in England as an agreeable vegetable; the tomata, (*Solanum lycopersicum*,) of which many individuals are passionately fond; and the leaf-stalk of the rhubarb plant, (*Rheum palmatum*,) which in the spring and early summer months is consumed in large quantities made into pies and puddings by the community at large in England.

It is only lately that we have any accurate knowledge of the oxalate of lime occurring as a deposite from the urine. Dr. Prout, indeed, mentions one case in which he had observed this salt to be precipitated from the urine;\* but for by far the most complete account we have of this circumstance, we are indebted to Mr. Henry Brett, who, among his excellent observations on urinary deposites, contained in the seventeenth volume of the London Medical Gazette, has published the particulars of the case in which it occurred. The subject of observation was a man 35 years of age, who had been employed of late in sedentary occupations. Somewhat more than twelve years before, he had attempted to raise a heavy weight in each hand in a constrained position, and had felt something give way in his loins, and then passed bloody urine for

\* Inquiry, p. 153.



several months. Up to the time of observation he continued subject, upon making any particular exertion, to a discharge of bloody mucus in his urine, mixed with an amorphous deposite. In November, 1835, he had these symptoms in an unusually violent degree, attended with extreme pain in the lumbar region, but none in the course of the ureters. The urine at this time was of a dark reddish-brown colour and opaque; its specific gravity remarkably high, 1.060, and showed an acid reaction which it did not lose for several days. Left at rest for twenty hours it let fall a deposite of a greyish-brown colour, the supernatant liquid still continuing somewhat turbid. Filtered, the fluid that passed through was of a rich claret colour, and perfectly transparent. The insoluble part detained by the filter after being repeatedly washed was still of a greyish-brown colour. It dissolved readily in dilute nitric acid assisted by heat, the solution giving no indication of lithic acid or a lithate. Incinerated, it became blackened and passed rapidly into a bulky white ash, which was soluble in muriatic acid with disengagement of carbonic acid. This acid solution boiled and then treated with an excess of ammonia, remained clear; a little oxalate of ammonia, however, instantly caused a copious precipitate. The clear fluid was found to contain some albumen, freed from which by boiling and filtration it did not differ from healthy urine in colour.

Unquestionably deposits of the oxalate of lime will be found to occur much more frequently than they have yet been imagined to do, when the urine comes to be more a matter of enlightened attention



than it is at present, and when the members of the profession at large think it worth while to call up the few chemical principles, and the small share of manual dexterity required to examine the urine of their patients for themselves. Unmingled with other substances, as in the case just referred to, a deposit of oxalate of lime from the urine is probably a rare occurrence; there can be little doubt, however, but that a portion of oxalate of lime frequently occurs among the number of heterogeneous matters comprised in amorphous urinary sediments. Most of those who have been in the habit of examining the nature of these deposits chemically, have detected it from time to time, in company especially with the amorphous lithic acid sediment; though it would appear to have been frequently confounded with the lithate of lime, from which it may always be distinguished by its complete insolubility in boiling water, which takes up the lithate of lime readily.

The circumstances that may be supposed likely to lead to the state of urine in which the oxalic acid is thrown down in combination with an earthy base, and that consisting of lime, are in all probability intimately connected with those which lead to the deposition of lithic acid.

The medical *treatment*, in such a state of things, would be conducted on the same general principles which guide us in treating the lithic diathesis. The antiphlogistic regimen in moderation, alterative doses of chloride of mercury or of blue pill, occasional aperients, in which a neutral purgative salt of a vegetable acid formed an ingredient, and a course of the alkaline bicarbonates, continued for some



time would be the proper medicines. Should an oxalic deposit from the urine be observed to take place whilst any of the vegetables which contain oxalic acid were habitually used as food, it would of course be imperative on the party whose urine presented the peculiarity in question, to give up that article immediately. I shall have occasion to mention several instances, when I come to speak of renal calculus, in which concretions of oxalate of lime were actually formed in the pelvis of the kidney during the long continued use of sorrel as an article of diet.

SECTION 5.—*Of the discharge of Urine, which contains Albumen (as a derivative from Urea?)*

ALBUMEN is familiarly known to occur as an occasional accidental constituent of the urine. This happens under at least a twofold variety of circumstances, and with a tissue of local and general symptoms so dissimilar in themselves and of so opposite a tendency, that it seems impossible to doubt but the pathological conditions accompanying each must be essentially different. In one form of albuminous urine, the symptoms are always serious and often irresistibly fatal in their tendency; in the other they are by no means formidable, and do not seem necessarily to interfere with the prospect of long life. The first of these forms of albuminous urine appears to be connected with a positive alteration in the structure of the kidney, or with a state the tendency of which is to end in this, which has recently attracted much



attention both in this country and on the continent, as accompanying the general dropsical condition of the cellular membrane and serous cavities, which is characterized as anasarca. The second form of albuminous urine does not appear to be associated with any kind of change in the organization of the kidney, and may be viewed as depending on functional derangement of this important organ; the derangement probably consisting in a laxity of vessels by which a portion of the serum of the blood escapes along with the fluid the elaboration of which constitutes the proper office of the kidney.

That there are two essentially different pathological conditions accompanied with an albuminous state of the urine appears farther in this: that in the one and more formidable disease the composition of the urine is materially altered—its distinguishing ingredients urea and uric acid are either entirely wanting or are greatly diminished in quantity; in the other and less important malady the constitution of the urine is not essentially changed, it is merely loaded with albumen,—it contains all the principles that are proper to it as urine, and one in addition. Whilst in the one disease, therefore, there is a manifest ratio between the quantity of urea and of albumen contained in the urine, the urea diminishing in amount in the same proportion as the albumen increases; in the other the quantity of urea would not appear to be influenced in any determinate manner by the presence of the albumen, even when the urine is so much loaded with this substance in one of its modifications as to form a tremulous and pretty consistent jelly on cooling,—the



quantity of urea present may not differ much from the standard of health; this never happens in the other which I have spoken of as the more formidable disease; when but a few flocculi of albumen are thrown down by heat or nitric acid, the quantity of urea is notably diminished; and when the albumen becomes abundant, it is no longer to be discovered. Another important difference presented by the urine in those states in which it is loaded with albumen occurs in the specific gravity of the fluid. In the morbid state which depends on organic disease of the kidney, the sp. gr. is always lessened—the mean of a great number of cases investigated by Dr. Gregory, gives no higher a figure than 1.012.\* When the impregnation of albumen is accidental, as in cases of anasarca occurring after scarlet fever, and in the course of different other acute diseases, or habitual as among the natives of the Isle of France, and others, the sp. gr. does not differ essentially from that of healthy urine.

All we know would, therefore, lead us to infer, that in the dangerous form of albuminous urine, either the formation of urea, wherever this takes place, was suspended, that it was not duly separated from the blood by the kidney, or that in the process of elimination, it had a large accession of carbon and of the elements of water and so became albumen, just as albumen, the epitome and resulting principle of all the heterogeneous matters taken into the body by animals as food, must lose a large quantity of carbon and of the elements of water, in order to be converted into urea and uric acid, the representatives of the effete elements of

\* Edinb. Med. and Surg. Journ. vol. xxxix.



nutrition in animals from the highest to the lowest. We know that urea is not formed by the kidney, but only abstracted from the blood by its agency; and the presence of urea in the dropsical fluids of those who have been passing albuminous urine, indicates that this substance is produced in the body as usual. The conclusion would therefore be, that the urea was imperfectly and but partially withdrawn from the system in these cases, the elements of that which was abstracted appearing in the shape of albumen. May a defect in the decarbonizing process of the economy have anything to do with the ætiology of dropsies with albuminous urine? In the other form of albuminous urine, we can only conclude that the albumen of the blood finds its way into the urine, probably accidentally, by the ready strainer of the kidney. In the one case the processes of nutrition are obviously implicated, and the health suffers accordingly—we have dropsical effusions, emaciation, hectic, and death; in the other the system only loses so much of one, and that not the most important element of its vital fluid, and is always at work to repair the drain, just as it is in cases of bleeding hemorrhoids, &c.

In the form of albuminous urine which is attended with dropsical effusions, emaciation, &c. we have had ample opportunity of investigating the morbid states of the internal organs with which it is connected; and all observers, from Dr. Bright, to whom belongs the whole honour of the discovery, downwards, concur in viewing it as dependent on a granular and organically altered condition of the kidney. In the other form of the affection, which is unaccompanied with general constitutional symp-



toms, I am not aware that a single examination of the kidneys after death has yet been made, such an occasion not having occurred.

In the present state of our knowledge, I do not feel authorised to pursue this subject further in this place. It will be found treated generally in the chapter on those morbid states in which principles belonging to the blood are contained in the urine, to which I beg to refer.

SECTION 6.—*Of the discharge of Urine which contains the Elements of Urea in the shape of Carbonate of Ammonia.*

In the general introduction to the different sections of this chapter, I have spoken of the fact, that the elements of one atom of urea combining with those of one atom of water constitute one atom of carbonate of ammonia. A combination of this kind, implying decomposition both of urea and water, is familiarly known to occur very readily under the influence of increased temperature. We have in fact but to expose healthy urine to a heat somewhat above that at which water boils, or to allow the fluid to stand for some length of time exposed to the air, to have a large quantity of carbonate of ammonia evolved. Now it is no less curious than indubitable that the decomposition of urea in contact with water which we effect in these ways in our laboratories, occasionally takes place in the kidney, in which the urine is formed. The ammoniacal smell of the urine of patients labouring



under a variety of diseases, particularly continued fevers of bad character, had been frequently observed and commented on; but this condition of the renal secretion was always ascribed to putrefactive decomposition of the urine in consequence of long retention in the bladder, or of a morbid state of that receptacle. It was Dr. Graves, of Dublin, I believe, who first demonstrated that the carbonate of ammonia occasionally contained in the urine could not always be ascribed to either of these circumstances, but that it was eliminated directly by the kidney, and in virtue of a process different from that which is properly designated putrefactive. The first instance in which ammoniacal urine was observed by Dr. Graves, occurred in a patient labouring under bad continued fever with petechiæ. The urine abstracted from the bladder, which showed no signs of disease, within two hours after it had been completely emptied, was found strongly ammoniacal.\* The second case was that of a powerful labourer, who fell dangerously ill of fever and anasarca, from having worked up to his knees in water during cold weather. The urine here was of a pale straw colour, and deposited the phosphatic salts on standing; it smelt strongly of ammonia, and effervesced briskly on the addition of an acid, when a sample of it, obtained from the bladder within so short a time as half an hour after this viscus had been completely emptied, was examined. This patient died. The bladder was found perfectly healthy. The kidneys were enlarged, and turgid with blood.

\* Trans. of the K. and Q. Coll. of Phys. Dubl. vol iv.



The liver was much diseased. The urine was without a trace of urea.\* M. Nysten, long before Dr. Graves wrote, quotes a case of ascites in which the urine, of a deep red colour and turgid when passed, contained a large quantity of carbonate of ammonia, but not a particle of urea, this substance having apparently been resolved into the volatile alkali.† In two cases which were under treatment for the honey diabetes in the Royal Infirmary of Glasgow by means of animal food and opium, the urine which had been highly ureous, became suddenly alkaline, and was found to contain a large quantity of ammonia, but no urea.‡ There can be no doubt but that these are other and very interesting cases of the chemical powers of the kidney; the elementary constituents of urea, instead of existing in the state of combination which produces this substance, are here brought together in such a manner as to constitute the compound carbonate of ammonia.

In certain irritable states of the system, when the urine is secreted copiously, and with a disposition to throw down the phosphatic salts, circumstances in which the fluid is often neutral, or acid only in the very slightest degree, any additional irritation, such as that produced by the introduction of a bougie or catheter into the urethra, will often suffice to turn it positively alkaline.

The state of the urine in typhoid fever, with regard especially to its acid or alkaline reaction, is often ad-

\* *Dubl. Journal*, vol. vi. p. 69.

† *Rech. de Physiologie, &c.*, sup. cit. Paris, 1811.

‡ Macgregor, in *Lond. Med. Gaz.* vol. xx.



vantageously consulted as an index of the progress of the disease. In the earlier stages the urine is acid, and as the disease advances it becomes neutral, and then alkaline ; as the disease declines, on the contrary, the urine from alkaline becomes neutral, and then acid. The return to the acid state is always a favourable sign, and may sometimes enable us to give a flattering prognosis when there is nothing else in the state of the patient that betokens improvement.

Ammoniacal urine is plainly a consequence of other primary and preceding deranged conditions of the system in general, or of the chylopoetic organs in particular. The treatment of such a state is, therefore, always secondary and subordinate to that of the primary affection with which it is connected. The principal error committed regarding states in which the urine is ammoniacal, is this : that they are generally held dependent on ordinary putrefactive decomposition of the urine occurring during its sojourn in the urinary bladder. In certain chronic diseases of the bladder we have indeed ammoniacal urine of the most offensive description evacuated. There, the ammonia seems really due to rapid decomposition of the urine effected by the putrefactive ferment of a diseased vesical mucus. In many of these cases if the bladder be carefully washed out as a preliminary, urine may be withdrawn by a clean catheter, that will show acid reaction. The urine, therefore, is not secreted with the elements of its distinguishing constituents in new and peculiar combinations, as I believe it to be, when it presents itself charged with carbonate of ammonia in the course of typhoid fever, scorbutus, &c. Healthy acid urine uninocu-



lated by such a ferment, is a fluid that is by no means greatly disposed to run into putrefaction; we often see it withdrawn in cases of retention, after having been pent up in the bladder for two or three days, perfectly unchanged; and I have kept the highly acid urine of a patient labouring under calculus of the kidney in an open vessel for more than a fortnight, in a temperature varying between 50° and 65° F. without its undergoing any change. The ammoniacal urine which is the product of a new combination among the elements of urea at the moment of its formation, is not particularly and otherwise offensive—it has the smell of ammonia super-added to its own urinous odour. That which results from putrefactive decomposition is fetid and disgusting in the last degree.

SECTION 7.—*Of the discharge of Urine containing the Hydrocyanic and Ferrocyanic Acids.*

It has happened in more than one instance in which a salt of iron had either been taken in the way of medicine or accidentally, that the urine voided has presented a blue colour, from containing the compound of ferrocyanic acid and iron which is commonly called prussian blue. Thus Dr. William Batt, of Genoa,\* observed in a girl who had been taking six grains of the *æthiops martialis* or black oxide of iron daily for a few weeks, on account of some stomach complaints, that the urine evacuated was of a blue

\* *De Urina Sedimentum cœruleum demittente*, 8vo. Genœ, 1809.



colour. The fluid collected and set aside deposited upon the bottom and sides of the recipient a quantity of sediment of a beautiful blue colour. This sediment analysed by Professor Mojon was found to consist of the prussiate of iron. M. Julia Fontanelle\* has given the histories of two cases in which urine was discharged having a blue colour. The first occurred in the person of an old man aged 82, who, on the second day of an illness caused by an acute affection of the urinary passages, began to pass urine which was thick and ropy, and of a deep blue colour. The ropiness was owing to the presence of a plentiful admixture of albumen or gelatine, the colour to that of the hydrocyanate of iron combined probably with soda. This patient had taken no preparation of iron. But as oxide of iron has been shown to be a constant constituent of urinary sediments deposited during febrile states of the system, its presence in the colouring compound is readily accounted for. The second case happened in a lad of 15 who was suffering from violent colic, in consequence of having swallowed a quantity of ink by mistake. The urine when first voided was of a greenish-blue colour, which after the lapse of an hour deepened into a rich blue. The tint became still more intense (probably from an additional quantity of precipitate being thrown down) when a few drops of the persulphate of iron were added to the urine. The sediment of the urine was found to have all the properties of prussian blue. In a case

\* Journ. de Chimie Med. tom. i. and Archiv. gen. de Médecine, tom. ii. p. 105, 1823.



detailed by M. Cantin,\* the urine discharged resembled a solution of indigo in sulphuric acid diluted with water. This urine was found on examination to contain the saccharine matter of diabetes, free hydrocyanic acid, and the prussiate of iron. In M. Dranty's† "case of blue urine," the urine of a young man labouring under influenza, was of a deep blue colour, and on cooling deposited a blue sediment which was ascertained to consist of ferrocyanate of iron and potash.

The urine is generally stated in these cases to have been thick and ropy, and to have contained albumen or gelatine. In one case it contained sugar. Whether its usual elements were present in their ordinary proportions is not anywhere particularly mentioned. Only in the last case referred to, that namely of M. Dranty, is it stated to have shown traces of urea.

It is pretty certain that the presence of cyanic acid in these cases was only discovered in consequence of its having accidentally met with iron, by combining with which a compound was formed, the peculiar colour of which was sure to attract attention. There is every reason to believe that the cyanic or hydrocyanic acid may often exist in urine, and pass unsuspected. One instance indeed and only one so far as I am aware is recorded, in which prussic acid, free and uncombined, as I read the various reports of the case, has been detected in the urine. This instance occurred to the distinguished

\* Journ. de Chimie Med. tom. ix. p. 104.

† Ibid. 2nd Series, tom. iii.



Italian chemist Brugnatelli.\* The patient who was the subject of the observation, was affected with dropsy, (an *ascites*, I believe, from disease of the liver,) and the urine contained almost no urea. In M. Cantin's case, free hydrocyanic acid was also ascertained to be present, along with the compound of this acid and iron.

There can be little doubt but that the urine, were it properly examined, would be found to contain prussic acid in a variety of morbid conditions of the general system. Hydrocyanic acid is a product of the destructive distillation of animal matters generally, of blood and lithic acid in particular; and we know enough of the chemic powers of the kidney to warrant our admitting its ability upon occasion to separate the elements of the hydrated cyanate of ammonia, or urea, combined as cyanic acid and water, just as they are occasionally eliminated in the shape of bicarbonate of ammonia.

I am not aware that the presence of hydrocyanic acid or of the prussiate of iron in the urine has been attended with any peculiar consequences. Dr. Batt's patient did well. So did both the cases seen by M. Julia. The urine in the cases generally, however, seems to have presented other evidence of being in a morbid state, and in some of them at least, was undoubtedly connected with constitutional derangement, probably with organic lesion, that would have received the most careful consideration from

\* I have searched in vain for a reference to the original record of the case by Brugnatelli. Almost the only place I have not looked into in the hopes of finding its history, is the Journal edited by him, I think at Pisa, in 4 vols. 8vo. 1791-2.



an enlightened pathologist. The albuminous, or as they are sometimes improperly styled, gelatinous states of the urine, point to the existence, in some cases, of inflammatory action in the system, a circumstance which is also farther proclaimed by the plentiful traces of iron encountered, a substance only met with in quantity in the lateritious sediments of inflammatory and febrile urine. These considerations taken in conjunction with every other circumstance would influence, and probably to a certain extent guide, our mode of treating such cases.

For an account of the secretion of urine of a blue colour, depending on another cause than the presence of a combination of hydrocyanic acid with iron, the reader is referred to the Section of this Chapter which treats of modifications of the colouring principle of the urine, or of urine presenting abnormal and remarkable varieties of colour.

SECTION 8.—*Of the discharge of Urine containing Carbonate of Lime in solution or as a deposite.*

THE carbonate of lime, although its elements exist in the urine, and it forms an occasional constituent of urinary calculi, has not yet, so far as I know, been observed either in solution or as a deposite in the urine of man. The urine of many of the lower animals, indeed, especially the herbiferous, contains it in abundance. And that it occurs at times in that of the human subject, I do not doubt; al-



though, held in solution by an excess of carbonic acid, which also aids in keeping the phosphatic salts dissolved, or disguised from intimate admixture with these and other precipitates, I imagine it must always be detected with difficulty. Small renal or urinary calculi composed of nearly pure carbonate of lime have been observed by Brugnatelli\* and others; and there is a case related by Mr. Howship,† in which the pelvis of one kidney, greatly enlarged, was found full of a white pultaceous mass, which Mr. Brande found to consist of carbonate of lime mixed with an animal matter.

SECTION 9.—*Of the discharge of Urine which is luminous or phosphorescent.*—PHOSPHORURIA.

IF the kidney generally exerts an acidifying influence upon certain bases or elements subjected to its power, it seems also occasionally to fall short of its due effect in this direction. The older chemists used to extract phosphorus from urine by decomposing the phosphoric acid which it contains abundantly in combination with a variety of bases. From some cases that have occurred, it would seem that the painful process they followed might have been spared, and that a subject passing luminous urine might have served them instead of furnace and alembic. There are actually several instances on record, in which the urine has been voided di-

\* Litologia Umana.

† On Diseases of the Urinary Organs, p. 7, 8vo. Lond. 1816.



rectly from the bladder, either generally luminous, or having luminous points intermingled with it. Thus : Dr. Jurine,\* then in his usual health, whilst making water one dark night in a corner, observed that his urine bore numerous shining points along with it in its current. The boards down which it flowed, and the leaves upon which it fell, also glimmered with many luminous particles or spots the size of a small lentil. The light continued for about thirty seconds and then disappeared. To make sure that the luminous points he observed were voided with his urine, the Doctor passed a little of it into the palm of his hand, and in this he observed several of them floating about. He closed his hand and hurried home to examine the small quantity of fluid he could carry in this way ; but even with the assistance of a magnifier he could discover nothing. Doctor Jurine was living in his usual temperate way when this happened, and though he was on the watch for a recurrence of such a phenomenon, he did not perceive his urine to become phosphorescent for a long time. At the interval of a year, however, the same thing happened again.†

Dr. Guyton,‡ of Autun, on making water one evening in the end of November or beginning of December, observed with much surprise that his urine, at the point where the stream impinged upon the wall, became luminous, and shed a soft light, which was strong in proportion to the force with which it was projected. The stream from the body to the

\* Recueil Period. de Sedillot, tom. xlviii. p. 48.

† Bibloth. Med. Nov. 1813.

‡ Guyton-Morveau, in Ann. de Chimie, tom. lxxxix. p. 182.



wall was not luminous; neither was that which trickled down the wall, nor did it contain any shining points as in Dr. Jurine's case. M. Guyton felt no heat or irritation of the urinary passages, and was in perfect health at the time the occurrence in question happened. M. Guyton-Morveau, the distinguished chemist, who reports this case, supposes that the phosphorus to which the phenomenon is to be ascribed, may exist in combination with nitrogen. The phosphuret of nitrogen brought into contact with air gives out light, and suffers a kind of slow combustion.

The celebrated M. Pictet of Geneva, is also said to have observed his urine to be luminous upon one occasion.\* Dr. S. Reisel† is another and older authority for the occurrence of luminous urine. Making water one night, he was astonished to find himself voiding a stream of luminous fluid. On communicating with his learned and observing friends, he found that Dr. L. Pettenkover had noticed the same thing in his own person, after indulging in somewhat liberal potations of beer.

These are certainly curious, and in a physiological point of view, interesting facts, the authenticity of which there is no reason to question. They probably occur more frequently than is imagined; a few men of science have hitherto in their own persons offered the only examples that are recorded. These were, we may presume, temperate men, as men who labour with their minds usually are. Dr.

\* Jurine, in *Bibliothèque Med.* Nov. 1813.

† *Miscellan. Acad. Natur. Curios.* Dec. 1. An. 6 and 7, p. 280.



Pettenkover, indeed, owns to having made a sacrifice to the jolly god on the occasion in which his urine became luminous. The following is a question I should like to see particularly answered:—In what state is the urine among habitual drunkards, among those corpulent dram-drinkers, who might be held good subjects for the occurrence of that strange phenomenon, spontaneous combustion?—The breath, and even the whole person of these individuals often smell very decidedly of phosphorus. Is it possible that the phosphorus, which is commonly eliminated in such quantity by the kidney in combination with oxygen as phosphoric acid, is not duly discharged? that the body becomes as it were a sponge filled with an oily solution of phosphorus, in which combustion once begun may go on at a temperature not high enough in every instance to char, or at all events to ignite, vegetable substances, just as we see a stick of phosphorus slowly consumed by proper combustion, when it is exposed to the air, yet without setting fire to the paper, &c. in which it may chance to be wrapped?

SECTION 10.—*Of the discharge of Urine of various abnormal and remarkable colours.*

THE proper tint of healthy urine is a shade of citrine passing into a yellowish-brown, of various degrees of intensity. The properties of the principle upon which the colour of the urine depends are probably less familiarly known, and have been less carefully studied than those of any of the other



constituents of urine. It is even doubtful whether chemists have succeeded in isolating the colouring principle of the urine, and consequently whether it has ever been examined free from foreign admixture.

In the present state of our knowledge it is impossible to say positively whether the principles which are occasionally found tinging the urine of a variety of colours different from the shades of yellow and brown which are proper to it, are derivatives from and modifications of the ordinary colouring principle, or are to be held as new and accidental products of the economy eliminated by the kidney.

I have already had occasion to speak of the rosy red urine, and of the pink sediments which are now and then met with in the course of practice, and have shown that the colouring principle in these cases depended in all probability on the presence of two different substances, purpuric acid, and a peculiar animal matter of doubtful nature. Again, when we have the elements of urea separated by the kidney in the form of hydrocyanic acid, and this substance encounters a salt of iron, we have the urine of a deep blue colour, and letting fall a precipitate of prussian blue. The phosphate of iron has also been observed in one instance to be developed in a portion of febrile urine, which had been set aside for examination, and to colour the sediment in points of a fine blue colour.\*

When the colour of abnormally tinted urine de-

\* Angilini, in *Configliachi e Brugnatelli, Giornale*, tom. xviii. p. 388.



pend on the presence of an alkaline purpurate, for a cyanate or phosphate of iron, we conceive the colouring matters developed at the expense, or in consequence of the decomposition, of one or other of the ordinary ingredients of the urine. But instances of red, blue, green, and black urine have occasionally been observed, the peculiar colour of which could not be referred to the existence of any purpurate, or of any combination of iron with the cyanic or phosphoric acid. Of this description appear to have been the varieties of urine observed by many of the ancient physicians, and particularly described by Actuarius, who flourished towards the end of the thirteenth century, in his work "*De Urinis*,"\* under the titles of *Urinæ venetæ, lividæ et nigræ*. The kind of urine characterized as *Urina veneta*, appears to have been of a slate-gray colour, for the tint designated by the epithet he informs us may be imitated by mixing equal parts of ink and white lead together.† The word *venetus* was afterwards used however to signify a deep blue. We thus find Janus Plancus, in a letter, *De Urina veneta*,‡ describing the case of a man 60 years of age, who had suffered for two years from dysury and symptoms of calculus, but who was at this time affected with typhoid fever, under which he finally sank and died. On the third day of his confinement with his last illness, the urine of this patient was observed to deposit a quantity of sediment of a deep blue colour like ultramarine or prussian blue, which

\* First published in a Latin translation in 1519, at Venice.

† *De differentiis Urinarum*, cap. viii.

‡ *Commentarii Instituti Bononiensis*, ad Ann. 1767



could readily be collected on filtering paper. This blue state of the urine continued for three days; the urine then assumed a sub-virid appearance, smelt strongly of ammonia, and let fall a deposit which, collected on a filter, bore a close resemblance to Massiline verdigris. During the last three days of the patient's life, the urine being passed involuntarily could not be collected; but it stained the linen of his bed of a deep blue colour, and evidently contained a sediment of the kind it had formerly deposited. There was no chemical examination of the urine in this case, and it is possible that it may belong to and ought to have been mentioned in the category of blue urines from the presence of the ferrocyanate of iron.

The recent researches of Marcet, Prout, and Braconnot have, however, placed it beyond doubt that some deep brown or black, and blue coloured urines owe their peculiar tint to the presence of a new proximate principle, which with reference to a dark brown or black urine was spoken of under the title of *Melanic acid* by Dr. Prout, and by Braconnot under that of *Melanourine*. In giving the chemical history of a blue urine, the last-mentioned distinguished chemist speaks of the colouring matter under the name of *Cyanourine*.

Cases of black urine are rare. Dr. Marcet had only met with a single instance of the kind in his practice up to the period at which he encountered the second, of which he has left us an ample and interesting record in his "Account of a singular variety of urine which turned black soon after being



voided.”\* The first case occurred in the person of a young female subject to febrile and hysterical attacks, during which the urine assumed a deep purplish brown or black colour. The second case presented itself in the practice of the late Dr. Babington. The subject of it was a child seventeen months old, whose urine from the time of his birth had been observed to stain his napkins of a dark purple colour. This circumstance naturally excited considerable alarm at first; but the infant thriving, the fears of the parents gradually subsided, and the peculiar urine seems to have been at length regarded rather as a matter of curiosity than as of any importance with reference to the health of the child. At nine months of age, the urine was observed when first discharged to be clear and almost colourless, but gradually to acquire a dark colour like that of port wine, which deepened continually by standing until it became black. The urine, however, varied greatly in its qualities, being at times quite natural in appearance, and undergoing no change in colour. At the age of seventeen months the child was active, robust, and lively. A phialful of the urine shown by Dr. Babington to Dr. Marcet at this time, was black and opaque, but only from its depth of hue, for it was not turbid and had deposited no sediment; it bore a great resemblance to a strong solution of extract of liquorice in water. Three specimens of the urine were collected: No. 1, was of the deep purplish black colour of the sample already mentioned; No. 2, passed in the morning, was colour-

\* Medico-Chirurg. Trans. 1822.



less and remained so; No. 3, was also colourless when voided, but after standing for some days and becoming ammoniacal it acquired the tint of a pale claret wine.

No. 1, examined at the interval of some days, was found ammoniacal and quite black. Its specific gravity was 1.022. It contained none of the red globules of the blood. Neither did it show a trace of iron. Dilute nitric acid, digested on a portion of it and evaporated to dryness, left no red stain, as it would have done had there been any lithic acid present. In a subsequent examination of this sample, indeed, Dr. Prout could discover no trace, either of lithic acid or urea, (the latter was not to have been expected, it having unquestionably been all resolved into carbonate of ammonia). The deep colour seemed to be due to the action of ammonia, spontaneously evolved, upon a peculiar principle or matter held in solution by the urine. Dr. Prout regarded this as of the nature of an acid, and accordingly named it *melanic acid*. He found it to bear a closer analogy to lithic acid, or to some of its products engendered by the action of nitric acid, than to any other principle contained in the urine. This specimen of urine remained without further change for a period of seven years, not even depositing any sediment in all that time. The specimen, No. 2, grew a little deeper in colour by keeping, became alkaline, and then putrid. No. 3, an hour after it had been voided, was still colourless; but was becoming ammoniacal. In the course of a few days, it had acquired the pale claret colour mentioned. A little carbonate of ammonia added



to it, threw down a white powdery precipitate, (triple phosphate of ammonia and magnesia,) and in the course of two hours caused the supernatant fluid to assume the same deep black colour as that presented by the specimen, No. 1.

In his account of the chemical examination of some specimens of blue and black urine, M. Bracconot\* speaks of the colouring principles under the titles of Cyanourine and Melanourine. But, instead of regarding them as of the nature of acids, with Dr. Prout, he found these new proximate principles to have the property of bases, to combine with acids as the weaker alkalis do, and to form compounds, which as subsalts were of a brown, and as supersalts of a brilliant carmine colour. Berzelius† remarks, that the melanic acid of Prout is very analogous to the black pulverulent substance, insoluble in alcohol, which is developed when the extractiform constituents of urine are submitted to the action of concentrated acids. The substances named melanic acid and melanourine seem also to bear a strong resemblance to those produced by the action of the hydrochloric acid on fibrine and albumen. If pure fibrine be acted on in this way, the colour of the solution is a rich blue; if it has not been quite pure the tint is of a greenish black, or black.‡

Among the few cases of black urine recorded by authors worth referring to, is the one related by Dr. Galeati,§ in which not only the urine, but the

\* Journ. de Chimie Med. tom. i. p. 454.

† Chimie par Esslinger, tom. vii. Paris, 1833.

‡ Berzelius Chimie, u. s. tom. vii. p. 39.

§ Com. Bononiens. ad Ann. 1787.



sweat was black. The principal interest of this case, however, is connected with the use by Donelli of the microscope in the analysis of the deposite, which was found to consist of extremely minute globules, mingled with acicular saline crystals. Another, is the case of Dr. E. Thomson,\* in which the urine voided by a young man apparently in perfect health, was black and opaque, but deposited no particular sediment. The abnormal character of the urine in this instance disappeared during the exhibition of the decoction of uva-ursi and carbonate of soda.

Such instances of black-coloured urine would not in themselves appear to be of any consequence. Black and brown urine occurring in the course of other diseases, has generally been looked upon as of very unfavourable import; although among the older authors instances are not wanting in which black urine has appeared to prove critical, and to herald various formidable diseases to a happy issue.

SECTION 11.—*Of the discharge of Urine of various peculiar and abnormal odours.*

It is familiarly known that various articles of food and medicine communicate strong and peculiar odours to the urine. Some of these are pleasant rather than otherwise, others are exceedingly offensive. Turpentine taken as medicine, or its vapour inhaled even in very small quantity by the lungs and for a very short time, communicates a fragrant

\* Quoted in Froriep's Notizen, B. II., probably from an English Journal.



smell to the urine, which has been compared to that of violets. Several of the balsams have the same effect. Asparagus, again, although in itself but slightly and not ungratefully odorous, imparts, as all must know who have eaten it, an extremely disgusting smell to the urine.

The writer has observed, that the urine of those who have weak digestive powers very constantly partakes in a greater or less degree of the odour of the higher flavoured articles of food they consume. The odour of boiled beef, of stewed celery, of ale and beer, &c., &c., may always be detected in the urine of such individuals.

The smell of the urine is also affected to various extents in the course of different diseases. It has sometimes been remarked of a musky odour; occasionally it has the peculiar smell of mice, which seems to pervade the whole body in certain cases of typhoid fever. In other cases it is simply fetid and sickly. I have in particular very frequently observed the urine to have a most offensive odour in children who were labouring under affections of the digestive apparatus.

These and other peculiarities are unquestionably evidences of so many abnormal conditions either of the system at large, or of particular organs, with the exact nature of which we are yet but ill acquainted, which, however, with the assistance to be derived from the present advanced and ever advancing state of pathological knowledge, may be expected one day to afford valuable hints in the diagnostic and semeiotic departments of the healing art. Future opportunities may enable me to supply particular facts



and farther observations for this section, which I cannot doubt, from what I have observed, would be found of interest. At present my scanty knowledge of the subject only enables me to make a memorandum of it, as of a matter requiring and deserving illustration.

SECTION 12.—*Of the discharge of Urine which contains Silica in solution or as a deposite.\**

SILICA is reckoned among the constituents of healthy urine by Berzelius, and this earth has been detected as an ingredient in a few of the immense number of urinary calculi that have been analysed. It is also one of the substances which, given to animals, in combination with potash, has been found to pass out of the body by the route of the kidney.†

Masses of siliceous matter, said to have been passed from the urinary bladder, are very frequently sent or brought to medical men and chemists for analysis. There are few collections of calculi in which a box of *siliceous gravel* will not be found. In that of the Royal College of Surgeons in London, for example, I observe one. Dr. Venables believed that he had seen siliceous matter voided by the urine in two instances.‡ In the one, the concretion was of some size, and bore considerable resemblance

\* This Section belongs of right to Chapter III. but was omitted in its proper place through inadvertence.

† Tiedemann and Gmelin, Versuche ueber die Wege, &c. in Zeitschr. &c. B. i.

‡ Journ. of the Royal Institution, N. S. vol. vi. p. 234.



to a tooth, to which it was likened by Dr. Prout when it was shown to him. In the other, the silicious matter was like river or sea-sand. Medical practitioners have repeatedly had considerable masses of various mineral substances presented to them as urinary calculi, which they have often been able to pronounce at a glance to be ordinary rolled pebbles of the surrounding country. A friend informed me lately, that within a few weeks he had had, I think, three samples of silicious *urinary gravel* transmitted to him for examination, which in each case consisted of pieces of quartz; and I know that both Dr. Bostock and Dr. Christison have oftener than once been requested to ascertain the chemical composition of certain masses of quartz and flint which were said to have been voided from the bladder.

There is every reason to believe that Dr. Venables was imposed upon by his patient, as, in the other instances quoted, imposition was attempted. It has often been remarked, that the so called *silicious gravel* is always of a description in relation within the geological structure of the district in which it is said to have been discharged. Some of the specimens have even had portions of other minerals, with which quartz is known to occur associated, adhering to them. This was the case with at least one of the specimens sent for Dr. Bostock's examination. Patients, and especially female patients, often show a singular taste for having diseases unlike all the rest of the world; and most of the instances in which these silicious concretions were said to have been voided, occurred in females.



Did we ever discover silica as a deposit from the urine, it would undoubtedly be in the shape of an impalpable powder, as it is thrown down from its combination with alkalis by the addition of an acid. Silicate of potash can be detected in the urine of animals to which it has been given by the mouth. It has the faculty of rendering the urine highly alkaline;\* the salt must pass the kidney in combination with an excess of base. The addition of an acid to such urine, and even the free acid of the fluid, would necessarily cause the precipitation of the silica. The silica of the urine is unquestionably one of those accidental matters which find their way into the body along with substances used as food, and then make their appearance in the secretion of the kidney in the course of rejection from the system, in the constitution of which they have no necessary part.



## CHAPTER V.

MORBID STATES IN WHICH CERTAIN MATTERS BEING  
CONSTITUENTS OF THE BLOOD ARE CONTAINED IN  
THE URINE.

WHEN we observe the rapidity with which fluids in general, and many saline, odorous, and colouring matters taken into the stomach are rendered by the kidneys, when we consider the great vascularity of these organs, and the freedom of communication that must exist between the arterial exhalents and the uriniferous tubules, we are almost prepared to expect that the blood, escaping from its proper channels, will occasionally make its appearance in the urine. And accordingly we find that under a variety of circumstances, some of which can scarcely be regarded as of a proper pathological nature, one or other of the elements of the blood,—the albumen, the oil, the fibrine and the red globules show themselves either severally or associated, mingled with the product of the renal function.

Chemists are now generally agreed in considering the proximate organic principles named *albumen*, *fibrine*, and *caseine*, as mere modifications of one and the same element, which is conveniently and with great propriety indicated under the common epithet of albuminous. The urine, if the reports of highly respectable authorities are to be taken, occurs impregnated with the albuminous



principle in each of the states constituting the three modifications that have been mentioned. But the existence of caseine as a constituent of the urine under any circumstances, has lately been called in question by M. Rayer,\* who has shown that the evidence upon which its presence was admitted is defective.

This Chapter naturally divides itself into three Sections, in conformity with the number and nature of the elements of the blood which the urine happens to contain,—a division which also harmonizes to a considerable extent with the peculiarities and pathological conditions with which each of the three forms of albuminous urine about to be described is associated.

SECTION I.—*Of the discharge of Urine having the Albumen of the blood mingled with it*,—SERO-ALBUMINOUS URINE.

VERY slight causes, especially such as interfere with the due performance of the process of digestion, have frequently the effect of rendering the urine even of a person in perfect health slightly turbid. Under the influence of higher degrees of disturbance of this important function, and a variety of other circumstances, some of which in this mode of affecting the organism escape our research, whilst others are obvious and readily understood, the urine will be secreted opalescent, and possessed of

\* L'Experience, No. XLII.



the appearance of whey. The milkiness in such cases has been ascribed to the presence of albumen. Dr. Bostock\* even came to the conclusion that albumen may at times be detected by appropriate tests in the urine of the great majority of individuals, apparently in perfect health. In his own person he had observed the quantity to be considerably increased by very trifling causes. I have in very many instances observed the urine secreted under the circumstances indicated, to be opalescent or milky; indeed, there are probably few men alive, who when they have been compelled to exert themselves immediately after a full or hurried meal, have not noticed their urine to become turbid, and as if mixed with a little chalk or milk. I have not, however, found that the cause of the milkiness or want of transparency in these cases, was due to the presence of albumen. There may, it is true, have been rather more than the average quantity of vesical mucus diffused through the urine, but the microscope showed that the opacity depended upon the suspension of an amorphous precipitate, which the proper reagents afterwards proved to consist of the ordinary earthy salts of the urine. Albumen, indeed, is by itself incompetent to cause milkiness such as is observed in these cases; a solution of simple albumen in water, or water impregnated with the saline constituents of the urine, is transparent. By the application of heat or the addition of a drop of nitric acid, such a solution immediately becomes turbid. The turbid urine in question, exposed to heat

\* Cycl. of Pr. Med. Art. Urine.



becomes opaque in an increased degree; but the addition of a drop of nitric acid, either before or after it is boiled, gives it complete transparency. This subject has been already touched upon in the section on Earthy Urine (Ceramuria.) The proper inference from this diversity of experience is, that albumen is not always the cause of the milky or turbid urine rendered under the circumstances specified, by individuals otherwise in good health.

The most simple and common form of albuminous urine met with in practice, is that which has been signalised as connected with dropsical affections, more especially with the dropsy of the cellular membrane called anasarca, a form of disease upon which the successive researches of Cruickshank, Wells, Blackall, and more recently and particularly of Dr. Bright, have thrown much light, although it must be owned that there still remains a vast deal to be done before the pathology of dropsical affections accompanied by the secretion of albuminous urine can be regarded as completely cleared up.

In the class of cases just particularly mentioned, the albuminous principle is mingled with the urine in the state in which it occurs in the serum of the blood and the white of the bird's egg; and would escape observation but for the power possessed by heat and certain chemical reagents of causing its coagulation and precipitation in a solid form. In its sensible properties albuminous urine varies greatly, and does not always differ essentially from the healthy fluid. Sometimes, perhaps most generally, it is paler in colour, secreted in larger quantity, and froths more when passed in a full stream into



the utensil than usual. In such cases the specific gravity of the urine is uniformly low. In other cases, however, in which the urine is albuminous, the quantity elaborated is below rather than above the proper standard, and the fluid is high coloured, and of great density. This happens in the course of different acute inflammatory diseases. It is worthy of remark, that in some of the forms of disease in which the urine finally becomes copious and of inferior density, it is in the first instance scanty, and of higher specific gravity than wont. The anasarca that succeeds scarlet fever is very commonly accompanied in its invasion by dense, high coloured, and scanty urine. Brought to the temperature of  $120^{\circ}$ , albuminous urine begins to grow turbid, and as the temperature rises, to deposit coagulated albumen in clouds or flakes, which subside to the bottom. The amount of abnormal impregnation detected in this manner varies extremely; in some cases it is so trifling as to be barely perceptible, in others it is so great, that nearly the whole portion of urine submitted to experiment runs together into one solid mass, as the serum of the blood would do. Nitric acid dropped into this urine also causes a precipitate, which is abundant in proportion to the quantity of albumen it contains.

In the pale coloured albuminous urine of low specific gravity there is always a deficiency of urea; and it is interesting and important to know that this deficiency is uniformly in proportion to the abundance of the albumen, a fact which plainly points to a connexion between these two proximate organic principles, and shows the morbid state proclaimed



by the disappearance of the one and the appearance of the other, to be of the nature of that which has already been spoken of under the head of Ureo-albuminous urine. In the deep coloured albuminous urine of average or high specific gravity, again, the urea is not necessarily deficient in quantity. I have by actual experiment found it present at least in the proportion in which it occurs in health, in a variety of cases,—in an instance of suppuration of the kidney, probably induced by the presence of a calculus in its pelvis; in a case in which the disease had been hæmaturia, but the urine at the time the examination was made, although highly albuminous, contained no red globules in anasarca after scarlatina, &c.

With regard to the pathology of the simple albuminous urine, especially of that which occurs along with general dropsy, opinions are at present very much divided. Whilst some maintain\* that the appearance of albumen in the urine of dropsical patients is the never-failing indication of organic mischief going on in the kidney, others† have insisted that this circumstance was often indicative of simple febrile excitement of the circulating system, of some general or local inflammation, of functional derangement of the kidney at most, and sometimes not even of that, the albuminous impregnation of the urine being the mere effect of a general effusion of a serous fluid into all the cavities and interstices of the body. Mr. Cruickshank in particular held albuminous urine to accompany “every case of in-

\* Bright, Gregory, Christison, Rayer.

† Wells, Cruickshank, Blackall, Graves.



creased action of vessels, more particularly when this was of the inflammatory kind," and believed that anasarca (which he calls *general dropsy*, and which he obviously considers as a disease dependent on increased vascular action) may be distinguished from the dropsy produced by a morbid condition of one or other of the viscera, from the circumstance of its always being accompanied by an albuminous state of the urine.\* Dr. Wells concludes his truly excellent paper, "On the Dropsies that follow scarlet fever,"† by advocating the practice of blood-letting in such cases, regarding them as connected with a general inflammatory state of the system. Dr. Blackall,‡ too, whose experience and candour deserve and secure our highest consideration, holds the presence of albumen in the urine of dropsical patients to be a certain indication of the existence either of a general inflammatory diathesis, or of some distinct local inflammation which requires antiphlogistic measures—the abstraction of blood, low diet, &c., for its subdual.

The same idea of increased vascular action as the cause of albuminous urine, has been carried still farther in very recent days, but with a progressive disposition to localize the inflammation, and to attach it to the kidney. This is the general tendency of that section of Dr. Bright's recent admirable work, which is devoted to the consideration of "Dropsy with an albuminous state of the urine."§

\* In Rollo, on Diabetes, 2nd Ed. p. 444 and 447. Lond. 1798.

† In Trans. of a Society for Improving Med. and Chirurg. Knowledge, vol. iii. p. 172.

‡ Obs. on Dropsies, 8vo. Lond. 1813, 4th Ed. ib. 1824.

§ Reports of Medical Cases, &c., 4to. Lond. 1827.



The cases and observations of the Drs. Gregory\* and Christison† have a similar bearing. In six of the fifteen beautiful plates of his magnificent work now in course of publication,‡ Dr. Rayer has given representations of the kidneys in various *Nephrites albumineuses*, or inflammations of the kidney with secretion of albuminous urine.

It is difficult to resist such high authority; nevertheless, several distinguished practitioners have opposed themselves to the fundamental notion espoused by all the names that have just been mentioned. Dr. Graves, § for instance, positively denies that the albuminous state of the urine in dropsies always or even generally depends on structural change in the kidneys. He had seen so many cases in which the albuminous state of the urine entirely and speedily disappeared under the influence of proper treatment, that the only inference he could draw was, that this state frequently depended on mere functional derangement of the secreting organ. Dr. Graves was even led to prescribe opium and animal diet in some cases of dropsical effusion with albuminous urine, with the very best effects. Dr. Mateer || of Belfast was led to believe that the albuminous urine of certain dropsies was sometimes the effect of stimulating tonic and saline medicines. Mercury is well known occasionally to have the effect of causing the urine to be secreted loaded with albumen. The late Dr. M'Intosh of Edinburgh and

\* In Edinb. Med. and Surg. Journ. vol. xxxvi. 1831.

† Ibid. vol. xxxii. 1829.

‡ Sur les maladies des Reins, 8vo. et fol. Paris, 1837-8.

§ Dublin Journ. vol. vi. p. 72.

|| Edinb. Med. and Surg. Journ. vol. xlvii. p. 68.



Dr. Elliotson have also expressed themselves against the notion of structural disease as the general cause of serous urine in dropsy of the cellular tissue. Legitimate deduction from my own experience in numerous cases of anasarca succeeding scarlet fever and exposure to cold, which I have had an opportunity of treating at the Royal Infirmary for Children, would also lead me to conclude that structural disease of the kidney could not have been the cause of the albuminous state of the urine which I found almost invariably to accompany the progress of the disease. Finally, it is well known, that the urine is albuminous in the course, and especially as M. Martin-Solon\* has shown, on the crises, of a great number of acute diseases. The following Table from the work of the writer just quoted, exhibits the results of his experiments in this direction:—

DISEASES.	NUMBER OF CASES.	URINE COAGU.	URINE NOT COAG.	RESULT.
Intermittent Fever	8	7	1	All cured
Typhoid Fever - -	23	19	4	21 do 2 dead
Rubeola - - - -	7	5	2	All cured
Variola - - - - -	11	2	6	Ditto
Scarlatina - - - -	3	22	1	Ditto
Pleuro-pneumonia	24	5	2	19 do 5 dead

In the generality of rheumatic cases, also, the urine was found coagulable by heat or nitric acid; but no exact account of these having been kept, it was impossible to insert them in the Table.

Far from being the herald of organic disease of

\* De l'Albuminurie, 8vo. Paris, 1838.



the kidney, and therefore of despair in every case, albuminous urine would consequently appear to promise a happy termination to many formidable diseases, and to be a sign that may be often looked for with an expectation of proving advantageous.

Albuminous or sero-albuminous urine of the kind we are discussing, however, is under certain circumstances a symptom of very unfavourable import. In those interesting and intractable cases of kidney disease in which the symptoms are referred to the bladder and urethra, the urine is constantly sero-albuminous. I had very lately a gentleman under my care whose urine was extremely acid, of high rather than low specific gravity, mixed with a large quantity of pus and loaded with albumen. The whole of the symptoms are so nearly like those of stone, that I still flattered myself, against my better knowledge, that the bladder might contain a calculus, until, having allayed the irritability of the urethra by appropriate treatment, I was enabled to introduce a sound and ascertain that this sac was empty, and for aught I could discover to the contrary, quite healthy.

From all that goes before, it is obvious that sero-albuminous urine is indicative of no particular malady; on the contrary, it occurs as a feature in a great variety of diseases, and must be met by the treatment appropriate to each of these. Generally speaking, the antiphlogistic plan,—bleeding from the system, from the region of the kidney, or from the neighbourhood of any organ that appears to be particularly affected, may be considered as the rule. To this, however, there are many exceptions.



But as it would lead to a discussion of the pathology and therapeia of half the diseases in the nosology, I dare not attempt being more particular in this place.

SECTION 2.—*Of the discharge of urine having the oily and albumino-fibrinous elements of the blood mingled with it,—OLEO-ALBUMINOUS URINE, (Chylous Urine, Prout.)*

INSTEAD of a simple albuminous impregnation, there are numerous cases on record in which the urine has been secreted with such an addition of oleaginous particles that it has borne the closest resemblance to milk, or to water with which a quantity of cream had been mingled. Such instances constitute the *chylous diabetes*, the *milky urine*, &c., of authors.

Such a state of the urine has been observed to occur in the course of certain diseases, and at times apparently to be induced by the agency of certain medicines. Thus, M. Chevallier\* found the urine of a patient under the influence of mercury, which had become white and opaque or milky, to contain a large quantity of albumen mixed with oleaginous matter. The urine of a woman who had died in her confinement, was observed to be of a milky white colour, and somewhat more consistent than usual; but beyond this it had the smell, &c. proper to the healthy secretion. Left at rest this urine deposited a quantity of white flocculent matter, which col-

\* Journ. de Chim. med. Avril.



lected on a filter, washed and dried, was found to possess all the properties of the modification of albumen called caseine. The clear supernatant fluid, by exposure to heat, let fall a farther precipitate of the same kind.\* A gentleman, after a succession of long journeys, in the course of which he enjoyed excellent health, returned home in the same satisfactory state. A few days after his arrival, however, he was attacked with slight diarrhoea, and a trifling catarrhal affection of the chest; and by and by he perceived that his urine, which was rather more scanty than usual, was of a milky-white colour, but passed without any uneasiness. On standing, this urine, which had no peculiar smell and reddened litmus paper, let fall a precipitate of a white cheesy-looking substance, amounting nearly to one half of the whole quantity of fluid evacuated. Intercepted on a filter and washed with distilled water the deposit was found to have all the properties of caseum, or coagulated albumen, becoming transparent and horny when dried, being insoluble in alcohol, swelling up and turning gelatinous when digested in acetic acid, and forming a deep violet-blue coloured solution when treated with hydrochloric acid. Heat applied to the urinous fluid, freed from the deposit by filtering, threw down an additional precipitate of albumen, which yielded a considerable quantity of oily matter when treated by boiling alcohol. Tested farther, the urine was found to contain its usual salts and constituents, and in addition a notable quantity of acetic acid.† In another remarkable case of milky

\* Petroz, Journ. de Chimie Med. 1828.

† Blondeau in Journ. de Chimie Med. 1830.



urine, the sediment which subsided at first amounted to nearly half the bulk of the fluid, and by the application of heat a farther quantity was obtained. The supernatant fluid, which did not affect turnsole paper, was slightly turbid, whitish in colour, and smelt exactly like whey. The precipitate in this instance also presented all the characters of caseine: it was soluble in an excess of acetic acid, precipitated with ferrocyanate of potash, was soluble in caustic potash, and fell again unchanged on the addition of an acid. Its solution in sulphuric acid was of a deep purpurine tint. This urine afforded no trace of urea, but contained the saline matters usually found in healthy urine. A creole of the Isle of France, in the apparent enjoyment of perfect health, was in the habit of passing urine of the whiteness, consistence, and opacity of milk. This fluid was neutral; it had a sweetish saline taste that was not unpleasant. It was coagulable by heat, and the solid substance presented the most perfect analogy to caseous matter.\* Had this urine been tested more particularly, it would in all probability have been found to owe its whiteness and opacity in great part to the presence of an oleaginous matter.

Many other cases of the description of those now quoted might be mentioned, in which the milkiness or opacity of the urine will be found attributed to the presence of the albuminous principle in the shape of caseine. One of recent occurrence is noticed in a clinical lecture by Dr. Graves, of Dublin.† The

\* Chatelain, in *Ann. de Montpellier*, tom. xlv.

† Rept. in *Lond. Med. Gaz.* April, 1837.



urine in this case, when first examined, was found to be without urea, and, according to the experiments of Dr. Aldridge, to contain caseine. Dr. Rayer\* has opposed his high authority to the idea that the albuminous principle discovered in these and analogous cases is in reality caseine. In a great number of cases which he had had an opportunity of examining in an extensive private practice, and in the ample wards of the Hôpital de la Charité, he had never discovered the true milk-globule in urine, save in a single instance, and in this the patient was detected scheming—she had mixed a quantity of milk with her urine after it was discharged from the bladder. The milky appearance of the urine whenever it occurs, is due to the suspension of oily matter in the fluid impregnated with albumen.

But the milky urine hitherto described is not the only variety of this fluid that is encountered. The oleo-albuminous matter is not always suspended as it were in the menstruum, and apt to subside to the bottom when the mixed fluid is allowed to stand for some time at rest. Occasionally it is intimately incorporated with the fluid evacuated, and instead of falling to the bottom as a precipitate, possesses the property of coagulating spontaneously and entangling the whole of the water in its meshes, so as to form one homogeneous tremulous mass like jelly, or the fresh coagulum of the blood.

The albuminous principle here obviously presents the distinguishing feature of the fibrinous modifica-

\* L'Experience, No. XLII.



tion of albumen—spontaneous coagulation. Urine of this description presents itself with every degree of opacity. Sometimes it is of a pearly-white colour and nearly as opaque as fresh-drawn milk ; at other times it is almost transparent, of an amber-yellow tint, and in its general appearance very much like orange jelly ; in other instances still the colour is reddish, and the mass closely resembles pale red-currant jelly. This singular coagulum by and by begins to separate into two portions, exactly as blood does, the one watery or serous, the other, freed from moisture by gentle pressure, firm, elastic, fibrous, and possessed of all the sensible as well as chemical properties of fibrine.

The kind of albuminous urine now described is by no means common, especially in Europe. Different practitioners have, however, met with a case or two of it. I remember Mr. Abernethy used to mention the case in his lectures of a female, who at times discharged urine of such a kind that had it been allowed to cool in a proper shaped vessel might, in so far as appearance went, have been served at table as blanc-mange. This patient, Mr. Abernethy met with, after the lapse of a dozen years or so, looking fat and well, enjoying tolerable health, and still occasionally voiding urine of the old description. Dr. Prout in his "Inquiry" has particularly described two cases which occurred in the practice of Dr. Elliotson, in which the urine at one time bore a strong resemblance to blanc-mange, and at another to orange jelly. The same excellent authority, in his *Gulstonian Lectures* of the year 1831,\* informs

\* Rept. in Lond. Medical Gaz.



us, that in the course of his practice, or through the kindness of friends, he had seen as many as eight cases of this spontaneously coagulating oleo-albuminous urine. I have myself met with one, in which the coagulum, from the presence of the colouring matter of the blood, resembled pale red-currant jelly, and which from this circumstance I have referred to the section on Hæmaturia, although I believe the renal affection to have been of the same essential description as that in which the urine is milky, and the coagulum white, or yellowish and opalescent.

To exhibit the general features of those cases in which milky and spontaneously coagulating oleo-albuminous urine is discharged, I shall cite one of the latest and most complete that has been published.

The gentleman who was the subject of observation here, was M. V. da Costa, a native of the Brazils, 22 years of age at the time of the relation—1836. Four years before this time M. da Costa after undergoing considerable bodily fatigue observed that his urine, though passed without uneasiness or pain, was white and milky in appearance. A year after this occurrence M. da Costa suffered an attack of severe pain in the lumbar and pubic regions, and experienced so much difficulty in making water that he had to rest on his hands and knees to aid his efforts in expelling his urine, which was now a thick and tenacious fluid, from the bladder. When passed, this urine formed a homogeneous and uniformly opaque white mass. Sometimes, however, it came away of a red colour, obviously from being mixed



with a good deal of blood. For three months after this severe attack, the urine continued to be for the most part either white and milky, or red and tinged with blood; occasionally, however, it was transparent and natural. M. da Costa, in spite of the obvious derangement of the renal functions, enjoyed excellent general health; he slept well, the appetite was keen, the digestion perfect. The bloody urine, left at rest, separated into two parts; the one opaque, and solid, was of a deep red colour; the other, fluid and milky, presented a slight reddish tinge. This red and milky fluid, as also the urine that was passed simply milky, when left to stand threw up a quantity of cream, which was sometimes so abundant that it formed a fifth of the whole quantity of fluid examined. The milky urine shaken up or mixed with a portion of sulphuric ether was rendered clearer; the ether acquired a yellow colour from having taken up a quantity of oily matter, and rose rapidly to the top; the operation repeated once or twice with fresh portions of ether had the effect of rendering the fluid quite transparent. The ethereal solution exposed to a gentle heat, quickly parted with the ether by evaporation; what remained was oil. The milkiness of the urinous fluid was therefore due to the presence of a quantity of oil or grease mixed with it. The grumous mass which subsided from the red-coloured urinous fluid when treated with ether was immediately dissolved, and a transparent solution of a beautiful bright red formed;—this matter, therefore, was the colouring substance of the blood without fibrine. The urinous



fluid freed from oil and colouring matter, brought to the boiling point let fall a copious precipitate of albumen; a precipitate of the same kind was also thrown down by the addition of nitric acid. When a little nitric acid was added to the filtered fluid, a copious crystalline precipitate of nitrate of urea was formed. This urine, consequently, differed from ordinary urine in containing a large quantity of albumen and oleaginous matter, to which was added occasionally the colouring matter of the blood. The blood of this patient analysed, was found to differ from normal blood in containing a smaller proportion of fibrine, but a larger quantity of albumen and of oily matter. It coagulated spontaneously, but became fluid again when shaken.\*

Occasionally oily matter has been found present in the urine in extraordinary quantity. A man was brought to the Hôpital de la Charité in a state of asphyxia from the fumes of charcoal, where he died in the course of the day. The blood in the heart and great vessels, and the urine in the bladder, were alike remarkable from containing a quantity of yellowish oily globules swimming on their surface. Several other cases of a similar kind have been recorded. In a paper on the discharge of fatty matters from the alimentary and urinary passages,† Dr. Elliotson has given the case of a lady aged 79, with whose urine about one third of an ounce of oil

\* Case by Dr. Caffé; Analyses by M. Guibourt, in *La Presse Medical*, Avril, 1837; Extract, in *Gaz. Med. de Paris*, 1837, p. 381.

† *Trans. Med. Chir. Society*, vol. xviii. p. 82, 1833.



was discharged daily for some considerable time during her last illness. This is trifling, however, to the quantity of oil which Bachetoni \* drew off by the catheter from the bladder of a certain noble damsel (*virgo quædam nobilis*). Here two ounces were discharged at once on two different occasions. But as the lady had taken four ounces of almond oil some days before as an aperient, and was labouring under a variety of hysterical and anomalous symptoms, it is just possible that wishing to be thought *extraordinarily* ill, she may have imposed upon her physician. The rank of the individual in these cases goes for nothing.

A very remarkable circumstance in the history of cases of oleo-albuminous urine is, that the derangement certainly occurs without any great amount of constitutional disease, often without the slightest implication of the general health. Mr. Abernethy met the subject of the instance he mentions, after the lapse of a dozen of years, looking fat and well. In one of the cases which Dr. Prout has detailed, the urine was positively known to have been secreted with the morbid characters it presented for a period of five years at least. Here the general health was not at all affected; neither were the reproductive functions interfered with, the subject of the observation, a female, having conceived and born a living child in the interim. Another very interesting fact connected with the elaboration of oleo-albuminous urine is that it seems endemical in certain countries. In Brazil especially, from a discussion

\* Comm. Bonon. Pars. I. ad An. 1787, p. 218,



that took place in the Medical Society of Rio Janeiro, quoted by Rayer,\* the affection would appear to be common.

On the treatment of this perverted action of the kidney I have nothing to offer. Did it seem to depend on excitement of the vessels of the organ immediately affected, the sedative and antiphlogistic plan would probably prove beneficial. Could it be shown to be connected with atony or debility, tonics and stimulants, such as the muriate of iron with uva-ursi, the tincture of cantharides, the balsams, turpentine, &c., would be the proper medicines.

SECTION 3.—*Of the discharge of Urine having all the Elements of the blood mingled with it,—HÆMATURIA.*

THE discharge of blood or of bloody fluid from the urinary passages is almost always observed either as a sign and sequence of some disease existing in their course, or still more frequently, perhaps, of the presence in some point of their interior, of a calculous concretion. Instances of idiopathic hæmaturia do, however, present themselves occasionally in practice, some of which have many features in common with the cases described in the last section. Oleo-albuminous states of the urine, in fact, frequently alternate with proper bloody urine—hæmaturia; and in separating these two classes of cases, I yield rather to wont and authority than to the

† L'Experience, No. XLII.



suggestions of my own mind, which would have led me to discuss the two under one head. Many of those who pass spontaneously-coagulating urine, observe it to be of a muddy amber-yellow, and of a dilute or deeper red-currant jelly-colour at different times, obviously according to the predominance of the several principles—the oil, albumen, fibrine, and red globules, whose presence gives to the discharged fluid its distinguishing characters, especially its colour.

The following remarkable case of *hæmaturia*, as it would generally be called, but which I believe to have the distinguishing features of the class of complaints discussed in the last section, came first under my notice, now about twelve years ago; and by a happy chance I am enabled to continue the history down to the present time. In the summer of 1826, I was desired to see ———, a gentleman about 40 years of age, of pale leucophlegmatic temperament, engaged in sedentary occupations, leading on the whole a regular and temperate life, and enjoying a fair share of health. This gentleman I found had voided in the course of the previous night a large quantity, nearly two quarts, of a fluid which I at first sight took to be pure blood, from his bladder. On my entrance he was in the act of straining to get rid of a succession of soft gelatinous clots which obstructed the urethra, and prevented him as he said from making water. Examined more closely I found the fluid discharged to be urine tinged with the colouring matter of the blood, and coagulating after a time into one moderately consistent, gelatinous-looking mass, which trembled



in the utensil when shaken, and bore the most exact resemblance, when a portion of it was viewed by transmitted light, to rather pale coloured red-currant jelly. The mass had but a very slight urinous smell. It gradually separated into two portions a reddish serum, and a darker clot, which last when gently pressed, greatly resembled the crassamentum of the blood partially freed from red particles by washing. Kneaded gently under water after it had acquired a certain degree of consistency, the clot was gradually very much reduced in size, became paler and at last of a dirty white colour, and stringy texture—it was to all intents and purposes fibrine. The serous fluid was of rather a deep red colour, and deposited a quantity of red globules, which were undoubtedly those of the blood. Exposed to heat in a spoon, the quantity of albumen that coagulated was so great, that the fluid part was all but completely enveloped by the coagulum.

An attack of the same description as that I had just witnessed, I found, on inquiry, had occurred oftener than once before; on the present occasion it continued for about a fortnight, at the end of which time the urine having been gradually diminishing in quantity, had regained its healthy characters and appearance. The patient could not ascribe his malady to any particular cause; he was as well as usual when the fits came on, and save of a certain sense of weakness or languor, made no complaint of illness during the one whose course I had observed. He was left considerably reduced in strength, with a pallid and even blanched look. During the attack I kept the patient in bed, and prescribed anoydnes,



and just so much mild aperient medicine as held the bowels, which were inclined to be constipated, gently open. At my suggestion he consulted Dr. Prout as soon as it was deemed prudent for him to venture abroad. The Doctor ordered him general tonic remedies, and a few drops of the liquor potassæ from time to time. But the patient soon recovering his usual health, and fancying he no longer required physic, gave up the use of medicine entirely. Before many months had elapsed, however, I was again summoned to the same gentleman, affected precisely as he had been when I first saw him. The quantity of bloody urine voided during the night previous to the day of my visit measured nearly two quarts. It coagulated into one homogeneous gelatinous red-coloured mass, and then separated slowly into a serum and crassamentum as before. The fit on this occasion did not last long. With rest, a recurrence to Dr. Prout's medicine, and an anodyne for a few nights, he got well. In the course of the next year and half, I was called to my patient a third and fourth time, under precisely similar circumstances. The latter attacks I could distinctly trace to irregularities of diet, for though a temperate man my patient was also a convivial man.

I now lost sight of this gentleman entirely, he having quitted my neighbourhood, nor did I encounter him again for the long period of ten years. A few weeks ago, however, I met him by accident in the street. He had the same pallid appearance, and was looking very much as he had done when I parted with him last. He had completely forgotten



his former medical attendant, but soon remembered me. He informed me that he had never entirely lost his old malady; he still suffered an occasional attack of it, during which he kept himself quiet, but took no medicine, having found nothing that had ever been prescribed for him to do him any good. The attacks he said he could now generally trace to having taken *acids*, which I interpret—having been imprudent in the articles of meat and drink. In spite of a certain degree of languor, he continued to pass a tolerably comfortable existence, in the enjoyment of a fair portion of health, and above all blessed with equable and excellent spirits.

Of the same nature as the case just related is undoubtedly the one mentioned by Mr. Abernethy,\* in the following words: "An elderly gentleman whom I had long known, and who was a very healthy man, told me that he was occasionally subject to hemorrhages (from the kidney.) The first time he was seized he was much alarmed. He had got up to make water as usual and voided about a quart; on looking at it, it was as red as blood; and after standing, about half of it formed into a coagulum." Sir E. Home† appears also to have met with a case of the same kind, in which the bloody urine discharged not only coagulated in the pot de chambre, but in the bladder, and occasioned strangury.

One of the most remarkable circumstances connected with hæmaturia, of the kind I have just par-

\* Lectures on the Theory and Practice of Surgery, 8vo. Lond. 1830.

† Philos. Trans. 1796, p. 486.



ticularly described is, that it occurs as an endemical disease in some countries. M. Chapotain,\* for instance, informs us, that in the Isle of France, children from their earliest infancy are liable to this complaint, without suffering any pain from it, or its appearing to prejudice their general health. M. Salesse,† a native of the Isle of France, and now a practitioner of medicine there, states that three fourths of the children are affected with hæmaturia at one time or another. In these cases the bloody urine is generally observed to alternate with that which is chylous or oleo-albuminous. During the invasion of Upper-Egypt by the French, many of the men suffered from an epidemic hæmaturia.‡

All these endemic hæmaturias I am inclined to refer to the same state of kidney as that which produces the albuminous, oleo-albuminous, or chylous and spontaneously coagulating urine of homogeneous appearance, and various shades of colour, from the pearly white to the currant-jelly red. The colouring matter of the blood in the whole of these cases seems to be entirely accidental; sometimes it is altogether absent; at no time does it exist nearly in the proportion in which the albuminous principle in one or other of its modifications occurs. The albumino-urinous fluid poured out under these circumstances has all the characters of a secretion. The term hæmaturia would probably be advantageously restricted to those cases in which there was simple exudation of

\* *Typographie Med. de l'Isle de France. Paris, 1812.*

† *Diss. sur l'Hematurie, Theses de Paris, 1834.*

‡ Renoult, *Notice sur l'Hematurie. &c. in Journ. Gen. de Med. tom. xviii.*



blood from some point of the mucous surfaces lining the urinary passages, or direct extravasation from the vessels of the kidney. Here the fluid discharged is less *albumino-urinous*, than a *mixture of blood and urine*; the vital fluid and the excretion only chance to pass off together. In this case the colouring principle of the blood is in large proportion, and along with the fibrine is precipitated from the urine in the shape of a dark brown sediment. Under such circumstances hæmaturia commonly indicates the existence of some special disease of the kidneys or bladder, or is caused by a foreign body, as a calculus, lodging in their interior. It also frequently accompanies the course of a variety of acute and dangerous diseases. The urine in small pox, for instance, is often bloody. So is it in purpura, in typhoid fever of bad type, in scorbutus, in acute anasarca from exposure to cold,\* &c. Sometimes the blood presents itself in the urine in the shape of small distinct coagula, or with its serum and colouring matter diffused through that fluid, whilst its fibrine is in threads and masses.

The source whence the blood proceeds in these cases, and the causes of its effusion, vary. The mucous surfaces are those especially from which hemorrhages occur; evidence of which we have in the epistaxis of youth, in the hemoptysis of approaching manhood, and in the hemorrhoids of riper years. There is no reason whatever to suppose that the mucous linings of the renal cavities, ureters, and

\* Vide Bright, op. cit. and particularly "A Clinical Lecture by Dr. Wilson of the Middlesex Hospital, reported in London Med. Gaz. Apr. 14 and 21, 1838.



bladder, may not occasionally take on the same morbid action as the membranes of the nose, bronchi, and rectum, and suffer a certain quantity of blood to transude from their surface; and this accordingly does seem to occur in some rare instances. The bladder is the organ the inner coat of which is most frequently affected in this way. In some subjects it seems to act very much in the same manner as the membrane of the rectum in hemorrhoids, and to relieve itself from time to time by pouring out a quantity of blood, more or less, from its surface.

But by far the most common cause of renal, ureteric, and vesical hemorrhage, is either the presence of a foreign body in the pelvis of the kidney, in the course of the ureter, or in the urinary bladder. The kidneys, like so many other glandular parts endowed with offices proper and peculiar to themselves, are but sparingly supplied with nerves of common sensation. Whence it often happens, that extensive structural changes are found to have taken place in their substance, even before mischief to them was apprehended. In the same way they have frequently contained large calculi, the existence of which would hardly have been suspected, but for the discharge of bloody urine after somewhat violent or continued exercise, such as a long walk, a smart ride on horseback, or a drive in a carriage over a rough road. When hæmaturia follows severe pain in the lumbar region, which shoots down into the thigh, causes retraction of the testis, and is accompanied by sickness and vomiting, we know that a calculus has made its escape from the pelvis of the kidney, and is making



its way down the ureter, a canal which, as it performs less of a special function, is endowed with a larger share of common sensibility than the kidney. Of the cause and source of the bloody urine, and sometimes of the pure blood, that is passed when there is a calculus in the bladder, there can be no doubt.

Occasionally hæmaturia is an indication of malignant disease of the kidney; occasionally of a fungoid tumour produced from the inner surface of the bladder, and perhaps still more frequently of an enlarged and altered condition of the prostate gland.

Proper hæmaturia, however, in the sense which I would attach to the word, does appear now and then with all the characters of a peculiar and independent affection. I lately met with a case among my patients at the Royal Infirmary for Children, which I cannot help regarding as idiopathic, and viewing as though the discharge of blood constituted the sum of the affection. At all events, I can discover no cause for the hemorrhage, and it is uncomplicated by any other morbid symptom. The subject of observation, who is still under my care, is a boy, aged five, strong and lusty for his years, and having always enjoyed good health from his birth. It is now between a year and a half and two years since this boy began to pass bloody urine. The first attack the mother seems inclined to ascribe to an accident, but I could not perceive that the *fall* to which the beginning of the disorder was ascribed, could have had any influence in its production. This child has never seemed to suffer any pain or



difficulty in passing his water, or whilst actually labouring under an attack of his complaint; but he cries from *stomach-ache* as he calls it some time before the recurrence of the fit, which is periodical, and returns at intervals of about three weeks. The little fellow did not shrink when I pushed my fingers deeply into the lumbar regions, nor when I kneaded the abdomen on either side. As there was no complaint in the bladder, I did not think it necessary to pass a sound.

The first specimen of the child's urine which was brought to me for examination was quite opaque, and of a deep chocolate-brown colour, from the diffusion through it of a grumous sediment. I caused the child to make water in my presence, which he did without any difficulty and in a full stream. The fluid discharged presented the appearance of unmingled blood of a brown colour; the tint became much more bright by exposure to the air; the fluid flowed sluggishly over the bottom of the shallow white earthen pan in which it had been received. Set aside, this strange fluid separated into two strata, but did not coagulate. The upper was of a pretty deep red colour, and did not become quite transparent; the lower was a thick grumous sediment, consisting of red globules, fibrinous floculi, and crystalline particles of lithic acid. The supernatant fluid was so highly charged with albumen that it ran into one solid mass when exposed to the boiling heat in a spoon. This sanguineo-urinous fluid had a sweetish and not altogether unpleasant smell, which was increased by the rise of temperature for a time; but by and by this gave



place to the proper urinous odour which a little short of 212° F. became very decided. A second sample of this child's urine, procured at an interval of four days after the last, was of a greenish-brown colour, and turbid. It reddened litmus paper strongly, had the proper urinous odour, and a specific gravity of 1.024. Left to settle, a thin stratum of very bright red globules subsided to the bottom. Above this there was a thicker layer of opaque mucous looking matter, which consisted of fibrine and innumerable crystals of lithic acid. The supernatant fluid was of a deep coppery-red colour, with an intermixture of olive green. Exposed to heat, a dense cloud of albuminous flocculi subsided from it. Nitric acid also caused a copious precipitate of the same kind. Slightly concentrated by evaporation, and treated with nitric acid, an abundant crop of crystals of nitrate of urea was procured. An accident to my evaporating apparatus prevented me from pushing the analysis farther at this time. But I have since examined three other specimens of the urine obtained in succession—at night, in the morning, and during the day—and of the high densities, 1.023, 1.028, and 1.022, very similar to that last examined, only still more copiously loaded with crystals of lithic acid, so that under the microscope, the ropes of fibrine covered with them looked like masses of sugar-candy. These three last specimens were all genuine samples of highly lithic urine, mingled with a small quantity of blood. They were each albuminous in different degrees, and were rich in proportion to their densities in all the characteristic ingredients of the urine—urea, uric acid, urod-



mechrome and salts. A mercurial purge, followed by a course of alteratives for a week, and ten grains of the bicarbonate of soda three times a-day in barley-water, had a very marked effect on the state of the urine in this instance. The fluid was secreted in larger quantity, of lower specific gravity, nearly neutral, and on cooling remained free from crystals of lithic acid. It still continued slightly albuminous, however; and it is likely that with the discontinuance of medicine, &c., the infirmity will return.

The preceding views of the pathology of hæmaturia make any lengthened discussion of the principles upon which the treatment of the affection must be conducted unnecessary. Where it is an effect of any of the morbid conditions that have been hinted at in the preceding paragraph, attention must be directed primarily to them. Where there are symptoms which might lead us to infer that the discharge of blood by the urinary passages was connected with a state of general plethora, or of local congestion, the means must be of a kind calculated to subdue these. The antiphlogistic regimen, a mercurial followed by a saline purge now and then, cold enemata, light covering of the pelvis, &c. may all be required. It is seldom necessary or advisable to abstract blood generally in hæmaturia; the subjects of the affection are rarely of a constitution to stand this measure. The local abstraction of blood by cupping from the loins or perinæum, by the application of leeches in the latter situation or to the verge of the anus, however, may sometimes be had recourse to with advantage.



When the affection seems vicarious of some other habitual discharge, as of the menstrual flux in women, of the hemorrhoidal evacuation in men, we must do all in our power to restore this to its wonted course; a matter difficult to be done indeed, in as much as our means for accomplishing such an end are mostly of a kind calculated to increase the flow by the channels from which we would divert it. Some of the articles, however, that seem to exert their influence upon the lining membranes of the urinary passages more especially, may sometimes be tried with excellent effect. The uva-ursi in extract, the diosma crenata or buchu, the oil of turpentine, and even the cantharides used cautiously, and in such a way as to secure their tonic, without inducing their stimulating effects, will often produce the best effects. Where there is pain and irritation, opiates, the warm bath, &c. must be had recourse to. Where the disease is plainly connected with a lax and debilitated habit, general tonic medicines, the preparations of iron, bitters, the bark, &c. will be the appropriate remedies.

It sometimes happens, when the discharge of blood is considerable, that the fluid, accumulating in the bladder, coagulates there, and forms a solid mass which it is often extremely difficult to get away. Under these circumstances we have been recommended to introduce a sound or catheter for the purpose of breaking down the clot. This advice must be acted upon with great caution; much mischief might ensue upon its being enforced by a rash or even a bold hand. It will probably be better to pass as full-sized a catheter as can be made



to enter, and by means of a syringe fitting into the outer orifice of the instrument, to endeavour to suck out the coagulum; or warm water may be repeatedly injected so as to wash down the clot.

The nature of the impregnation in these varieties of urine is often proclaimed by the general physical qualities of the fluid—its colour, consistence, disposition to coagulate, &c. The only difficulty ever experienced in regard to any of them, is to distinguish between small quantities of albumen and certain varieties of mucus possessed of peculiar chemical properties, which are occasionally met with in the urine.

In practice, the knot may be cut, which it is here difficult to untie. Let heat and nitric acid be the tests relied on for the discovery of albumen, and no mistake of any consequence can occur. If we have a cloudy precipitate on the application of heat, and after the addition of a drop or two of nitric acid, there is certainly albumen in the urine. The mucus which requires long boiling to throw it down, which is soluble in nitric acid, &c., is derived from the channels and reservoirs permeated by the urine in its course, and is not of greater moment than the secretion that is poured out by the nostrils, when their membrane is affected with a trifling catarrh.\*

\* On this subject, see a paper by Mr. Bird, read before the Westminster Med. Soc. in the *Lancet*.



## CHAPTER VI.

MORBID STATES IN WHICH THE CONSTITUENTS OF  
SECRETIONS AND ALTERED ELEMENTS OF THE  
BLOOD ARE DISCHARGED WITH THE URINE.

THE number of matters produced by the surfaces of the urinary passages themselves, and by the organs more immediately in relation with these, which are upon occasion discoverable in the urine, is much more considerable than might at first have been supposed. Thus we have scales of the epithelium, mucus, pus, the prostatic fluid, and the spermatic fluid, mingled with the urine. Besides these we have bile, the product of the hepatic function; according to some, milk the product of the mammary gland; and pus the product it would appear of an inflammatory state of the blood, or of parts or surfaces in a peculiar pathological condition.

EPITHELIUM.—The mucous surface of the canal of the urethra, like that of the membrane lining the mouth, &c., is among the number of those that are covered with an epithelium,\* and this, in the same manner as the epidermis or cuticle, is continually throwing off minute plates or squamæ, which the microscope in the hands of M. Vigla† has revealed in multitudes mingled with the urine. The scales

\* Henle, *Symbolae ad Anat. villor. intestinal.* 4to. Berl. 1837.

† *Etudes microscop. de l'Urine, L'Experience.* No. XII.



of the urethral epithelium are easily distinguished; they are exactly like those which may be procured for examination in a moment, by drawing the point of a finger over the inner surface of the lip or cheek, and transferring the moisture to the table-glass of the microscope. They present themselves as small, ragged, generally round, but often irregular, transparent scales, in the middle or towards one side of which a darker and evidently raised point may commonly be distinguished, by which they probably adhered to the mucous surface. These squamæ are sometimes present in such numbers, that they form a considerable part of what is called the mucous cloud of healthy urine.

MUCUS.—The whole course of the urine, from the infundibulum of the kidney to the meatus urinaris, being through channels lined with a membrane secreting mucus, the fluid necessarily becomes mingled with more or less of this substance. To the presence of a certain quantity of mucus has been ascribed the property which the urine possesses of *frothing* as it is discharged. The quantity of mucus present in the urine of different individuals, and of the same individual at different times, vary greatly. In that of some it is scarcely to be detected; in other instances it very constantly forms a flocculent and pretty copious cloud, which appears as the urine cools and gradually settles to the bottom. The urine emitted at one time even contains different quantities of mucus, according to the moment at which samples are taken for examination. Thus Berzelius \*

\* Chimie, tom. vii.



found that which was first discharged to contain a considerable quantity of mucus, and to deposit a cloud of this substance; that which was voided at the last appeared to be quite free from any mucous admixture. The mucus of the urine when abundant is easily collected for examination upon a filter. When in small quantity, it makes no show upon the surface of the filter, and must be withdrawn from the bottom by means of the pipette. Under the microscope the mucus of the urine presents itself in two forms,—as an amorphous matter, and as a congeries of flattened, rounded, colourless globules, granulated on the surface, and not distinguishable from those of pus, save by the difference of the chemical effect of ether, which digested on pus becomes charged with oily matter, but digested on a quantity of proper mucus-globules remains free from any such impregnation.\* We know how readily the whole of the mucous surfaces pour out proper pus instead of their normal lubricating fluid. The mucus of the nose secreted by the Schneiderian membrane free from all excitement, is a tremulous, amorphous, gelatinous matter. This same mucus elaborated by the membrane with its action altered in ever so slight a measure by the influence of cold, even by violent sneezing, pours out matter principally composed of rugged globules, from which ether extracts nothing; but if the excitement increase, the globules gain the coating of oily substance by which they are constituted pus.

A thick tough ropy mucus is poured out by the

\* Vigla, op. cit. p. 180.



inner surface of the bladder, in extraordinary quantity in certain morbid conditions of this part. The secretion under these circumstances is of a peculiar nature, and I believe owes several of its distinguishing qualities to this, that it has been chemically acted upon by an alkali, generally the ammonia. The disease which is characterized by this copious formation of ropy mucus is the chronic inflammation of the mucous membrane of the bladder, entitled *Catarrhus vesicæ*. In this disease it seems very probable that the exhalants are actually pouring out pus, but that this by combining at the time of its formation either with ammonia evolved from a portion of urine partially decomposed, or with a neutral salt, such as the chloride of sodium, loses its globular constitution, and becomes the homogeneous ropy mass we observe.\* The consideration of the mucus of the urine naturally leads to the mention of the substance with which it is so intimately connected, namely,

Pus.—This is by no means an uncommon addition to the urine, and is generally to be very carefully distinguished from other deposits, inasmuch as it is frequently the chief, sometimes almost the only sign of organic mischief proceeding in the kidney or some other part of the uropoetic apparatus. Purulent urine, when voided, is turbid in a degree proportionate to the quantity of matter that is mingled with it. Left at rest the globules of pus speedily subside to the bottom, where they form a well defined stratum of variable thickness. This

\* See farther on this subject the Chapter on CYSTORRHŒA.



stratum has generally the ordinary features of pus so well marked, that the nature of the matter forming it is not liable to be mistaken :—it is of a yellowish white, or pale greenish-yellow colour, readily diffusible through but nowise soluble in the fluid. When examined under the microscope, pus is found to consist of congeries of whitish globules of twice or more than twice the diameter of the blood-globules, of pretty regular general spheroidal figure, although rugged or granulated on the surface. The urine with which pus is associated, seems to have but one constant property—it always contains albumen ; it varies infinitely in regard to all its other physical and chemical qualities. Sometimes it is of high in other cases of low specific gravity ; sometimes it is highly acid, at other times neutral or positively alkaline ; sometimes it is very little disposed to run into putrefaction, at other times it can scarcely be kept for two or three days without undergoing decomposition. The purulent urine of a gentleman who was believed by Dr. Prout and myself to be labouring under suppurative destruction of the kidney, probably from the presence of a calculus within its pelvis, I found to have a specific gravity of 1.024, to exhibit strong acid re-action, to possess the sensible properties of healthy urine, in so far as colour, smell, &c. went, in perfection, and to contain the usual, or perhaps rather more than the usual, proportions of urea, lithic acid, &c. But this urine coagulated by heat and nitric acid, and a column of it, measuring six inches in height, deposited a layer of pus nearly a quarter of an inch in thickness. This urine was so little disposed to



undergo decomposition, that I kept a phialful of it loosely stoppered for nearly three weeks, in a temperature between 50° and 65° F. without change. At a later period of the disease the quantity of urine secreted was greatly increased, the specific gravity and colour were much lowered, the acid re-action was less decided, the phosphatic salts predominated, and the fluid soon became alkaline and putrid. When alkalescence and putrefaction have taken place, the pus loses its original and distinctive characters. The globules disappear, and the whole is resolved into a tenacious, glairy, and often semi-transparent mucaginous looking matter, like thick dirty-coloured white of egg.

But the pus that now and then appears in the urine is not always derived from any disease actually situated in the course of the urinary passages. "The formation of pus seems intermediate to hemorrhage and secretion; pus may either be viewed as a secretion which, instead of special products, contains the universal plastic matters, or as a hemorrhage in which the blood has undergone a change indeed, yet reappears with all its elements."\* This view of the distinguished writer quoted, is strongly confirmed by the recent discovery by Mr. Gulliver† of the existence of globules of pus in the blood, not merely in every case in which there was pus actually formed in some particular part, but in which there was inflammation and the preliminaries to this event. Pus, however, is foreign to the blood, and must be

\* Burdach, *Physiologie par Jourdan*, tom. viii. p. 226.

† Paper read before the Royal Society. *Athenaeum* for July 14, 1838.



discharged from the system. And cases are constantly occurring in which, from the severity of the constitutional disturbance, the presiding vital powers seem to be so completely overwhelmed that the blood-vessels deposit pus at random as it were, and everywhere through the system—in the substance of the viscera, cavities of the joints, serous sacs, &c. When circumstances are more favourable, the purulent matter would sometimes appear to make its way out of the system by the route of the kidney. Professor Chelius\* of Heidelberg, for instance, observed the urine to become loaded with pus, in a patient labouring under a purulent deposit, within the bag of the pleura, in consequence of a penetrating wound of the chest. The stuff that subsided from the urine could not be distinguished from that which flowed out of the chest by the wound. In puerperal fever, too, a purulent or purulent-looking deposit from the urine is sometimes observed to occur critically. Some recent cases related by Dr. Mouatt† confirm these occurrences in a very remarkable manner. Dr. Mouatt observed considerable quantities of proper pus to be discharged both by stool and urine in several instances of purulent deposits in remote organs occurring after acute inflammatory affections. Several of these cases did well. Several that terminated fatally afforded opportunities of ascertaining that no communication existed between large collections of pus which were found in the liver, &c. and the intestines or urinary passages—

\* Woehler, Uebergang, &c. Tied. and Gmel. Zeitsch. B. I. S. 297.

† Calcutta Quart. Med. Journ. July, 1837.



the pus must have been present in the blood, and eliminated by the mucous membrane of the bowels, and the exhalants of the kidney.

PROSTATIC FLUID.—This fluid Berzelius\* describes as being as clear as water, and susceptible of being drawn out into a thread of a certain length. The fluid which exuded from the cut surface of the prostate of an adult male subject was found by M. Vigla† to consist almost entirely of a congeries of very minute globules; and these, or globules presenting the same appearance, he detected on different occasions in the urine.

SPERMATIC FLUID.—The distinguishing peculiarity of this fluid is, that it contains a multitude of Infusoria, which, strange as it may appear, seem actually to be necessary elements in its constitution; they exist in the spermatic fluid of every animal that has yet been examined. On many occasions M. Vigla‡ discovered Spermatozoa in urinary deposits. Once and only once, in one of the cases, were the animalcules found still alive. At all other times they were dead. The presence of these animalculi might possibly give a hint as to the cause of certain anomalous cases now and then encountered in practice, accompanied with great prostration of strength and much emaciation without any recognizable cause. It is possible that the presence of small quantities of the prostatic and spermatic fluids in the urine may have been the cause of the difficulties experienced by chemists in determining the precise

\* Op. cit. tom. vii. p. 555.

† Ibid. p. 186.

‡ Ibid.



nature of certain mucous matters now and then discovered there.

BILE.—The biliary secretion pent up within its excretory ducts, is well known to be taken up again by the lymphatics and veins, and to appear not only in the general torrent of the circulation, but to impregnate every tissue, and every other secretion of the body, with its distinguishing principles. In cases of icterus, the urine never fails to contain a quantity more or less of bile. The colour of this urine partakes of the greenish-yellow proper to bile. This urine is either transparent, or deposits. The sediment may consist of various matters, but all are dyed with bile; sometimes it seems to consist entirely of yellow flocculi, which remain upon a filter, and prove to be the colouring matter of the bile. A piece of linen dipped in bilious urine and dried, is stained of a bright yellow. Bilious urine having a little hydrochloric acid added to it, commonly becomes of a bright green, sometimes it is turned brown, a variety of effect which appears to depend on the modification under which the colouring matter occurs in the urine. When a quantity of nitric acid is mixed gradually with an equal measure of bilious urine, the mixed fluid becomes first green, then blue, violet, red, and finally yellow, these changes of colour succeeding one another in the course of a few seconds. This phenomenon is distinctive of the presence of the peculiar colouring matter of the bile.

MILK.—Many cases of *milky* urine, the epithet being used in some instances to imply that it contained milk, have been recorded by authors. If we



discover one or other of the elements of bile, and even bile with all its elements in the urine, when the ductus hepaticus, or ductus choledocus communis, happens to be obstructed, I can see no reason to doubt the possibility or likelihood of milk being discovered there also. Pent up in the ducts of the mammary gland, milk is certainly re-absorbed, and must be mingled with the general circulating fluid. But the milk-globule is not the blood-globule, and must necessarily be found foreign to the stream with which it is mixed; it will consequently require to be thrown out of the system, and I can fancy no readier or more likely path for its discharge than the kidney. Nevertheless it remains true, that the analyses and examinations that have been made of any urine entitled milky, have been defective in some degree or another. M. Vigla,\* and I believe with this ought to be associated the honoured name of Rayer, never found the urine truly milky, save once; and then it was so because the patient had mixed a quantity of milk with it;—the catheter passed unexpectedly into the bladder drew off some perfectly healthy urine. This urine greatly resembled that which contains pus. It was turbid and whitish when discharged, and deposited by standing a sediment, or rather a stratum of fluid, of a whitish colour, which was also like pus. Under the microscope the globules of milk are perfectly transparent, and more regular than those of pus. They are seen to run together and coagulate when treated with acetic acid, and ether takes up oil or grease from them.

\* Op. cit. p. 187.



YEAST.—In a case of diabetes Dr. Prout observed the urine to contain a white milky-like fluid, precisely similar to chyle, which slowly subsided to the bottom of the vessel, and by the rapidity with which the vinous fermentation was induced, seemed to act like yeast. M. Vigla also met with a deposit of this kind, but it was in a vessel that had been used repeatedly to receive the urine of a diabetic patient. M. Quevenne, from a chemical analysis of the matter, pronounced it to be yeast, as energetic as that of beer, and perhaps identical with it. Undoubtedly the yeast in these cases was not produced within and discharged immediately from the body, but was formed by the decomposition of portions of urine which had already sojourned in the vessels from which it was obtained. The yeast-globule has been shown by M. Cagnard Latour to have the faculty of procreating itself, and therefore to enter within the domain of organization. M. Quevenne\* has studied this principle particularly, and given a most ample and interesting account of its properties.

\* L'Experience. No. XXVI. p. 405.



## CHAPTER VII.

MORBID STATES IN WHICH PRINCIPLES FOREIGN TO THE URINE AND THE BLOOD, AND DERIVED FROM NONE OF THE NATURAL CONSTITUENTS OF THESE FLUIDS, ARE ELIMINATED BY THE KIDNEY.

THE living body exists surrounded and acted on by a variety of physical agents, such as light, heat, electricity, atmospheric pressure, moisture, &c. It is farther influenced by the nature of the food consumed, and the quality of the air respired. Still farther, it is obnoxious to the agency of certain morbid matters entitled miasms, which induce pathological states of diversified character, and by this are themselves proclaimed to be of different kinds. Some of these miasms seem to expend themselves in the pathological state induced, and to be propagated no farther; such is the nature of the miasm of intermittent fever. Others act not merely as leavens or causes of disease, but give the economy once inoculated with them a faculty of engendering matters capable of inducing trains of morbid phenomena similar to those with which they were themselves associated, and from which they apparently sprung. These are the *animal poisons*, or *contagions* properly so called. Of these many escape research by our senses entirely, and like heat, are only known to us in their effects: the poisons of typhus, measles,



scarlatina, cholera, &c., appear to be attached to no peculiar modification of matter, they exist in a shape that is altogether unknown to us. Several of the animal poisons, however, we observe in something of a tangible form; the contagion of cow-pox, for instance, is associated with a viscid lymph, that of syphilis with the ichor of a sore, that of hydrophobia with a glairy saliva, that of glanders with a purulent flux from the nostrils, &c. The contagion of small-pox, again, occurs in both shapes, attached to a peculiar matter, and inherent in an impalpable miasm.

Animal poisons are not invariably and necessarily the effects of communication in every instance. Some are undoubtedly engendered by the system in which they appear, and, circumstances being favourable, reason leads us to infer that the whole of the known series and many others altogether unknown might be produced *de novo*.

We have already seen that the matters of the secretions when they continue mingled with the torrent of the circulation, either from not being duly discharged, or from being absorbed back into it, exert a highly deleterious influence on the body, and act very much in the manner of ordinary poisons; as witness the effects of urea circulated with the blood in anuria, of bile in icterus, of pus in metritis and inflammations of the veins, &c. Pathological chemistry is still in its first infancy, but the little we know leads us to the rational expectation of being one day able to connect the causes of disease in many other instances with the generation in the system and presence in the circulating fluids of



certain peculiar forms of matter. There is even one very remarkable instance in which I hold such a connexion to have been demonstrated; I allude to the disease generally denominated *diabetes mellitus*, in which the economy appears to be guilty of a kind of felo-de-se, in turning food of all kinds into sugar, which being taken up and circulated with the blood produces effects of a most distressing kind, and finally proves fatal either by wearing out the body, engaged in a hopeless struggle to free itself from a matter which to all intents and purposes acts upon it as a poison, or by inducing incurable disease in some vital organ. It is very singular that the offending matter in this case should be *sugar*, a substance so extensively used throughout nature as food. By the agency of the process of digestion, however, the elements of sugar are unquestionably made to undergo a new arrangement; in so far as the substance becomes nutriment, it ceases to be sugar. We observe other instances of the same kind; several of the deadly animal poisons, exposed to the action of the gastric juice, lose their virulence; the carcasses of animals that have died with malignant carbuncle, for instance, are consumed as food with impunity, and the venom of the rattlesnake, so rapidly fatal when infused into a wound, may be taken into the stomach with safety.

In the present state of our knowledge this Chapter contains but one Section, the subject of which is that morbid state in which sugar is engendered and appears in all the secretions, particularly in the urine.



*Of the discharge of Urine containing Saccharine matter in solution.*—MELITURIA.

THE title *diabetes* has been applied to so many forms of disease accompanied with an increased flow of urine, that I have imagined it would conduce to the advancement of accurate knowledge to leave it out of the question altogether, and to designate each variety of urine in conformity with the nature of its characteristic or most striking ingredient. I have therefore ventured to designate the tissue of morbid phenomena, among the most remarkable of which is the discharge of urine of a sweet taste, by the title of *Melituria*, a term which does not admit of mistake, and which is composed in harmony with the other words that indicate affections of the secreting functions of the kidney.

The disease which is to occupy our attention is characterized not merely by an increase in the quantity of urine elaborated, but is distinguished from every other by the peculiar saccharine state of the fluid. Whether the singular nature, the intractability, or the fatal tendency of melituria be considered, it is one of the most interesting of all the maladies in which the function of the kidney is implicated to a great extent. Dr. Thomas Willis, the distinguished anatomist and practitioner of the time of Charles II., is allowed on all hands to have been the first who observed the peculiar saccharine state of the urine, which is now considered as pathognomonic of melituria: "What so many writers,"



says he,\* “have said as to the urine (in diabetes) differing little or none at all from the drink that is consumed, is very far from the truth; for the urine in every case that I have known, and as I believe universally, differs entirely, not only from the drinks imbibed, but from every fluid in the body, having a remarkable sweetness, and tasting as if mixed with honey or sugar.”

Melituria is generally spoken of as one of the rarer diseases. In this country, and in London especially, it is by no means uncommon; it is often observed in our hospitals; few have practised for any length of time without meeting with an instance or two, and my friend Dr. B. G. Babington has informed me, that on occasion of preparing to keep an *Act* at Cambridge during his college life, his father the late Dr. Babington then in very full practice had found him opportunities of seeing as many as *twenty-three cases of the disease at one time*, in every one of which the sugary state of the urine was ascertained.

The symptoms of melituria are very remarkable, and taken in conjunction with the sweet taste of the urine, quite distinctive of the disease. In the beginning, the morbid phenomena are those of general indisposition; there is uneasiness, restlessness, disturbed digestion, loaded tongue, thirst, hot and dry skin, &c. Risings from the stomach of a sour fluid are very commonly complained of; and still more uniformly a sense of constriction and of burning heat at the *scrobiculus cordis*. This uneasy and often

\* Pharmaceutice Rationalis, Sect. 4, Cap. 3.



very painful feeling, begets a craving for food, whilst an unceasing dryness of the fauces, and by and by calls for drink that are most imperious, and perfectly irresistible, lead the unhappy patient to consume immense quantities of solid food, and to swallow a still more enormous proportion of fluid. In spite of the quantity of food taken, however, and the readiness with which the stomach now seems to perform the first part of the process of assimilation upon it, the strength fails and the flesh falls off: the patient withers visibly, complains of a sense of weariness in his limbs, especially in his thighs and in the calves of his legs; the countenance becomes hollow, and the expression one of languor, exhaustion, and despondency, which, indeed, is but the state of the system mirrored in the face—the body wasting, the mind enfeebled.

With these symptoms there are associated, at an early period of the disease, frequent calls to make water, and a greatly increased secretion of urine, which, when particularly examined, is found to have a sweetish hay-like smell, a taste that is saccharine in a greater or less degree, and a pale greenish-yellow colour, like that of some of the finer vegetable fixed oils. In spite of its quantity, melituristic urine is always of high specific gravity, ranging between 1.020, and 1.050, and even 1.055, a quality that evidently depends on the large quantity of extractive, principally saccharine, matter which it holds in solution. Tested chemically, it is found to contain the usual saline ingredients of healthy urine, nearly in their due proportions; but it is almost invariably deficient in lithic acid, and was long be-



lieved to lack urea also; many analyses of diabetic urine are reported in which it is said that no trace of urea could be detected. Dr. Prout, however, never examined a specimen of such urine, without discovering a little, and very recent researches have shown that urea is not only not deficient in melituristic urine, but is generally contained even in larger relative proportion in it than in the healthy fluid. The urea is masked by the presence of the sugar, and cannot be discovered by being made to combine with nitric acid, the ordinary mode of demonstrating its presence, without peculiar management. Dr. Henry, indeed, by distilling the residue of a given measure of urine at a temperature a little above the heat of boiling water, when urea is decomposed, had ascertained from the quantity of carbonate of ammonia evolved that the characteristic element of urine must be present in considerable proportion at least; but Mr. Kane, by treating the residue of a diabetic urine with dilute nitric acid in a flask, and plunging this into a freezing mixture, obtained fully the average quantity of nitrate of urea. Mr. M'Gregor, again, after getting rid of the sugar by means of fermentation, evaporating slowly, and treating the extract obtained with anhydrous alcohol, &c., found he was able to procure the urea in a crystalline mass and uncombined. In this way Mr. M'Gregor\* demonstrated that one diabetic patient was passing 1013 grains of urea daily; that a second was voiding 945 grains, a third 810 grains, and a fourth 512.5 grains, the quantity discharged by a person in health

\* Lond. Med. Gaz. vol. xx.



amounting to from 362 to 428.5 grains. None of these patients had undergone any treatment, and the specific gravity of the urine in each in succession was 1.040, 1.045, 1.034, 1.050, the quantities of urine discharged being, in the same order,  $38\frac{1}{2}$  lbs., 30 lbs., 40 lbs. and 25 lbs.

Melituric urine is occasionally slightly turbid when voided, and has then been found to contain a quantity of albuminous matter in the caseous form. In other cases, though transparent when passed and even after having stood for some time, heat and several of the ordinary chemical reagents throw down from it a flocculent precipitate, indicative of the presence of leucomatous albumen. Occasionally it has a quantity of the red particles of the blood mingled with it, which appear to be purely accidental. Allowed to stand in a moderate temperature, melituric urine generally becomes sour, and smells like milk that has turned. Sometimes it ferments briskly in the first instance. The addition of a little yeast, especially if the urine have been previously somewhat concentrated by evaporation, always causes it to undergo the vinous fermentation, after which it yields alcohol by distillation; and this, freed from water and weighed, is one of the most certain modes of estimating the quantity of sugar contained in any given measure of the fluid. Reduced by gentle evaporation to the consistence of syrup, and suitably treated with animal charcoal, acetate of lead, &c., in the manner generally known to chemists, melituric urine affords a crop of crystals of a sweet substance, which differs in nothing from that obtained from the must of the grape,



or from fecula by the action of dilute sulphuric acid. There also remains a considerable quantity of sweet uncrystallizable syrup, analogous in its nature to molasses.

Next to its taste, the quantity of urine ordinarily evacuated in melituria is the most remarkable feature in the complaint. Morgagni gives a case in which the average quantity of urine passed in the course of the four and twenty hours was 42 lbs. In a case seen by J. P. Frank, in which the usual daily quantity discharged was 40 lbs., it was, on one occasion, observed to amount to 52 lbs. I recollect myself seeing a case of diabetes mellitus in the Hôtel-dieu of Paris, now many years ago, in which the quantity of urine passed daily for some little time after the patient's admission averaged between 40 and 50 lbs. In this case the chief discharge seemed to take place during the night, so that at the visit in the morning the patient's bed used to be surrounded with vessels of all descriptions full of urine; the accumulated discharge of two days was frightful to contemplate. So great a discharge of urine, however, is not common; eight, ten, twelve, fourteen, or sixteen pounds being the quantities more usually met with.

It has been maintained, and particularly by Dr. Prout, that the diuresis, or increased secretion of urine in melituria, is to be considered as accidental, and by no means as a necessary part of the disease. To this conclusion he is led, First, by observing the influence of remedial means on the disease; for the quantity of urine may be rendered natural, and yet continue saccharine; and this being so, there seems to be no reason why the disease may not exist ori-



ginally, and for some time at least, in a similar form ; Secondly, in a case in which diabetes mellitus afterwards occurred in its worst form, the patient's attention was attracted by the peculiar qualities of his urine, long before its quantity struck him as any thing remarkable. Wherever the urine happened to fall on the dress, imperfect crystallization took place, and the part became stiff and clammy, and attracted the dust. In this case Dr. Prout says, he could not help thinking that a saccharine condition of the urine had existed in a greater or less degree for some considerable time before the complaint became complicated with diuresis. Against this supposition nothing can be urged. And whether the substance that crystallized imperfectly and attracted the dust were urea, which there is every reason to believe often exists in the urine in excess as the first step in melituria, or was sugar, the matter is not changed.

Another feature of the melituria accompanied with diuresis, that has been very generally remarked and commented on, is the excess of the urinary secretion over the quantity of fluid consumed as drink. If on any one day a patient labouring under melituria be restricted in his drink, it is certain that the quantity of urine voided will greatly exceed that of the drink imbibed. But this is also a natural phenomenon. Thus the subject of Dr. W. Philip's\* experiments, a healthy boy, taking on one occasion only six ounces of drink in the course of the day, discharged one pound seven ounces of

\* On the remote Causes of Urinary Gravel. 8vo. Edinb. 1793,



urine; on another, the drink being sixteen ounces, the urine amounted to twenty ounces; on a third, the drink being but eight ounces, the urine was one pound eight ounces. In melituria it is impossible to persevere in experiments of this kind; the necessity for drink is felt so imperviously, that have it to a certain amount the patient must, or he would die. When the fluid and solid ingesta and excreta are measured regularly in cases of melituria, no such anomaly, or discrepancy only to an extent that can be satisfactorily accounted for, will be discovered. In the great majority of instances, the quantity of urine evacuated is unquestionably in the direct ratio of the fluid, *plus* the watery part of the solid food consumed. This even obtains in health. M. Chossat\* found in the course of his experiments, that during the depth of winter, the quantity of urine excreted by persons in health exceeded their drink in the proportion of 1.5 to 1. Between midwinter and the vernal equinox, the urine fell short of the drink in the ratio of .94 to 1. In the summer months the difference was still greater, the urine falling short of the drink in the ratio of .89 to 1. Even the most solid food consumed by man contains a very large proportion of water; and by whatever amount the urine discharged surpasses the drink imbibed, the excess is in all probability commonly derived from this source. The quantity of dry feces voided by man in the course of the day is extremely small, not amounting to more than from one to two ounces, the individual consuming regularly from

\* In Magendie's Journ. de Physiologie. tom. v.



twenty to forty ounces of food styled solid in the same time. We also observe sheep, goats, hares, and other herbivorous animals, eating many pounds of succulent food in the course of the day, and discharging only a few ounces, or even a few drams of very hard dry excrement; but they void large quantities of urine, even when they do not drink at all. It is interesting to observe, that the feces in melituria have commonly the dryness and hardness of those of the rodent and ruminating animals mentioned. Dr. Bardsley's\* inquiries, indeed, may be regarded as militating against these views. With every attention to the weight and measurement of the ingesta, he found that the mass of matter excreted surpassed that taken in. If this were so, the additional fluid was in all likelihood derived from the atmosphere by the mucous membrane of the bronchi; this having been shown in some experiments of Professor Mayer† particularly, to have the power of rapidly absorbing fluids placed in contact with it.

The breath and person of patients labouring under confirmed melituria have been observed to exhale something of a musty, sweetish, or hay-like smell. The alvine evacuations are also very commonly without the peculiar fœtor proper to these discharges in man; they rather resemble the comparatively inodorous droppings of the deer, goat, sheep, and other herbivorous animals. I forget at present where I have read that a diabetic patient having been brought to perspire, the fluid thrown out upon the

\* Medical Reports, &c. 8vo. Lond. 1807.

† Quoted in the Edinb. Med. and Surg. Journ. vol. xvii. p. 468.



skin collected and analysed, was found to contain sugar. I have not seen a patient labouring under melituria perspire, but I have known the furfuraeous cuticular exfoliation of the legs to be distinctly sweet to the taste. The skin itself is always very manifestly implicated in melituria; it is harsh, shrivelled, and as dry and unperspiring as parchment. Mr. M'Gregor found the saliva of a patient labouring under melituria to ferment briskly when inoculated with yeast, and therefore to contain sugar. Patients themselves indeed frequently complain of having a constant sweet mawkish taste in the mouth, and of their teeth feeling as if set on edge.

When the disease is fairly established, and the urine, considerably increased in quantity, is also heavily laden with extractive matter, this drain from the system must be supplied; and then we have the ravenous appetite and unquenchable thirst that have been so generally remarked as essential symptoms of this sad malady. The desire for cold drink is often quite uncontrollable; though warned that indulgence of the appetite will but increase it, and make matters worse, nothing short of coercion will generally prevent patients from indulging their eager thirst to a very injurious degree. No less remarkable at times, but less constant and generally less urgent, is the ravenous hunger that is experienced, which patients will often use every artifice to indulge, though they do so to their prejudice. These exaggerated sensations of thirst and hunger seem to be immediately engendered by the state of the fauces, which are dry and covered with a thick tenacious mucus, and of the stomach, in the region



of which painful burning sensations, compared to such as might be presumed to be excited by the presence of a corroding acid or a glowing coal, are constantly complained of. The tongue is generally pretty evenly covered with a thick fur; sometimes, however, it is clean and of a bright red; often the edges are of a fiery red, whilst the middle is coated with white, brown, or black sordes. As the disease advances the gums frequently become affected, apparently as in scurvy, and then the breath is very offensive, instead of being merely faint and sickly, which it had been before.

With the progress of melituria the strength declines more and more; the muscular and the nervous systems seem in particular to feel the effects of the decay. The patient is not only disinclined, but is absolutely incapable of taking any exercise or making any exertion. The sexual appetite generally disappears at a somewhat early stage of the complaint, and it is curious to know that in one of the few cases of recovery (and I use the word guardedly) from the disease that I am acquainted with, the only function that remained in abeyance was the sexual. The temper very commonly gives way, the patient becomes irritable and unreasonable, and his disposition is suspicious, gloomy, and desponding. Incontinence of urine and paralysis of the bladder are occasionally added to the list of the unhappy sufferer's miseries, and Dr. Berndt\* of Greifswald has seen blindness from amaurosis as a climax to the whole.

\* Encyclop. Woerterbuch d. med. Wissenschaften, Art. Diabetes.



In general, melituria runs its course slowly; in the majority of instances it is a chronic disease, and with adequate care has been known to exist for years, exhibiting something of an intermittent type, alternately and irregularly better and worse, apparently kept at bay by the dietetic and medicinal measures enforced. There are not wanting instances, however, in which it has shown itself with all the characters of an acute disease, having run its course to a fatal termination in the course of a few weeks, and in one case it might almost be said in the course of a few days.\* When the disease persists uncontrolled and uncomplicated with other serious affections, the patient commonly sinks exhausted, emaciated to the last degree, and fairly worn out. Far more commonly, however, some vital organ, generally the lung, feels the influence of the cachectic state of body which the continuance of such a disease either implies or engenders; tubercles are formed, or purulent deposits take place within its substance, and the sufferer is released from his misery under the symptoms of phthisis; or else a general dropsy supervenes, or a colliquative diarrhoea sets in and soon exhausts what remains of the enfeebled powers of life.

The causes of melituria are obscure and little known. The disease occurs most frequently about the middle period of life, though it has been met with in the youthful and in persons far advanced in years. Mr. M'Gregor observed it in a boy of three years of age, and in both boys and girls about twelve. I have myself seen it in an early stage, in a boy of

\* Oosterdyk, in Horn's Archiv fuer med. Erfahrung, B. 2.



five, the urine being sweet to the taste, fermenting with yeast, and acquiring a vinous odour. It seems to attack individuals of every variety of constitution, and living under the most opposite circumstances, in so far as wealth and poverty are concerned. If any peculiar temperament more than another may seem to dispose to the disease, it is the spare and nervous. Men of the most temperate and regular habits, as well as those of dissipated lives and who in former years have abused their animal appetites, seem alike obnoxious to its attacks. Sex appears to have no real influence on its production, though men have generally been held to be its most common subjects. Of all the remote causes enumerated as potential in causing melituria, one of the best ascertained is *inherited predisposition*. The complaint has been distinctly traced through several successive generations; and though not one of the diseases of every day occurrence, if one member of a family be affected, another and another will, in all probability, be subsequently assailed either by this or some other form of malady in which the function of the kidney is seriously implicated. The disease, however, is spontaneously evolved in numerous instances; to be liable to its attacks, it is not necessary to have sprung of parents or to have had near relatives who have been its victims. Neither does it follow that the offspring of one who has died of melituria shall be subject to the disease. I know, in particular, a family of eight, not any member of which has ever shown the slightest tendency to urinary derangement although the father died of melituria in its most aggravated shape.



Of all the immediate causes of the breaking out of the disease, exposure to cold would seem to be the most influential, or at least is the one which has been most frequently forced upon observation. In the variable climates of the countries where medicine is principally cultivated, and this among other diseases has been most carefully studied, we should probably be at no loss to trace out exposure to cold as the antecedent to most of the maladies from which their inhabitants are known to suffer. The healthy body resists, or on the renewal of the stimulus of higher temperature, overcomes impressions of cold; the feeble or sickly frame alone sinks under them. Predisposition therefore in all likelihood precedes melituria developed after exposure to cold. The disease besides occurs in intertropical countries, as Ceylon,\* where the natives are little exposed to vicissitudes of temperature; and it is almost unknown in others, as Russia,† where the extremes of heat and cold are endured. Can the disease under any circumstances prove infectious? Reil mentions the case of a woman who having slept for some time in the same bed as her diabetic husband, became affected with all the symptoms of the disease, though she at length recovered.

The proximate cause or essence of melituria has been a subject of much difference among pathologists, so that each new writer on the subject has felt himself free to imagine a different one. Rollo‡ and most of the English authorities on the subject

\* Christie in Edinb. Med. and Surg. Journ. vol. vii.

† Lefevre Lond. Med. Gazette of Nov. 29. 1834.

‡ On Diabetes Mellitus. 8vo. Lond. 1796.



after him, have fixed the seat of the disease in the stomach: "increased secretion, with a vitiation of the gastric juice and probably too active a state of the lacteal absorbents," according to Rollo, are the efficient causes of all the rest of the symptoms. Baillie,\* whilst he admitted that the chyle might be so imperfectly prepared as to afford, or to be in a state apt to undergo a partial change into, saccharine matter by the action of the kidney, thought it probable that melituria was especially owing to a derangement in the secreting function of the kidney, and even to a change in the structure of its secerning portion, which disposed the blood to new combinations.

Dr. Dezeimeris,† one of the most learned physicians of his country or age, regards DIABETES as a state dependent on *gastritis*, the word being used I presume in the sense in which it is understood by the school of Broussais. The proximate cause or essence of the disease, indeed, he says consists in irritation of the kidneys; but this is seldom primary; it is more commonly secondary, being one of the consequences especially of chronic gastritis, (continued fever,) in which thirst is always a symptom. The presence of sugar in the urine is not regarded as essential, it is accidental and secondary to the true disease.

The view taken by Frank‡ of the pathology of melituria is striking, and as it is the offspring of the mind of a great physician, and approaches to what I conceive to be the truth, I shall notice it here at

\* Trans. Soc. for Impr. Med. and Chir. Knowledge.

† Mem. de la Societe Med. d'Emulation, tom. ix. p. 211.

‡ Epitome de curand hom. morbis, lib. v. p. 28.



some length. The disease he ascribes to an animal poison, a *diabetic virus* engendered spontaneously, or inoculated into the economy like that of rabies; he even believes that the disease may actually have been induced by the bite of the serpent *dipsas*, as related by the ancients. This virus, however formed, he imagines exerts an especial influence upon the nerves of the fauces, of a nature the opposite of that of rabies, occasioning unquenchable thirst instead of an invincible dread of water. The virus through the medium of the nerves farther influences the lymphatic system in a peculiar manner, arousing it to unwonted activity and causing excessive absorption from all the secreting surfaces of the body—those of the mouth, stomach, skin, &c. whence the thirst, which he says is the first symptom manifested, and the passage of the chyle into the *secundæ viæ* still crude and unconcocted, not because of any weakness in the stomach, but in consequence of premature absorption. The increased flow of urine follows, hurrying along with it the imperfectly elaborated nutrient principles supplied by the food, and the juices that have already undergone all the degrees of animalization, the consequence of which is the *phthisis urinosa*, the consummate disease.

A purely chemical theory of the disease was propounded by Dr. Lubbock,\* based on the researches of Cruikshank and Abernethy. He supposed that in consequence of the suppression of the cutaneous functions the proper quantity of carbonic acid was not eliminated from the sys-

\* Lond. Med. and Phys. Journal, vol. v. p. 56.



tem, but being retained entered into combination with the other available quantities of carbon, hydrogen, and oxygen of the blood or urine, and so went to the formation of the new and distinguishing product of the disease, namely, sugar. Another chemical theory of melituria worth mentioning is that of Haase,\* which bears some analogy to the one just particularly mentioned, but is far more complete and satisfactory. The first step in the production of the disease, according to Haase, is the occurrence of hyperoxydation in the juices of the stomach and intestines, generally as a consequence of functional disturbance, sometimes of more serious organic disease of the great abdominal viscera. The altered juices excite the digestive organs and the skin dynamically to more rapid absorption. They also stimulate the kidneys, much in the manner in which young acescent wines act as diuretics. Hitherto the disease has been diabetes insipidus, and is curable. The second stage in the morbid processes consists in the evolution of saccharine matter through the action of the predominant acids of the stomach and bowels upon the vegetable substances used as food, in the same manner perhaps as this substance is formed from starch, by a chemical process in the laboratory.

In connexion with the chemical hypotheses of melituria, it is interesting to refer to the elementary or atomic constitution of some of the principal ingredients of healthy and diseased urine, and I subjoin the tabular view of the matter given by Dr.

\* Chron, Krank, 3 Bde. 8vo, Leipz. 1817,



Prout, \* from whose labours a new theory of the disease might readily be deduced :

ELEMENTS.	SUGAR.	UREA.	LITHIC ACID.	ALBUMEN.
Hydrogen - - -	1.25	2.5	1.25	8.75
Oxygen - - - -	10.00	10.0	15. 0	30.00
Carbon - - - -	7.5	7.5	22. 5	56.25
Nitrogen - - -	—	17.5	17. 5	17.5
	18.75	37.5	56.25	112.5

From the above table it appears that the weight of the atom of sugar is just *half* that of urea ; that the absolute quantity of hydrogen in a given quantity of both is equal, whilst the absolute quantities of carbon and oxygen in a given weight of sugar are precisely twice those in urea. The chief, almost the sole difference between sugar and urea consequently lies in the entire absence of nitrogen in the sugar.

The weak point in the views which place the seat of melituria in the stomach, and ascribe the formation of the sugar to faulty action there, lay in the fact that the presence of sugar in the stomach had never been demonstrated, and above all, that its existence in the blood had been searched for repeatedly by the most distinguished chemists of the past and present age

\* Med. Chirurg. Trans. vols. viii. and ix. Dr. Prout has more recently announced urea as an albuminous product, and one of the proximate principles or organic compounds (urate of ammonia is the other) into which albumen is capable of being resolved. Gulstonian Lectures, reported in Lond. Med. Gaz. June, 1831 ; also separately, 8vo. Lond. I know of nothing more interesting in BIO-CHEMICAL SCIENCE than the hints thrown out and the views sketched in these Lectures.



in vain. The weight of testimony was altogether against the fact of the existence of sugar any where but in the urine. Wollaston, Marcet, Thenard, Vauquelin, Bostock, Henry, &c., had all failed in detecting it in the serum of the blood, although its presence there had been often asserted, among others by Cullen, Dobson, and more recently by Zipp,\* but constantly without any demonstrative evidence of the fact. The perspiration, however, when excited, had been observed to have a sweet taste in some cases of the disease, and I have alluded to one which proved fatal, where the furfuraceous exfoliations of the cuticle were distinctly sweet-tasted. But if the perspiration and the scales of the cuticle have ever been found impregnated with sweet matter, it is certain that this must have been derived from the blood. And the progress of chemical science has at length led to the demonstration of this important point. It was first announced by Sig. Ambrosioni,† pharmacist in chief to the hospital of Pavia, and a year later by Mr. Charles Maitland,‡ who each obtained a quantity of sugar from the clot and serum of the blood of a patient labouring under melituria by what appears the ordinary methods of treatment.

These discoveries of Ambrosioni and Maitland have been amply confirmed by Mr. M'Gregor, of Glasgow, in his admirable "Inquiry into the state of urea in healthy and diseased urine, and of the seat of the formation of sugar in diabetes

\* Hufeland's Journal, B. 65.

† Omodei's Annal Universali di Medicina, Aprile, 1835; in French, in the Gaz. Med. de Paris pour 1837, p. 693.

‡ Lond. Med. Gaz. vol. xvii. p. 900, March, 1836.



mellitus,"\* an essay which I cannot but consider as one of the most complete and valuable contributions ever made to pathological science. Mr. M'Gregor found the specific gravity of the serum of the blood of a patient labouring under melituria to be 1.033, that of healthy serum being 1.029. The taste of the morbid serum was only slightly saline, that of the healthy fluid strongly so. To obtain the sugar, the diabetic serum was coagulated and carefully dried by heat. The solid mass, being divided as minutely as possible by a pair of scissors, was boiled in water; and the decoction having been filtered through paper, was evaporated to a certain extent. The concentrated liquid on the addition of yeast fermented strongly for several hours. The blood of different diabetic patients was examined in the same manner, and always found to agree with that in the case more particularly described above.

Mr. M'Gregor did more than this; he traced the sugar back, and demonstrated beyond the possibility of doubt that it was formed in the stomach. Tiedemann and Gmelin in their "Experiments on Digestion," had found sugar present in the stomachs of several of the lower animals. To a healthy man who had dined three hours previously Mr. M'Gregor administered a scruple of sulphate of zinc, which produced free vomiting. The ejected matters suitably treated and concentrated by evaporation, fermented very strongly, showing that in health there is sugar present in the stomach. A patient afflicted with melituria was the subject of a similar experi-

\* Published in the *Lon. Med. Gaz.* of May, 13 and 20, 1837.



ment, and here fermentation was induced and went on vigorously for twelve hours in the concentrated solution of the matters vomited.

To prove that the sugar present in these cases was not introduced in the vegetable part of the food, a healthy individual, and one labouring under melituria, were vomited and purged, and then fed for three days in succession upon beef and water exclusively. At the end of this time, and three hours after a meal, the contents of the stomach, procured by the operation of sulphate of zinc, were treated as before. Those from the healthy individual gave no sign of fermentation; those from the subject affected with melituria fermented pretty briskly, though much less so than in former trials.

Mr. M'Gregor next examined the saliva, the liquid of the alvine evacuations, and the sweat of melituristic patients. The presence of sugar in the saliva was readily demonstrated; the liquid concentrated and set apart in a suitable temperature with yeast fermented readily. The sweat, however, never could be made to ferment. The feces of one of the patients, allowed to dry spontaneously, by and by became covered with distinct crystals of sugar; and yeast having been administered to two patients in doses of two ounces after each meal, had soon to be discontinued, because the patients, to use their own expression, "were on the eve of being blown up."

Out of the dawn arises the day, and from the obscurity of speculation with uncertain data the slow advances of knowledge sometimes enable us happily to emerge into light. So it has been as



regards notions of the pathology of melituria; we are now in a condition to do more than speculate upon the nature of this interesting disease. The facts just exposed, taken in connexion with the views hastily sketched in the general remarks under the title of this chapter, give a key to the right understanding of the whole phenomena of melituria. Derangement of the digestive functions is here unquestionably the head and front of the offence. This derangement too is of a very peculiar kind: the stomach has a disposition to fabricate sugar to a preternatural extent out of the food, particularly the vegetable food, taken into it; for the disease is functional in every part, and is actually *disease* only because the *degree* of a natural process is surpassed—the healthy stomach generates sugar to a limited extent; the stomach of the melituristic individual generates sugar in excess. The sugar produced in health is without doubt decomposed in the after-stages of digestion; it does not appear in any of the fluids of the body, nor in any of the secretions save milk, of which it is an element, nor in the feces; in the melituristic state the sugar engendered is not decomposed; it enters the circulation. To explain all the rest of the disease,—the fever, and wasting, and excessive secretion of urine, &c., becomes easy after this: there is a substance mingled with the blood which is foreign to its constitution, and which consequently poisons life in its fountain head. The derangement of the kidney is purely secondary, and is consequent upon its efforts as grand purifier of the system along with the lung, to free the circulating fluid of the cause of all the evil—



the sugar. The morbid changes discovered in the kidneys after death from melituria, have even generally been extremely trifling, they have mostly been such as indicated simple increase of functional activity ; and this, in fact, is all that the kidneys can be rightfully charged with,—if their efforts are not much rather beneficent than prejudicial ; for my own persuasion is, that without energetic action on their part, the disease would prove far more rapidly fatal than it does.

What is the precise nature of the gastric affection in melituria ? This is, indeed, a puzzling question. We certainly see infinitely more local suffering from derangement of the functions of the stomach, and even some very singular chemical changes effected within it upon the articles taken in as food and drink, without any so formidable disease as melituria ensuing. I have known intimately, and given my advice professionally for a long time to a gentleman, whose stomach used for many years to cause a copious evolution of sulphuretted hydrogen from raw fruit of any kind taken along with ship-biscuit, and as regularly and certainly to turn a glass of spirits and water, with or without the addition of sugar, into vinegar, as this change is induced in the vats of the continental manufacturer of acetic acid from attenuated alcohol. This individual, after twenty years or more, is still alive ; he has always been worried by a delicate stomach, and has generally laboured under a trifling degree of what I have called hydruria, but he is active in body and mind, and with great attention to his diet has the health that a student and a man of literary tastes



living in a large town can hope to enjoy. The kidney in like manner has been found very extensively altered in structure, and long and seriously deranged in function without its individual disease having turned to, or been complicated with, the elaboration of sweet urine.

Pathological anatomy has not contributed essentially to clear up the nature of melituria. The nervous centres and great sympathetic have been observed with traces of disease in some fatal instances; the brain\* and spinal cord† being of unusual hardness and otherwise morbidly affected; the great sympathetic‡ having from three to four times its ordinary diameter after its passage through the diaphragm. Von Stosch§ lays much stress on the occurrence of a general congested or plethoric state of the chylopoetic viscera; the veins in connexion with the portal system in particular, have been found by many observers in a greatly overloaded state. It is a remarkable fact that in the much emaciated bodies of those who have sunk under melituria without the intervention of any colliquative stage or destruction of the lungs, the fat appears not to have been removed nearly in the ratio of the muscular or fleshy structures.|| The lymphatic glands have very commonly been found enlarged, softened, and of a redder colour than natural.

\* Horn's Archiv. B. xxii.

† Venables on Diabetes, &c. sup. cit.

‡ Duncan in Trans. Med. and Chirurg. Soc. of Edinb. vol. i.

§ Versuch, &c. sup. cit. sechtes Kapitel.

|| Rutherford, Duncan, Von Stosch, and others.



The stomach has been observed of double its ordinary capacity, its mucous membrane thickened, highly injected with blood, and of a very dark colour. This organ and the upper bowels generally appear distended with a large quantity of greenish-coloured fluid *possessing unusual acidity*. The great intestines are commonly impacted full of pale greenish-coloured dry feces or scybalæ without the proper excrementitious fœtor.

The liver has been found in very various states in different cases of this disease. Its secreting faculty, as evidenced in the product of this power, the bile, would seem to have been remarkably implicated in every case, for this fluid, when particularly examined, has always been found to possess acid instead of its natural alkaline reaction, and to be of a very pale yellowish colour, and peculiarly fluid. Gall-stones, and laminæ of recent deposition upon older concretions, when they have occurred, have also been observed to be colourless, and to resemble spermaceti.\*

The kidneys are the organs that have naturally attracted the largest share of attention in a disease that is obviously so intimately and so especially connected with abnormal performance of their function. Contrary to all reasonable expectation the kidneys have, however, on the best authority, been found either wholly unchanged in their general appearance and intimate structure, or they have been found changed in so trifling a degree only, as would seem to warrant the inference that no defect in them could

\* Horn's Archiv. 1807.



have caused, far less have brought so formidable a disease to so disastrous an issue. In a note to his reprint of Heberden's Commentaries, Soemmerring\* says that on the most careful inspection of the body of a young man who had laboured under diabetes for a year, and had died of fever, he could find little that was preternatural; the kidneys were *only in a very slight degree more loaded with blood than usual*, and the gall bladder was empty. But pathological anatomists generally agree in describing the kidneys in melituria as softened, and enlarged, their blood-vessels being of unusual magnitude, the papillary substance and tubuli extremely permeable, and the pelves and ureters of greater dimensions than common. Occasionally they have been found to contain calculi.

When melituria has continued for any time, the lungs very commonly sympathize particularly with the state of disorder into which the whole system falls, and it is well known that the immediate cause of the death of two thirds of those who have suffered from melituria is phthisis pulmonalis. To conclude, the body of the patient who has died of melituria has been observed not to exhale the usual cadaverous smell; even when laid open, the serous cavities emit nothing of the odour that is so peculiar and characteristic.

All that has been said makes it evident that melituria is a very formidable disease. The prognosis indeed is generally so unfavourable, that it has even been made a question whether any case of ultimate

\* Op. indicat. p. 111. 8vo. Francof, ad Moen, 1804.



and perfect recovery from the confirmed malady be yet to be found in the voluminous annals of practical medicine. This, however, is going too far. That the disease may and has been in several instances kept at bay for many years seems indisputable, so that in all probability life has at length not been materially shortened through its occurrence. The disease is besides unquestionably one of function, not of structure; and all we know leads us to infer that for functional disease a remedy exists. In the generality of cases, nevertheless, the melancholy truth remains, that the disease runs its course but little influenced by remedial measures of any kind, and in no long space of time consigns its victim to the grave. In what we might probably with justice term the incipient stages of melituria, before the organs implicated have acquired a *habit* as it were of acting faultily, there is reason to believe that the disease is very much within the reach of art; the cases which have done well have been seen at an early period. It were, therefore, of the last consequence that the constitutional disturbance which precedes, gives rise to, or accompanies the state of gastric disorder and of renal erethism that ultimately prove so intractable, were distinguished and subdued at the outset. Unfortunately patients are not, and cannot be expected to be aware of the nature of the disease with which they are threatened, and it too commonly happens that the mischief is irremediable before any application is made for relief.

In the treatment of melituria we have hitherto had nothing but experience to guide us; and



with all the better knowledge we now possess of the intimate nature of the disease, we must still continue to rely in a great measure on a rational empiricism. *Could we discover any means of preventing the stomach from forming sugar, we should, I believe, succeed in curing the disease.* To this end the efforts of practitioners ought in future, as I imagine, to be directed. Meantime, all the influences that have been regarded as remote causes of the disease, or in connexion with which it has arisen, such as the use of indigestible food, especially of a vegetable kind, diuretic drinks, exposure to cold or to sudden alternations of temperature, violent exertions of every kind, over-indulgence of the sexual appetite, depressing moods of the mind, too constant application to study, or business, &c., are, in the first place, to be sedulously avoided. Some attention should be given to the history of previous illnesses, and assurance should be had that the constitution is not suffering from the effects or *dregs*, as they are vulgarly called, of any of these. Intermittent fevers, measles, scarlatina, certain scaly and pustular eruptions, &c., often leave traces of their existence behind them for years after they have visibly disappeared. Measures are farther to be taken for correcting whatever is obviously faulty among the functions at large, or in any one of these in particular.

The most general morbid symptom, or rather aggregate of morbid symptoms complained of in melituria is *feverishness*, with its ordinary accompaniments; and in what may be called *acute* cases of the disease, such measures as act generally in re-



ducing this, are found to be of the greatest service. The most powerful of all antiphlogistic remedies is blood-letting; and there is perhaps no fact better established in connection with the treatment of melituria, than the temporary advantage to be derived from the abstraction of blood. This powerful means is of course to be used with great discretion; it is always to be borne in mind that blood-letting will not cure melituria, and that we have to do with a disease which cannot be cut short by the heroic administration of any remedial measure. A bleeding of from eight to twelve ounces, according to circumstances, may be commonly practised with considerable relief to the feelings of general uneasiness and state of excitement under which the patient labours, and this may be followed by the application of leeches or the use of cupping-glasses to the pit of the stomach where feelings of burning and constriction are complained of there, or to the region of the kidneys, in case they are the seat of anomalous sensations, and from the activity of the urinary secretion are seen to be in a state of particular erethism.

Next to blood-letting, or perhaps even superior in efficacy, but in the majority of instances necessarily following its use in this disease, is the exhibition of opium. In few diseases do we see the influence of any therapeutic means more marked than that of opium in melituria; it has hitherto been the sheet-anchor of almost every practitioner in arresting the progress of this disease. Some have recommended opium to be administered at once in large doses, and to be pushed to what might very fairly be styled



an abuse of a valuable means. Others seeing that opium had no specific action in melituria, that it acted in virtue of its qualities as a general sedative, have advocated its use to the extent of securing its tranquillizing effects and no farther. This is the course that reason and sound philosophy dictate. It is besides a great mistake to suppose that patients labouring under melituria are little liable to be influenced by opium, and that the drug may be given with impunity to almost any amount in the disease; for the fact is that ordinary doses here produce their ordinary effects, and in some cases so great an effect that they have to be lessened, and the medicine even suspended for a time, to be recommenced more cautiously, or pushed more slowly. One or two grains of opium in melituria, as in other diseases where the medicine is decidedly indicated, are in general the proper dose; if we can do with half a grain, so much the better. It is very commonly advantageous to aid the natural tendency of opium to the skin by giving it a combination with ipecacuanha, or still better with minute doses of the tartrate of antimony. The latter medicine will, I believe, be found more useful in allaying the craving and distressing sensations at the pit of the stomach, which lead the patient to seek relief in eating and drinking inordinately, than any thing else;\* it has also the

\* Upon the same principle I was led many years ago to recommend a man with whom I was acquainted, and who inherited a taste for spirituous potations, which in his lucid moments he bitterly deplored, but declared to be perfectly irresistible from the gnawing and horrible sensations he felt at the pit of the stomach, to mix small quantities of tartrate of antimony with his ordinary



advantage over ipecacuanha of determining still more powerfully and decidedly to the skin, a point of great moment in this disease.

Among general means *emetics* and *purgatives* require our particular consideration. In this country the use of emetics has gone very much out of fashion; purgatives are the only medicines in universal vogue. Nevertheless emetics are well worthy of attention; from the earliest times in the history of the diabetes mellitus they have been found useful in its treatment. The celebrated A. G. Richter\* tells us that he had succeeded in curing one case by their means, and Berndt† of Greifswald had seen a remission of all the symptoms, and a cure to all intents and purposes that lasted for full six months, brought about by the means of emetic doses of tartrate of antimony. Other cases of the same kind might be quoted.

The naturally confined state of the bowels in melituria, and the effect of opium in inducing this condition, necessarily require the exhibition of aperient medicine to secure the evacuation of their contents. But *purgative medicines* are remedies of far more potency, and have a much wider sphere of action on the animal economy than is implied in the most striking effect of their operation, namely, the discharge of the contents of the intestinal canal.

dose of liquor; and with excellent effect. This idea has I know struck and been acted on by others. The medicine is even I believe the ingredient in a nostrum against drunkenness, which enjoys extensive reputation in North America.

\* Med. Chirurg. Bemerk. B. I. s. 76; translated into English by Spence, 8vo. Edinb.

† Encycl. Woerterb. Art. Diabetes.



They are invaluable as correcting deranged action in the system generally ; by exciting the proper secretions of the alimentary canal they powerfully promote digestion, and facilitate assimilation ; by deriving, too, from organs in a state of over-excitement, or remedying what our forefathers entitled an *error loci*, which they do most efficiently, purgative medicines are not only among the most valuable remedies in the treatment of disease generally, but of melituria in particular. They ought always to be exhibited with a view to what may be called their constitutional effects. Rhubarb and aloes, aloes and extract of colocynth, jalap and senna, combined together, and castor oil, are among the best purgatives we possess under the circumstances we are considering. Whichever of these medicines is prescribed, or is found to agree best, ought to be given in such doses as will secure the passage of one, or even of two copious semifluid evacuations every day.

It is of the utmost consequence in melituria to restore the healthy action of the skin, to bring this extensive membrane from the state and semblance of a hard and impervious sheet of parchment, to the velvety, porous, and perspiring condition it presents in health. This indeed is a point extremely difficult of accomplishment, but in the ratio of the difficulty is the importance of the object in this instance. The ordinary means resorted to—the warm bath, &c., are totally inefficient ; a far higher amount of stimulation than can be borne when so perfect a conductor as water is used, is necessary to arouse the skin to healthful action in melituria. Happily we have in



the hot-air bath or sudatorium the means of applying the amount of excitement required. It happens very rarely indeed that a melituristic patient is found who resists this powerful agent, which causes large drops of sweat to start upon the skin where no trace of moisture had been seen for months. The sudatorium has even been held as a complete prophylactic of the disease we are discussing; and it is curious to learn that in Russia, as Dr. Lefevre\* informs us, where every peasant and artizan makes use of the sudatorium, the disease is unknown. He had himself looked in vain through the records of the principal civil and military hospitals of the Russian empire, for the mention of a single case; and Sir James Wylie had not met with it once among upwards of two millions of soldiers who had passed under his notice as general military inspector. Dr. Lefevre has even published a case† in which recovery took place under the united effects of two venesections, the Dover's powder at night, calomel and colocynth occasionally as a purge, and the sudatorium at 45° R., nearly 134° F. The urine of this patient was analysed by M. Chevreul, and found to contain a large quantity of sugar. Copious perspiration was induced, and all the morbid symptoms were relieved. The urine, from about ten or twelve pints, was reduced at once to five; and the bath being repeated, every vestige of the disease vanished. The urine became natural in quantity, and examined after an interval of four months, was found

\* Lond. Med. Gazette, Nov. 29, 1834.

† Journal de Physiologie par Magendie, tom. iv. 1824.



quite free from sugar. Dr. Watson has also published the particulars of two cases in which the sudatorium proved very beneficial, though it did not cure the disease. The patient's own account in one of these instances of his improvement is characteristic: "The urine is reduced more than one half, and does not contain much sweetness, but sometimes tastes salt, with a mixture of bitter. My stools, which were dry, and like balls packed together, are quite natural. The pains in my limbs are entirely removed. My spirits, which were very much depressed, are now revived, and cheerful. The unpleasant aching of my kidneys, of which I spoke little, lest I should be cupped in the loins, is now removed; only I feel weak there. I am cured of the pain in my stomach, and the circuitous working of the wind in my bowels, which formed lumps in my belly as it passed, resembling those formed by the cramp. I have likewise got rid of the palpitation at my breast, which was accompanied by a sort of dread. My breathing is much improved; perspiration in a great measure restored; and my skin, which was dry, is now become moist. I sleep well at night, whereas I could not sleep more than two or three hours out of the twenty-four. My thirst, which was excessive, has ceased to be troublesome." This patient finally became phthisical, and died. I have had the particulars of a fourth case communicated to me, in which the sudatorium has even appeared adequate to control the course of the formidable disease we are describing. I can only allude to this case here; but so long as the individual affected keeps the pores of his skin open by



means of the sudatorium, so long does his urine remain normal in quantity and healthy in character. When he neglects this means, the urinary secretion shows an immediate tendency to increase in quantity and to become vitiated in its quality.

As a farther means of promoting the action of the skin, dry frictions with flannel gloves and the flesh-brush are to be diligently used. Warm woollen clothing should as a matter of course be worn, and if by these means we succeed in restoring or inducing a sleek and perspiring state of the surface, we shall certainly do much for the relief of our patient. Frictions with oil over the surface of the body have been recommended by some. As inducements to perseverance in the use of the flesh-brush and friction generally, oily inunction may be instituted; the dry flesh-brush or flannel glove, however, is equally effectual as a stimulant, and far more cleanly.

Such are the general medical means to be employed in this disease. In so far as they tend to rectify disordered function, they are each useful; they are all equally defective, however, in not striking at the root of the evil, the peculiar state of derangement of the stomach and bowels which leads to the excessive elaboration of sugar.

An immense variety of particular medicines have been at different times proposed and strongly recommended by their advocates as efficacious in melituria. The number and dissimilarity of these impress the mind with a conviction of their common inefficacy. Rollo, for instance, appears to have had great faith in the alkaline sulphurets; and the



hydro-sulphate of potash, and solution of the hydro-sulphate of ammonia, or fuming liquor of Boyle, have often been prescribed by others; but always without decided benefit appearing to follow their use.

If any among the multitude of medicines that have been prescribed with a view of influencing melituria particularly, has ever had the slightest effect in controlling the state of stomach upon which it depends, it has been magnesia. I believe it was Dr. Trotter who first recommended the magnesia in this direction; he prescribed it at all events in large doses, and in two cases with success. It was probably tried in the first instance as a remedy against the sensations of heat and scalding so generally complained of in the region of the stomach; and it has undoubtedly been several times employed with more of what, in opposition to the prevailing views of the day, might be termed a *specific* effect, than any other medicine. It is one of the very few articles too that has done good in the hands of different practitioners. Hufeland\* among others speaks highly of its powers. My friend Mr. Benjamin Phillips tells me that he lately prescribed magnesia upon two occasions to the same individual labouring under melituria in an early stage, and in each instance with success: the sugar disappeared from the urine, the thirst and all the other symptoms of the disease were immediately relieved and speedily vanished. I had lately under my care at the Infirmary for Children a child about five years of age, with the symptoms of melituria well marked;

\* Journal, B. XLVII. St. 6, s. 117.



the urine was copious, of high specific gravity, (1.033,) passed spontaneously into fermentation, yielding abundant bubbles of carbonic acid gas for several days, and acquired something of a vinous odour. The constitutional symptoms were also those of the disease; there was wasting, thirst, shrivelled skin, &c. The magnesia in half dram doses in mint water three times a day, three grains of Dover's powder at night, castor oil in quantity sufficient to keep the bowels open, and a regulated diet consisting principally of eggs and meat, had the effect of relieving all the symptoms in the course of four days: the thirst was appeased, and the urine was reported as nearly natural in quantity. The medicines, &c. were directed to be continued for three days more, when the mother of the child was to have brought me a second specimen of urine for examination. It is with much regret I have to add that I was doomed in this instance to undergo the kind of disappointment so commonly experienced by the medical officers of dispensaries—I did not again hear of my patient, in whose fate I was so much interested.

I am not aware that any corresponding effects have been observed from the use of the alkalis or alkaline carbonates, although something might be anticipated from their use; indeed, I observe, that in the case of cure related by Zipp,\* both the carbonate of soda and the calcined magnesia, especially the latter, were freely used. Where there is obvious acidity of the *primæ viæ*, indicated by

\* Hufeland's Journ. B. 65.



heartburn, acid eructations, &c., the alkalis and absorbent earths are clearly indicated, and cannot fail to prove beneficial. The cause of this morbid state, however, must still be particularly regarded, and its radical correction be made the grand object in the treatment. Dr. Sharkey\* had two cases of the diabetes with sweet urine, the particulars of one of which he has given, which recovered under the use of the phosphate of soda. Another case in which the urine was not sweet, was not benefited by the same treatment. As tending to promote the proper action of the bowels, I can imagine the neutral aperient salts, the phosphate of soda, among the number, as every way calculated to be useful in melituria.

Mercury has of course been tried repeatedly in melituria, as in every other of the ills that assail humanity, and "with good effect," says he who particularly recommends it to our attention. At the present time I do not see a single indication that could warrant our pushing mercury the length of affecting the system. The favourable results boasted were very probably obtained in spite, not in consequence of the specific effects of the medicine. Some of the milder preparations of mercury, as the hydrargyrum cum creta, or the blue pill rubbed up with chalk mixture or with carbonate of lime and white of egg, in small and merely alterative doses, I should think would be very apt to be found serviceable.

The ammoniuret of copper was vaunted by

\* Trans. King's and Queen's Coll. of Phys. vol. iv.



Frank, but has not been found by subsequent practitioners to answer the expectations raised by his praises. Much has been said of the virtue of camphor in diabetes mellitus by many excellent authorities, and from its anodyne qualities and faculty of exciting the skin, I can well believe all that has been written in its favour. Turpentine, a medicine near akin to camphor, has been tried in melituria and found beneficial, particularly by Dr. Copeland.\* Cantharides is another powerfully stimulating medicine that has been employed in melituria; but upon what principle, it is difficult to imagine. If it were ever pushed the length of producing its peculiar effects, surely it could only do mischief.

Alum, from its astringent properties, and probably with a view that through these it might lessen the ready permeability of the kidneys, has been frequently tried in melituria; but never, save by the one or two, who in their anxiety to light on a novelty spoke first in its favour, with any advantage, and sometimes not without ill effects. Indeed, astringent medicines, whether of mineral or vegetable origin, seem rather to do harm than good in this complaint.

The same reproach cannot be made to the bitter tonics and mild chalybeates, such as the carbonate of iron, &c. which have often proved of great service in melitury. These medicines, in fact, used after measures calculated to allay the excitement in the stomach that commonly accompanies, perhaps causes

\* Dictionary of Practical Medicine, Art. Diabetes.



acidity and imperfect function, combined with opiate sedatives and proper regimen, have something of a specific virtue in controlling deranged states of the urinary secretion generally, and in the earlier stages of some of these, and especially of the rebellious form we are considering, seem to exert a very powerful and beneficial influence. The bark, and sulphate of quinina, are here, as elsewhere, among the most commendable and elegant tonics we possess. Of the bitters, the quassia, gentian, and calumbo, deserve to be particularly recommended. The carbonate of iron in a full dose, *i. e.*, a dram or two combined with compound powder of ipecacuanha, and made into an electuary with white of egg, taken two or three times a day, has been seen by Dr. Prout "to produce the very best effects."

There is one remedy of a class that has not of late years at least been held in any repute in this country, but which, from the high authority on which it is recommended, and also upon other grounds, I feel bound to mention. This is the bile of the ox. Hufeland,\* writing at the end of a long life devoted to the exercise of his art, speaks highly of its effects. Post mortem examinations have shown the bile of an unusual and unhealthy character, and probably of such a constitution as prevents it from accomplishing the ends for which it is prepared. Dr. Billing, in his very original and valuable work, "The Principles of Medicine,"† shows the manner

\* Journal, B. 65 ; and Encheiridion Medicum, 3tte Ausg. 8vo. Berl. 1837.

† Third Ed. 8vo. Lond. 1838.



in which the bile influences chylication to be akin to the operation of the *finings* added to wine, &c. This implies chemical, as well as mechanical, action ; and if by the exhibition of the healthy bile of the ox or sheep we could secure the more perfect performance of the after-stages of digestion, undoubtedly we should do much to remove that upon which melituria depends, the existence of unelaborated or undecomposed sugar in the bowels.

Among topical measures, independently of the use of leeches, and cups with scarification, already mentioned, blisters to the region of the kidney, and still better to that of the stomach, ought not to be neglected, general, or at all events local, blood-letting having been premised. If we would have counter-irritation in a severer and more penetrating form, the ointment or plaster of the tartrate of antimony, or a moxa applied till the skin and cellular tissue immediately subjacent to it were destroyed, will be found very powerful measures. The seton is another excellent and very manageable means of procuring counter-irritation, which is too much neglected in the treatment of affections of the deeply seated internal organs ; medicine, by this neglect, is deprived of one of the most powerful means of attacking chronic diseases in their seats yet discovered. The common place of establishing counter-irritation in melituria is the loins, particular regard being had to the kidneys ; the pit of the stomach were the preferable situation.

I now approach the second grand division in every scheme of cure proposed for melituria, without attention to which experience has shown that



all the pains in the world will generally be thrown away, this is the *ratio victus*, the regimen proper to be followed by the patient during the course of remedies prescribed for him. Where derangement of the functions of digestion, and undue elaboration of the chyle are, as I conceive them to be in melituria, not merely prominent features of the disease, but its very essence, the regulation of the diet becomes a measure of necessity, and ever since Rollo, acting on the hint of Dr. Francis Home,\* insisted on the advantages of a regimen consisting entirely of articles derived from the animal kingdom, this point has attracted particular attention.

There cannot be a question about the utility of the animal diet now so generally prescribed in melituria. Vegetable substances containing starch, and bread especially, afford the pabulum out of which sugar is produced if not entirely yet in very great part, and these being withheld, and no more sugar supplied to poison the blood, the distressing constitutional symptoms—the fever, thirst, parched membranes, restlessness, &c., subside, and the organ—the kidney, whose function is so much implicated, and so peculiarly exalted, seems at once to become quiescent, so that if it does not yet secrete urine exactly like that of health, its product, at all events, departs far less from the proper standard both as regards quantity and quality. The generality of writers are agreed, that under the influence of animal diet, the saccharine state of the urine disappears. Dr. Prout is the only good authority I find

\* Medical Experiments, 8vo. Edinburgh, 1783.



speaking doubtfully upon this point. He admits that the quantity of urine secreted is greatly lessened; but he, with justice, remarks, that its specific gravity remains as high as ever; and concludes that the sugar is merely masked, not annihilated in the fluid. Dr. Prout, however, does not seem to have insisted on a diet *wholly* of animal substances; his patients were still allowed a certain proportion of light farinaceous food; and it was not therefore to be supposed that the urine would present itself free from all saccharine impregnation under these circumstances. Mr. M'Gregor's experiments, indeed, go to prove that the stomach of the individual affected with melituria has the power of elaborating sugar to a certain extent, even out of food of a purely animal character. Animal diet therefore does not strike at the root or cause of the disease. It is invaluable as enabling us to gain time for the employment of general and particular remedial means calculated to overcome the peculiar functional derangement of the stomach; but it is in itself no cure for melituria. One of the great obstacles to our being able to derive all the advantage possible from the negative condition procured by the use of the animal diet, arises from the fact, that in temperate latitudes, food wholly composed of animal matters is not adapted for man; he becomes ill under its use; the remedy is itself an adequate cause of disease. Patients, also, after having gone on vigorously for a time with an exclusively animal regimen, at length feel such a loathing and repugnance for their meals, that it becomes impossible to persevere; they revert to vegetable



food, and the disease is immediately reproduced in as bad a shape as ever. It is astonishing how small a quantity of farinaceous food will bring back the fever and thirst and inordinate elaboration of sweet urine; half a small biscuit, of the kind sold at the rate of three for a penny, in one of Dr. Rollo's cases, caused the instantaneous relapse of the patient. This shows how inefficient animal food alone is to overcome the cause of the disease.

Nourishment given in too concentrated a shape never thrives with man; it excites and makes him feverish; and nature has mixed the food of all animals, save the purely carnivorous tribes, with a large proportion of insoluble and absolutely innutritious matter. The amylaceous particles and gummy elements of the cerealia and tuberous roots are still entangled in a considerable proportion of husk and woody fibre. The natives of uncivilized countries, when game fails and they are reduced to live on honey, always mix it with something that is insoluble. In Ceylon, where this frequently happens, decayed wood is the substance used for this purpose. One of the natives, when asked by my friend Mr. Marshall why he mixed the honey with rotten wood, replied, that "the belly required to be filled." Had I now a case of melituria to treat, I should act on this hint. I should supply a moderate quantity of nutritious animal food,—yolk and white of egg, beef and mutton finely chopped, soft curd, &c., mixed with a considerable proportion of woody fibre and indigestible matter, such as bran freed from all amylaceous particles, by boiling in a large quantity of water, the woody part of the potato



separated from its starch by rasping and washing, and the like. In this course we should be essentially aided, if a circumstance communicated to me by my friend Dr. B. G. Babington, whose researches into many interesting points of chemical physiology give him so deservedly high a place in the profession, be borne out by farther experience, namely, that green vegetables—the oleracea, such as spinach, cabbage, celery, &c., may be taken without increasing the saccharine qualities of the urine. These vegetables include next to no amylaceous particles; they, however, include a considerable proportion of gummy extractive matter, upon which their nutritive qualities entirely depend. If it be found by farther experiment that these are not converted into sugar in the stomach, I should regard the discovery as of high interest in the history, and calculated to be of the last consequence in the treatment of melituria.

The grand question in connexion with the treatment of melitury still remains unanswered. What can be done in particular to prevent the excessive formation of sugar in the stomach; and sugar being formed, what will secure its transformation into the elements of proper chyle? It is most difficult at all times to counteract the operations of nature acting faultily; it is doubly difficult to come between her and the accomplishment of any of her normal processes. Fecula or starch is one of the most universally distributed and generally adopted articles of food by man and beast, and the first operation of the healthy stomach upon this, is to convert it, to a certain extent at least, into gum, and then into



sugar. The agent in this conversion, however, would appear to be not the proper solvent or digestive juices of the stomach, but the saliva which is mixed with the food during mastication. Schwann and Mueller,\* in their experiments, found that the artificial digestive fluid, composed of an acidulated infusion of the inner membrane of a calf's stomach, dissolved starch completely, but did not give rise to the formation of any sugar; they observed, however, that when they added saliva to the peptic solution, sugar was formed; thus confirming the previous discovery of Leuchs,† of the power possessed by saliva of converting starch into sugar. Would any thing be gained by administering food to patients affected with melituria, without suffering it to undergo the ordinary preliminary mastication, thereby preventing it from being mingled with saliva? Would food that has not been mixed with saliva, thrive with man for any length of time? I believe it would; the tongue, I know, will become clean, and the strength will return under the use of pulpy food administered by means of an œsophagus tube, as I had lately an opportunity of observing in the case of an aged gentlewoman, who, in consequence of the mechanical obstruction of a piece of meat arrested within the œsophagus at the point where this conduit threads the crura of the diaphragm, having passed above fifty hours without food, showed the pale furred tongue of protracted abstinence, and was beginning to sink from ex-

\* Archiv fuer Physiologie, 1836.

† Poggendorf's Annalen, B. xxii.



haustion. Some broth thickened with arrow-root was injected into the stomach by means of an œsophagus tube, with the effect of making the tongue look bright and clean, of restoring the strength, and giving the irritated parts time to recover themselves, which they did in the course of a day completely. Could vegetable food be administered to melituristic patients without prejudice through an œsophagus tube? If the agent in the conversion of fecula into sugar be saliva, as seems certain from the experiments of the distinguished physiologists referred to, we should expect to avoid this conversion by preventing any saliva from reaching the stomach. Chemistry, which has served medicine so efficiently and on so many occasions, ought surely to come to her aid in this instance, and show as well what will *prevent* as what will *cause* the formation of sugar from starch.

It only remains for me to remind the reader of the necessity of conjoining with the medical and dietetic means employed, all those that by the experience of mankind at large are allowed to influence the state of the bodily condition. The patient should live in good air, in a healthy situation, avoid exposure to cold, &c., and make occupation for himself in directions that are not only not incompatible with vigorous health, but that conduce to this desirable state. It has been remarked, that those who suffer from diabetes are generally individuals of superior intelligence. Hufeland, writing after he had passed something like sixty years in the exercise of his profession, says he never met with a *stupid*



man affected with diabetes.\* Individuals with minds, if fortune only favour them, can be at no loss for healthful occupation out of doors, one of the great means of keeping "a sane mind in a sound body."

The method of examining the urine in melitury is simple enough. There are two points of moment to be considered in the analysis: First, the weight of urea; and, Second, the weight of sugar,—the *urea*. The general physical qualities of the fluid and its specific gravity having been noted, a portion of it, say 500 or 1000 grains are to be evaporated to dryness, and the residue treated with boiling alcohol at .833. This alcoholic solution of the sugar, urea, urodmechrome, and lactates, after filtration, is to be reduced to dryness, and the residue re-dissolved in distilled water; this solution having, in its turn, been reduced to the consistence of thin syrup, is to be placed in a freezing mixture of pounded ice and common salt, and to have a like quantity of a mixture of equal parts of nitric acid and water added to it. After a while, a crop of crystals of nitrate of urea will be formed. These crystals are to be separated from the fluid, and to be dried by being pressed between several folds of bibulous paper. They may even be purified to a certain extent by being washed with ice-cold water, without losing any sensible weight. From the quantity of nitrate of urea obtained, the amount of

\* "Ich erinnere mich keines diabetischen Kranken der dumm gewesen waere." Journal, B. 65, St. 1, S. 34.



uncombined urea can be readily deduced, according to the known constitution of the compound (nitric acid 54 or 1 equivalent, urea 60 or 1 equivalent.) This was the method followed by Mr. Kane of Dublin, in demonstrating the existence of urea in diabetic urine. The procedure of Mr. M'Gregor is very elegant. He destroys the sugar in a given quantity of urine by fermentation with yeast, evaporates to dryness over a steam bath, treats the residue with hot strong alcohol, filters, evaporates the solution to dryness, and obtains the urea in a crystalline form, not pure indeed, but sufficiently so for all practical purposes.

The *Sugar*.—For sugar there is no more useful test than yeast, which I believe was first employed in this direction by Dr. Fr. Home of Edinburgh. Mr. M'Gregor recommends the yeast to be introduced into the bottom of the phial, and a given weight of urine having been gently poured in so as not to disturb it, the mixture is to be placed in a temperature from 70° to 80° F. At the end of forty-eight hours the fermentation will have ceased; and the degree of attenuation undergone by the fluid will afford an index to the quantity of alcohol formed, otherwise, to the quantity of sugar destroyed. Yeast is an exceedingly delicate and very available test of sugar; half a grain of this substance in two ounces of urine being readily detected by its means. To obtain the sugar directly, the salts of the urine may be precipitated for the most part by the addition of a solution of sugar of lead, which in its turn is to be thrown down by means of a stream of sulphuretted hydrogen passed through the fluid. This being



filtered and allowed to evaporate spontaneously, or with a very little assistance from heat and a current of air, the sugar is obtained in regular crystals. Mr. M'Gregor collected sugar in such quantity by proceeding in this way, that he at length procured a small loaf of the substance. Another delicate and easily applicable test for sugar in the urine, was very recently proposed by Dr. Runge.\* A drop or two of the urine being dried by means of a very gentle heat on a porcelain dish, a drop of dilute sulphuric acid (1 of acid, 6 to 8 of water) is to be let fall on the spot, when the presence of sugar is immediately proclaimed by the place inclining to black. One part of sugar in 1000, and even in 2000 of urine, is immediately detected by this means. When the urine contains no sugar, little or no change takes place at the ordinary temperature of the air. Heated to 100° C., or 212° F., the spot assumes an orange colour. This test would be equally available for the discovery of sugar in the serum of the blood.

\* Poggendorff's Annalen, B. XLIII., S. 432. Berl. 1838.



## CHAPTER VIII.

CONSEQUENCES OF ONE OR OTHER OF THE MORBID STATES DESCRIBED, PARTICULARLY OF THOSE COMPRISED IN CHAPTERS III. AND IV.—UROLITHIASIS, THE FORMATION AND GROWTH OF URINARY CALCULI.

THE morbid states connected with the formation in excess of the various sparingly soluble ingredients of the healthy urine, as well as those in which matters foreign to the constitution of this fluid, and either readily precipitable from or altogether insoluble in it, are elaborated, have been already particularly discussed. Our business under the present head will be to examine the phenomena which accompany the deposition of one or other of these little-soluble substances in some point in the course of the uropoetic organs, the consequences of the presence of foreign bodies engendered, and the means, especially such as fall within the province of the physician, of removing these from the system.

SECTION 1.—*Of Renal Calculi, and the different kinds of calculus, whether renal or vesical.*—NEPHROLITHIASIS.—UROLITHOLOGIA.

In speaking particularly of the different kinds of sedimentary urine, it has been stated that the de-



posite was liable at any time to take place within the body as well as to happen in the recipient of the urine without it. The situation in which this internal deposition takes place, may be said (except in those cases in which foreign bodies are introduced into the bladder) to be invariably the body and pelvis of the kidney. The natural nuclei of urinary calculi of every description are engendered in the kidney; were there not something wrong at the moment the urine is generated, we should never have a nucleus, and so escape any larger concretion. In aggravated cases of the lithic diathesis, crystalline particles of the lithic acid or one of its salts may frequently be pressed out of the tubuli, or radiated tissue of the kidney, and aggregations of these particles are occasionally observed clogging up the tubuli; so that it is not even in the pelvis or receptacle, but in the substance of the kidney itself that the deposition of solid matter takes place, that the first step in the formation of a stone is achieved. In the other as well as the lithic kinds of urinary concretion, as those formed of the oxalate of lime, of the cystine or cystic oxide, of the xanthic or uric oxide, and of the phosphates, the process of generation is in all probability not essentially different.

When urinary concretions are of small size, and are passed directly as it were from the kidney with little or no delay in the bladder, the disease is characterized by the name of *gravel*. Gravel, or renal calculi, have been observed of many different kinds. There are only two of these, however, that are at all common, the lithic acid and



the triple phosphate; and of these two the lithic acid is out of all proportion the most frequent; in fact, if we were to exclude some particular districts in which the oxalate of lime concretion is common, as around Bristol and Wuerzburg, about nineteen in twenty cases of gravel would be found to consist of the lithic acid kind. As of by far the most frequent occurrence then, and consequently of much the most importance, let us briefly review the circumstances attending an attack of lithic acid gravel, the circumstances preceding which have been already detailed.

It is a remarkable circumstance, but one which had frequently been observed, that just before unequivocal evidence is afforded of the deposition of calculous matter within the kidney, the urine which had long been observed to deposit freely, ceases to let fall any sediment as it cools. Instead of this outward symptom of deranged renal function, the urine is secreted in diminished quantity, and even higher coloured than heretofore, and symptoms of general constitutional disturbance also make their appearance:—the appetite fails, the tongue is furred, the bowels are constipated, the skin is hot and parched, the pulse is increased in force and frequency, there is restlessness, head-ache, thirst, &c.,—in a word, the apparatus of simple fever is developed. These symptoms continue for a day or two, when gritty particles very commonly make their appearance in the urine. As they come away, these are apt to excite sharp scalding pains, higher or lower in the course of the urinary passages. So long as they remain lodged in the pelvis of the kid-



ney, indeed, they occasion little uneasiness beyond a sense of weight ; but the moment they have fairly entered the ureter, if they are of any size, the pain they excite often acquires a character of great intensity, so that a strong man in a paroxysm of *nephritic colic*, or *calculus making its way down the ureter*, generally becomes helpless as a child, he quivers with agony, big drops of sweat burst from his forehead, he becomes sick, and the contents of his stomach are discharged by vomiting. The pain from the part more particularly affected shoots at intervals, like a cramp, down into the bladder and groin, along the penis and front of the thigh, and the testis of the affected side is retracted towards the inguinal ring. During the fit there is farther a frequent desire to make water, which is always accomplished with difficulty, and with a severe extension of the pain to the extremity of the member. By and by the urine is very commonly tinged with blood ; and when this occurs to any extent, small coagula, or fibrinous clots, are voided with gritty particles adhering to their surface. The symptoms now specified continue with remissions and exacerbations more or less marked, for a variable length of time ; sometimes they are relieved suddenly, at other times they die away by degrees. The most favourable termination of the fit is when a quantity of gritty particles, or one or more concretions, are voided with the urine ; this conclusion, indeed, ought always to be anxiously looked for, and many of our efforts in the treatment are directed with a view to bring it about.

The symptoms attending the generation, and



especially those accompanying the passage to the urinary bladder of gravel or renal calculi generally, do not differ in any material respect from those which have now been described as marking the formation and progress of a concretion of lithic acid. But the different circumstances under which various concretions belonging to each of the two great classes into which all depositions from the urine may be divided, necessarily impress considerable variety on the kind of treatment adapted to these.

In the one class I arrange concretions of the lithic acid and the lithates, of the oxalates, of cystine or cystic oxide, and of the uric or xanthic oxide; in the other, I place the calculi formed by the phosphates. The state of system connected with which the whole of the calculi included in the first of these classes are engendered, has much in common; and though certain parts of the treatment especially adapted to the occurrence of lithic concretions, may prove of less avail in those cases in which the oxalates and animal oxides are deposited, still they will not prove prejudicial, and may even do as much good as any plan that can be followed. In those cases in which the phosphates are deposited, however, matters are different, and the treatment requires in almost every particular to be different.

In treating a fit of renal calculus rationally, it is therefore imperative on us to have an eye to the circumstances that have preceded the attack, and to make sure of the conditions and qualities of the urine that are associated with it. Supposing the lithic acid and the lithates to have been for some



time habitually deposited, and to be still precipitated during the fit, we have several clear indications of treatment before us, happily for the most part of easy accomplishment.\* These are, First, to lessen the quantity of the lithic acid elaborated by the kidney; Second, to increase the dissolving powers of the urine by adding to its quantity; Third, to augment the solubility of the lithic acid as it is formed by securing its combination with an alkaline base; and Fourth, to attempt the expulsion and solution of the concretions or calculi already formed.

I.—The most effectual means of lessening the quantity of lithic acid formed by the kidney is to diminish the semifebrile or hypersthenic state of the system with which it is so intimately connected, by abstracting largely from the amount of nutritious and stimulating food consumed. The patient must be put upon an *antiphlogistic* regimen, as it is termed; his diet must be strictly regulated; animal food in very moderate quantity must be allowed but once a day, a single glass of sound wine, where the party affected habitually uses wine, largely diluted with water, must be substituted for the usual dose of generous Sherry or Madeira and old Port, the latter of which, in particular, fills the veins of Englishmen in the easier classes with gout and their kidneys with gravel; in a word, from having lived luxuriously, he who is attacked with gravel must begin to live abstemiously first, and temperately ever afterwards.

\* This subject is very happily treated by M. Magendie, in his Essay already quoted.



The most powerful direct medicinal means we possess of checking the formation of lithic acid is the exhibition of purgative medicines. And here the class of purgatives which experience has shown to be peculiarly adapted to inflammatory complaints will be found to exert an immense and most beneficial influence. A dose of calomel and antimonial powder ought to be prescribed at night, and the common senna draught with soda tartarizata early in the morning, either every day or every other day according to circumstances at first, and regularly once if not twice a week for some time to come afterwards. The usual saline mixture containing the citrate of potash or soda, with small doses of the tartrate of antimony and ipecacuanha, is also a very useful medicine.

II.—*To increase the powers of the urine to hold in solution the lithic acid elaborated.* The means most obviously within our reach of accomplishing this indication, is to add to the quantity of the solvent menstruum, and this end is readily effected by the free use of diluents. Let the patient, therefore, who is attacked with lithic gravel, whilst he eats less, drink considerably more than usual of any of the mild diluents so commonly prescribed to patients labouring under febrile and inflammatory complaints, such as toast-water, barley-water, rice-water, decoction of linseed, quince-seed, &c. M. Magendie has warned us against the use of diluents taken warm, as they then tend to pass off by the skin, and the urine is left more than usually concentrated. This caution is probably given on purely speculative grounds. On the contrary, to maintain a perspir-



able state of the skin is a great element in the successful treatment of calculous disorders generally. The urine is not diminished in quantity under the use of diluents taken of a temperature calculated to excite gentle diaphoresis nearly in the ratio in which its colour is deepened; and the researches of Dr. Duvernoy, of Stuttgardt, already referred to, would lead to the conclusion that this state of urine was that precisely which it should be our endeavour to create, he having shown that the colouring principle of the urine was the element upon which the solubility of the lithic acid and super-lithate of ammonia mainly depends. Within the tropics, where the human skin is an open sponge, calculus is a disease almost unknown.

III.—*To increase the solubility of the lithic acid.* The very sparing solubility of the acid has been already noticed. And the accomplishment of this indication must be attempted in a great measure through the agency of the first and second,—we must use means to secure that as little lithic acid as possible be elaborated, and furnish that which is formed with such a quantity of its natural solvent and watery menstruum as shall be adequate to hold it fluid. Happily we can do more than this; we can guard against the decomposition and consequent annihilation of the proper office of the odorous and colouring matter of the urine—the *urodmechrome*, as it might be called, which in the generality of cases happens through the agency of some free acid in the urine, be this the natural lactic or phosphoric acid, or an adventitious acid such as the



nitric, and perhaps the hydrochloric. This important object is to be obtained by neutralizing any free acid which the urine may contain ; and farther, by presenting the lithic acid with a base by combining with which it may become more soluble than it is when free. The alkalis and alkaline earths fortunately accomplish both of these points in the most satisfactory manner. The alkalis especially are among the number of substances which find their way readily into the fluid secreted by the kidney, and used with discretion they are nowise prejudicial to the general health.

It is now upon the eve of a century since the Parliament of England purchased for a considerable sum of money from Mrs. Joanna Stephens her secret remedy for gravel and stone. This in the first instance consisted of calcined egg-shells, *i. e.* lime ; and afterwards of this substance in combination with soap ; in other words, a mixture of carbonate and hydrate of calcium and of margarate of soda, which last from its facility of decomposition may be viewed as equivalent to a compound of grease and the mineral alkali. This medicine long enjoyed an extensive and merited celebrity ; many men distinguished in their day bore testimony to its good effects, and its active ingredients are still those upon which we place considerable dependence in the treatment of calculous complaints. The *lime-water* and *bicarbonate of soda* which we now so commonly and often so successfully prescribe are nothing more than the *calcined egg-shells* and *Spanish-soap* of honest Joanna Stephens's specific in another shape ; whilst



they are not less efficient in their operation, however, they are much more elegant as medicines, and far less offensive to the stomach.

Among the first cases recorded of the systematic treatment of gravel by the simple alkaline carbonate is that of the celebrated anatomist Paolo Mascagni, the particulars of which he has himself recorded in a very interesting memoir.\* Mascagni suffered habitually from gravel. He had heard of the benefit which gravelly subjects derive from the use of Seltzer water, or aqua mephitica alkalina, one of the principal saline ingredients of which is bi-carbonate of soda. This water he tried and found benefit from it. It seems to have struck Mascagni that he might improve upon the mineral water by taking its active saline matter or a matter of the same nature in larger quantity. Accordingly he made himself store of neutral, or even bi-carbonate of potash in the autumn of 1798, and having in the course of the following year suffered from an attack of gravel, many of the particles of which, from their size, might have been called calculi, he put himself upon a course of his carbonate of potash, beginning with a dram dissolved in half a pint of water the first day, and increasing the dose till he took three drams dissolved in a pint of water, a quantity which he continued regularly for ten days. The urine was strongly acid when this treatment was begun; the second day it had undergone very little change, but on the third, it was neutral. The pain in the kidneys now declined in violence, and

\* Published in the 9th vol. of the Mem. della Societa Italiana.



no more grit or gravel was passed. By and by the pain ceased entirely, the urine appeared less loaded, and the alkali was recognized in it in excess. The medicine was now suspended, and several months elapsed before any farther symptoms of gravel were felt. On their recurrence on different occasions subsequently, Mascagni always resorted to his old remedy, and always with success. The fits gradually became more and more remote, and at the time of his writing, two years had elapsed without one having been experienced, though no carbonate of potash had been taken in all that time.

So remarkable a case as this, related by so remarkable a man, ought to have arrested attention more than it seems to have done ; but it was just about this time that chemistry successfully investigated the nature of calculous concretions, and the most common of all being found very readily soluble in the *caustic* alkalis, these medicines began to be exhibited in this shape, in which they are both extremely disgusting to the palate, and from their acrimony hardly to be taken in quantity enough to accomplish the object of their exhibition. Numerous failures and much disappointment ensued, and the alkalis very undeservedly fell into discredit as remedies in numerous forms of calculous complaint. It is only of late that the path of experience has been resumed, and that the alkalis in the form of bicarbonates have been prescribed with a success which only the interested enemies to improvement are found bold enough to deny. The pure or caustic alkalis, even supposing they were neither distasteful nor acrimonious, have in fact no advantage



over the bicarbonates in their action on the matter of lithic concretions, and can be perfectly dispensed with under the circumstances that engage us.

In prescribing the bicarbonates of potash or soda, it is of great moment that they be exhibited in a state of very plentiful dilution. It is this condition much more than the quantity of the salts taken that secures their efficiency. Equal quantities of some of the natural mineral waters that actually contain but one or less than one part of bicarbonate of soda in 200 of the fluid, are more potent in rendering the urine alkaline than a solution of the same salt in the ratio of one to fifty or sixty. A dram, or at most two drams of the salt in from a pint and a half to three pints of fluid, is the proper proportion; and this quantity may be taken at intervals in the course of the day, with the effect of powerfully increasing the activity of the kidneys, speedily putting an end to the acidulous state of the urine, and either washing out lithic grit and concretions of late formation from the pelvis of the kidney, from the ureter or bladder, or disintegrating and dissolving them, wherever they chance to be arrested. Should the urine not become neutral in the course of a day, the quantity of the alkali may be increased. The bicarbonate of soda in particular may be taken in very large doses for a succession of years without the least detriment to the general health. I am acquainted with a medical practitioner in this metropolis who for the last eighteen or twenty years has not gone to bed any night without swallowing two small rhubarb pills, which he washes down with a handful of bicarbonate of soda, stirred into,



rather than dissolved in, a glass of water. This gentleman has a weak stomach, and suffers from the generation of acid in the primæ viæ, but nearly seventy, he is as active as most men are at fifty, and he looks ruddy and well; indeed I have observed that individuals who habitually make use of bicarbonate of soda to neutralize acid in the stomach, have unusually brilliant complexions, a circumstance which recent discoveries enable us to explain. That the alkalis may be taken in large quantities for a long time, not only without injury, but under certain circumstances with advantage, is farther proved by the case of the lady whose history is related by Dr. Bostock.\* This lady had been recommended to take the sub-carbonate of soda for some complaint. She began by using half an ounce, but soon got the length of an ounce, two ounces, and finally three ounces of the salt daily. This last quantity, however, disagreeing, the dose was reduced to two ounces and a half, which, dissolved in two pints and a half of water, and washed down with a like measure of the pure element, this gentlewoman had long been in the habit of taking in the course of twenty-four hours. The urine Dr. Bostock found pale and transparent, and very copious. It showed alkaline reaction and effervesced briskly on the addition of a few drops of muriatic acid. The appetite and strength of the patient had improved greatly under the course.

The only improvement I can suggest on the mode of taking the bicarbonate of soda above recom-

\* Trans. of the Med. and Chir. Society, vol. v.



mended, were, in case circumstances could be made to bend to such a plan, to advise the sufferer from gravel to take it at the well-head in one or other of the natural mineral waters in which it is contained. The mineral waters of Vichy in particular, which hold in solution about one part of bicarbonate of soda in 200 of the menstruum, quickly render the urine of the drinker neutral or alkaline, and afford great relief to the unhappy sufferer with gravel and urinary calculus. The waters of Selters, Obersalzbrunn,\* Aix la Chapelle, Pougues, Spa, Carlsbad, &c., also contain carbonate of soda in variable and smaller quantities, and have long obtained and deserved much celebrity for their virtues in certain forms of gravelly complaints. One of the pleasantest sparkling waters I met with in a foot ramble through Germany, now many years ago, was in the immediate vicinity of Carlsbad. The hot sulphureous waters, however, are the only springs in vogue there; but the cold sparkling water might possibly be taken with advantage alternately with the hot spring. If we bring disease on ourselves by our folly, or they assail us as derivatives from the circumstances surrounded by which we live, or we suffer through the errors of our parents, nature is kind mother enough sometimes to help us to the remedy. But it is not

\* See an interesting case of nephritic calculus brought away, and a long period of suffering from gravelly complaints completely removed by the use of this water, in the person of Dr. Lebenheim, of Trebnitz, related by himself, in vol. xlix. of Rust's Magazin. He voided as many as twenty calculi of different sizes at once. The pelvis of one if not of both kidneys must have been full of concretions.



necessary to travel so far as France, Germany, or Bohemia, for water impregnated with carbonic and holding a little bicarbonate of soda in solution ; this can be prepared on the spot anywhere, and if a man will but consent to pay some little attention to his health, to follow a regulated diet, and to spare both his mind and body for a season from the worry of business and the eager pursuit of gain, he may almost choose his residence where he pleases, provided it be but airy and healthful. Nay, immense benefit is often derived from a course of *pure water*, or at least of water the saline impregnation of which is very trifling, and cannot have any chemical influence upon the matter of which calculous concretions are formed. I shall return upon this subject in speaking of calculus of the bladder.

Instead of the alkalis, the alkaline earths, as they used to be designated, lime and magnesia, are sometimes advantageously prescribed in gravelly complaints. Occasionally these substances have even seemed to prove more beneficial than the bicarbonates of potash and soda. But the efficacy of lime especially in many cases of gravel may, I feel persuaded, be generally ascribed to the state of great dilution in which it is necessarily taken. Equal parts of lime-water and rennet whey I believe to be one of the best diluents that can be taken for calculous disorders generally. Modern chemistry has furnished us with a very elegant mode of administering magnesia, namely, held in solution in water by an excess of carbonic acid. The same means is applicable to lime also. Two, three, or four pints of this super-carbonated magnesian or



lime-water may be taken in the course of the day with excellent effect.

IV.—*To attempt the expulsion and disintegration or solution of the grit or concretions of lithic acid already formed.* This is an all important indication, and has urgency stamped upon it. Whoever, with his urine habitually depositing a sediment, experiences a certain amount of uneasiness in the region of the kidneys, especially if he observes a few gritty particles voided from his bladder, should immediately take alarm, and by all means make sure that no crystal remains behind to serve as a nucleus for future deposition. The use of mild diluents, which may be made the vehicles of the alkaline carbonates, is here of the first necessity; and this, with attention to the state of the functions generally, to the regulation of the diet, &c., will often be sufficient. But if pain in the lumbar region continue unabated, and febrile symptoms be lighted up, it may be necessary to abstract blood from the arm, or by cupping-glasses from the seat of the pain, to call in the aid of the warm bath and especially of the hot air bath, and to purge the bowels freely with calomel, and the senna draught with crystals of tartar. There are certain medicines, too, which seem occasionally to have a kind of specific effect in expelling gravel with the urine; these are the balsams and turpentine. A full dose of the *Dutch drops*, *i. e.*, essential oil of turpentine, has often been followed by a kind of explosion of gravel from the kidneys, and complete relief of the pain and uneasiness that had for some time been endured.



This popular remedy may be tried with advantage in some cases.

Should the symptoms indicate that a concretion is engaged in the ureter, these means will all be proper. In case the pain is not very severe, or when it has been mitigated by general remedies, and there is no longer any tinge of blood in the urine, we may sometimes venture to prescribe an emetic of ipecacuanha, so as to produce full vomiting; or to recommend motion on foot, or in a carriage on a rough pavement. The powerful action of the abdominal muscles induced by the one, and the succussions encountered in the other, have occasionally been found of avail in promoting the onward progress of a renal concretion; some persons, indeed, have lived in ignorance that they were affected with renal calculus, until a rough shake from an accident has dislodged it, and procured its expulsion.\* These measures, however, are to be recommended and resorted to with great caution. The passage of a renal calculus along the ureter is generally a very painful process, and one that is always accompanied with a certain degree of hazard; the concretion may become impacted in the ureter, completely close up its canal, and so interfere directly and by sympathy with the function of the kidney, an event of all others the most to be deprecated. It is better to wait the tardy processes of nature, assisting her by means of low diet, the local abstraction of

\* Vide Sir B. C. Brodie's Lectures on the Diseases of the Urinary Organs, who quotes a case of this kind, p. 197. 2d Ed. Lond. 1835.



blood, topical fomentations, the warm and hot air bath, saline aperients, and the free use of diluents.

In the majority of cases, after the lapse of twenty-four, thirty-six, or forty-eight hours the pain in the course of the ureter ceases, the febrile symptoms abate, the urine flows freely and brings away either a quantity of gritty particles or one or more concretions of larger size, to the complete relief of the patient. This conclusion, and the evidence it affords that the fit is ended in the most desirable manner possible, namely, by the evacuation of the solid matters deposited, are always highly satisfactory.

But the concretion, the existence of which has been decisively proclaimed by the symptoms, does not in my opinion necessarily remain lodged in any part of the urinary passages, merely because we have not had ocular demonstration of its expulsion. The symptoms of renal and ureteric calculus are generally too unequivocal to be mistaken, and with the light derived from the present advanced state of chemico-physiological knowledge to guide our treatment, we do unquestionably sometimes succeed, whatever may have been said to the contrary, in annihilating them in their seat. It is then that we perceive no other traces of the concretions formed, than are afforded by the state of the urine of the patient. A. B—, a gentleman aged about 30, strong and healthy, living regularly but very highly, breakfasting, lunching, dining, and supping duly every day, drinking beer and wine with two at least and sometimes with three of these meals, after having for some time observed that his urine was more than usually high-coloured when passed, that it



always became turbid after it had stood, and often deposited dark red crystals on the bottom and sides of the utensil, was seized first with uneasy sensations in the region of the left kidney, and then rather suddenly with agonizing pain in the course of the corresponding ureter, which shot down into the groin and thigh, and caused both the limb and testis to be powerfully drawn up towards the abdomen. With this pain there was heart-sickness at each more violent twinge, and attempts to vomit, which after the stomach had been once emptied were always nugatory. At the same time large drops of sweat stood like beads upon the forehead and face, and the patient shook with agony. I never saw a man suffer more. The symptoms left no doubt as to the nature of the case; there was a calculus in the ureter making its way to the bladder. The symptoms were so violent that I was strongly tempted to take away some blood from the arm. Five grains of calomel were put upon the tongue, swallowed and retained; by and by two drams of the soda tartarizata with a little bicarbonate of soda and lemon juice were administered in a state of effervescence, and this dose repeated every two hours till the bowels were freely opened. The patient was supplied with plenty of mild mucilaginous diluent, containing forty grains of bicarbonate of soda, dissolved in each pint of fluid, and of this he was encouraged to drink freely. By the evening of the same day, the most urgent symptoms were somewhat relieved; slight traces of blood had appeared in the urine in the course of the day; from having been powerfully acid in the morning this fluid was now



limpid and all but neutral; the treatment was continued. Next day there was still some deeply-seated pain felt in the left lumbar region; but the distress and sickness were gone, the urine was copious, of a pale straw colour, alkaline and limpid. The nature of the attack, the probable causes which had led to it, and the means of guarding against the recurrence of another of the same description, were explained to the patient, a man of education and intelligence; and he was requested to pay particular attention to whether any calculous matter were ever discharged. I had myself examined every drop of urine passed during the ten days that immediately followed the attack, and the patient himself continued on the watch for some weeks after I had ceased my attendance; but no solid particle ever escaped. This gentleman soon regained his ordinary robust health, and has now lived between eight and nine years without a single nephritic symptom.

In this case I do not imagine a doubt can be entertained as to the formation and existence of a renal calculus, and as none was ever discharged, and no symptoms of the presence of a stone in the bladder have ever been felt, the only inference that can be drawn is that it was disintegrated and dissolved by the flood of alkalescent watery urine which was made to pass over it. Nor is this the single and solitary case of the kind I have met with. I had another which occurred in a female about a year ago, where the symptoms were so exactly akin to those just detailed that to repeat them would be waste of time, and where the result was as nearly



as possible the same, two minute crystalline particles, to all appearance worn on the surface, having been the whole of the solid matter passed after a week of intense suffering, which must certainly have been occasioned by a concretion of size sufficient to fill the canal of the ureter pretty tightly. This patient, too, by attention to her diet, &c., has escaped any of the usual consequences of an attack such as that she suffered. She certainly had a concretion in her ureter, she has not a symptom of any thing of the kind now.

*Renal Calculi of Oxalate of Lime.*

Should we have evidence that the oxalic diathesis is the one which is present along with symptoms of renal calculus, should we at any time detect an amorphous sediment of oxalate of lime among pulverulent sediments of lithic acid, and especially should the attack of nephritic colic supervene unexpectedly and without any precursory evidences of a deranged state of the urinary secretion, the urine never having been remarked as otherwise than clear, and to all outward appearance healthy, there will be strong reasons for concluding that the oxalate of lime is the matter deposited in the pelvis of the kidney.

Under these circumstances the treatment need not vary from that recommended under the existence of the lithic acid diathesis. There is always something of the same hypersthenic condition of the system, though probably this is less marked than in the lithic state. Until the *fit of gravel* has occurred, too, there is generally less of febrile excite-



ment under the oxalic than under the lithic diathesis. The system, however, is a magazine of inflammable matter that only wants the spark supplied by local pain to set it in a blaze. The constitutional treatment then may be of the kind just recommended. The antiphlogistic regimen must be enforced; the bowels freely purged; saline medicines prescribed, the warm bath, &c., employed as before. Diluents, too, must be ordered in profusion, and they may be medicated in the manner already recommended with the bicarbonate of potash or soda, less with a view, however, to the disintegration of the concretions, than to wash them out and prevent their lodging permanently anywhere in the course of the urinary passages.

Occasionally there are accidental circumstances connected with the formation of concretions of salts of the oxalic acid, which must be held important, and which it is necessary to be aware of and to set aside. These salts have in fact in some cases been evidently deposited in connexion with, and there seems no reason to doubt in consequence of the mode of life of the individual. Thus M. Magendie relates a case of a gentleman who suffered from a fit of gravel, and passed several concretions of the oxalate of lime after having long indulged habitually in sorrel as an article of food; and M. Ratier\* has given the particulars of another case in which many concretions, as he says of

\* Journ. General des Hôpitaux, quoted in Nouv. Biblioth. Med. tom. iv. p. 254. 1828.



the *oxalate of ammonia*\* were deposited in the pelvis of the kidney and subsequently evacuated after great suffering, from the continuous use of the same substance as food. It was computed that M. Ratier's patient had been in the habit of consuming about half a pound of sorrel daily for three years, when he suffered the nephritic attack that was terminated by the discharge of rather more than half a dram by weight of concretions of the substance mentioned, some of which were as large as peas. The treatment followed in this case was antiphlogistic, combined with the free use of diluents containing two drams of bicarbonate of soda daily, which brought the urine to show alkaline reaction; and put an end to the fever and other symptoms with which the attack had been accompanied.

Dr. Prout has suggested another original and very ingenious plan of treatment under circumstances in which the oxalates, and particularly the oxalate of lime, are deposited from the urine. He proposes to effect a revolution in the nature of the prevailing diathesis; to change the condition from that in which the oxalate of lime is discharged to that in which the lithic acid is excreted. But it is, in the first place, questionable, and how far this is really practicable; in the second how far it were advantageous, supposing it might be done. The oxalic and lithic diatheses often alternate one with

\* There must surely be some mistake here. OXALATE OF AMMONIA is a very soluble salt,; and its existence is impossible in a fluid such as the urine, which contains lime in abundance. Oxalate of ammonia is immediately decomposed by the urine, oxalate of lime and phosphate of ammonia resulting.



another, it is true, and under the use of muriatic acid the lithic acid will begin to be deposited abundantly in many cases. But are we quite sure that there is not also oxalic acid elaborated at the same time, and in consequence of the treatment by possibility even in greater quantity than before? And if a nucleus be present upon which deposition can take place, as in the case supposed, the advantages of having the lithic acid substituted for the oxalate of lime are not great enough to compensate for the more rapid growth of calculi when they consist of the lithic acid or the lithates. Where there has been no deposition within the pelvis of the kidney, Dr. Prout's novel and bold idea might be acted on, especially as there seems testimony from experience in its favour; where there was evidence of the existence of nuclei, however, it would seem more reasonable to endeavour by constitutional and appropriate means to correct "the ills we have, than to be flying to others that we wot not of."

The renal calculus of oxalate of lime is generally of a dusky or greenish brown, or of a bluish gray colour; in the latter case and when quite smooth, as sometimes happens, it constitutes the *hemp-seed* calculus, from the resemblance it bears to the seeds of the hemp plant. When the concretion is of larger size, it is generally tuberculated on the surface. Occasionally the oxalate of lime is passed from the kidney in the shape of an aggregation of well formed crystals. In any form its chemical qualities render it easily recognizable:—its insolubility in the cold nitric and muriatic acids, its becoming charred and then growing rapidly white



before the flame of the blow-pipe, a bulky ash remaining, which shows alkaline reaction, effervesces in a dilute acid, and consists of a mixture of oxide of calcium and carbonate of lime.

#### *Renal Calculi of Lithic Oxide.*

The *lithic uric* or *xanthic oxide* has not, so far as I know, presented itself as the subject of observation in the shape of a concretion voided directly from the kidney. Dr. Marcet however met with it in the kidney after death, and I have referred to the case in which a large calculus of the same substance had been extracted from the bladder by Professor Langenbeck of Gottingen, and been analysed by the distinguished chemists Liebig and Woehler. It is so rare that it can only be regarded as matter of curiosity. In its chemical qualities this substance agrees in many particulars with lithic acid. I have shown, however, that it is essentially different. It forms a yellow solution in hot nitric acid, which becomes of a reddish tint when neutralized by potash. Before the blow-pipe it decrepitates, gives out a very peculiar odour, and leaves a slight ash behind.

#### *Renal Calculi of Cystine.*

The number of cases in which the peculiar animal product called *cystic oxide* or *cystine* has been seen as the constituent matter of renal calculus or gravel, and has either been traced or taken immediately from the kidney, far exceeds those in which it has been extracted from the bladder by operation or after death. The specimens examined have all been remarkably pure; I think only two instances



are on record in which the cystic diathesis appears to have been followed by any other, and in both of these instances this was the lithic.

The treatment of the state of system along with which cystine is deposited in the kidney is somewhat doubtful. Dr. Prout expresses an unfavourable opinion of this form of complaint, from the circumstance of its having very generally been encountered in alliance with diseased kidney and as an hereditary malady. In the earlier stages of diathesis, it is probable that the antiphlogistic plan and the alkalis administered cautiously, would give the greatest chance of relief. When it occurs in conjunction with an irritable state of the system, however, an opposite course should be pursued. In the case in which I detected cystine in the urine, the individual was of an excitable habit of body, and alkaline medicines, though they relieved the acidity of stomach under which he often laboured, never failed to aggravate the general constitutional malady. The muriatic acid, on the contrary, united with light tonics and anodynes, especially the hyoscyamus, always proved serviceable. And this I believe is the result in regard to treatment that is sanctioned by experience.

Dr. Wollaston called cystine by the name of cystic oxide, from its resembling certain metallic oxides in being alike soluble in acids and alkalis. Cystine is in fact distinguished chemically by its solubility in the dilute nitric, muriatic, sulphuric, oxalic, and phosphoric acids, as also in caustic ammonia, potash and soda, and in the carbonates of the two latter alkalis. But the acetic, tartaric, and



citric acids, and the carbonate of ammonia not only do not take it up, but even throw it down from its states of solution. Before the blow-pipe it emits a very fetid and characteristic odour, and is entirely consumed. When we find a concretion that dissolves indifferently in dilute muriatic acid and in a solution of carbonate of potash, we shall be certain that we have a specimen of cystine under examination.

*Renal Calculi of the Phosphates.*

When I think of the numerous cases in which I observe the urine depositing the ammonia-phosphate of magnesia and the phosphate of lime, in this great metropolis, where mind and body are over-worked, where health is sacrificed by the anxious and industrious for gain, by the ambitious for distinction, and where the votary of vicious pleasure and the victim of intemperance are hurrying on in such crowds in their brief career, I am sometimes astonished that the phosphates in the shape of gravel or renal calculus should so seldom be encountered. Although among the most common of the matters composing the outer layers of calculi that have remained long within the body, it is quite certain that scarcely any substance more rarely constitutes the nucleus of these concretions than the triple phosphate of ammonia and magnesia or the phosphates of lime. The crystals of the triple phosphate, indeed, at all times show but little disposition to cohere so as to form a cluster. Even when forming on the lower surface of a urinary film they always drop away and sub-



side to the bottom singly. The phosphate of lime too precipitated from a state of solution shows itself as one of those dry unplastic powders which are very little apt to coalesce or become coated into an aggregated mass. And then, with the phosphatic state of the urine we have generally so free an action of the kidney, that any particles accidentally deposited have little chance of being allowed to remain ; they are almost certainly washed away immediately, as is proclaimed by the whey-like, semi-opalescent urine which so commonly accompanies the diathesis. Farther, the phosphatic cannot in general well be held the sign of an original morbid state of the kidney ; it is very commonly the consequence and termination of other faulty conditions of that organ ; when deposition does take place during its existence, this most commonly happens upon nuclei already provided.

Nevertheless, exaggerated states of the phosphatic diathesis are occasionally followed by depositions within the kidney, either of the ammonia-phosphate of magnesia, of the phosphate of lime, or of these two salts simultaneously. In the first instance the concretion consists of an aggregation of very white shining crystals of a cubical shape, with something of a pearly lustre, in the second of small rounded masses of a white or dirty white colour, smooth or polished on the surface, and of a dull chalky fracture ; and in the third of a mixture of glistening particles, and a lustreless amorphous powder.

The ammonia-magnesian phosphatic gravel is readily distinguished by the odour of ammonia it gives off when digested in liquor potassæ, and by its



ready solubility in dilute nitric acid, from which it is again precipitated in its characteristic white glistening crystals on the addition of an alkali. Under the blow-pipe this substance exhales the odour of ammonia, and at length melts with difficulty. The phosphate of lime, again, is distinguished chemically by its infusibility before the flame of the blow-pipe. It dissolves readily in muriatic acid, however, without effervescence, and is precipitated again in the form of an impalpable white powder on the addition of an alkali.

These two substances as just stated, often occur associated, probably not in chemical combination, but simply intermixed. I am not aware that they have in this state been detected composing renal concretions or calculous nuclei. But they certainly form the outer laminæ of a very considerable proportion of all the calculi, especially of all the large calculi that exist. The compound is chemically distinguished by its ready fusibility before the blow-pipe. It also dissolves completely in dilute muriatic acid. From this solution the lime is precipitated by the addition of oxalate of ammonia; the magnesia afterwards falls before solution of ammonia.

#### *Renal Fibrinous concretions.*

Calculous depositions in the kidney, and the passage of these substances along the ureter, often give rise to the discharge of blood with the urine. Sometimes the blood comes away in the shape of small clots with gritty matter adhering to their surface. What has been called the *fibrinous calculus* is probably formed from one of these clots detained in the



urinary passages, and washed in a considerable measure free from the colouring matter. Various other pathological states of the urinary organs are attended with the effusion of blood, and one of these may give rise to the clot which becomes condensed, and washed, and moulded into the form of a calculus. The fibrinous calculus described by Dr. Marcet, resembled yellow wax in colour and consistence. Its structure was fibrous, and it was somewhat elastic. Its chemical qualities were those of fibrine: it was soluble in caustic potash, from which it could be precipitated by the addition of a mineral acid. It was also soluble in acetic acid with the assistance of heat, and was precipitated by means of the ferrocyanate of potash. Sir B. C. Brodie is the only other practitioner who seems to have met with this peculiar calculus subsequently to Dr. Marcet. It was found in the bladder after death in a case where no affection of the organ had been suspected. It was of an oval shape, about the size of a horse-bean, yellow, semitransparent, not very unlike amber in appearance but less hard. This distinguished surgeon seems to regard the fibrinous calculus as in all probability connected with one or other of those states of the urine in which the principles of the blood pass off by the kidney.\* I have known a case in which an eminent surgeon performed the operation for stone with perfect success. Within a few months, however, the patient began to suffer from the symptoms of his old complaint. By and by a sound was passed into the bladder and a cal-

\* Lectures on the Diseases of the Urinary Organs, 2nd Edit. p. 214.



culus distinctly struck. The patient submitted himself to the hands of his surgeon a second time, and a finely crystalline calculus was extracted. The calculous matter, however, was found to be merely external; it formed a crust or shell around a clot of blood, which had unquestionably remained in the bladder after the first operation. The patient did well, and has suffered no second relapse.

There is yet another form of concretion, very lately described by Dr. Hodgkin, which can scarcely be called urinary, although it was taken from the bladder of a boy after death, its presence, owing to its peculiar constitution, not having been satisfactorily ascertainable by sounding during life, although all the symptoms of stone in the bladder were manifest. This concretion, instead of being hard and stony like calculi in general, consisted of a series of concentric layers of a white elastic substance, apparently like cheese or coagulated albumen, containing between each of them a thinner layer of very friable earthy matter, probably phosphate of lime, though this is not stated. When struck by the sound, this mass of course gave no other sensation than is communicated by the lining membrane of the bladder. It was in all likelihood, as stated by Dr. Hodgkin, the product of a morbid state of the urine which must have contained, at different times, portions of the fibrinous matter of the blood. A nucleus of this was formed in the first instance, accidentally; the irritation engendered by the presence of the foreign body in the bladder caused the elaboration in extra quantity by the phosphates which were deposited on the



nucleus; then came a renewal of the albuminous state of the urine with the envelopment of the phosphatic layer by a stratum of coagulum, and so on. There were two of these stones in the poor little boy's bladder, each about the size, and having something of the shape, of a pigeon's egg.\*

In the *Litologia Umana* of L. Brugnattelli there is mention made of two calculi the outer laminæ of which consisted of a semiopaque horny substance, a line in thickness, smooth and polished on its surface, and fibrous in its structure. This substance burned with the odour of the horn when thrown on hot coals, and was probably of the nature of albumen. He also describes and gives a figure of what he calls a Calculus of crystallized albuminous matter, which I imagine must have been a remarkably fine specimen of the cystic oxide calculus. When broken, the fragments were transparent and amber-coloured. It contained no nucleus.

SECTION 2.—*Of Vesical Calculi, their various kinds and general treatment.*

THE manner in which, and the circumstances under which, solid matters are deposited from the urine within the kidney, have been passed in review. The solid matter or calculous deposition that has taken place, has also been followed into the ureter, and the means described which seem

\* Guy's Hosp. Reports, vol. ii. p. 268.



most likely to insure it a safe and speedy passage out of the body ; measures calculated and adequate to decompose or dissolve it, supposing it to be of a certain and that the most common species, have also been indicated, should it show a tendency to lodge in any part of the urinary passages. It does indeed very fortunately happen that calculi formed in the kidney, even without any care on the part of the patient, are so commonly discharged from the bladder. This discharge usually takes place at no long period of time after the cessation of the pain, &c., proclaim that the concretion has escaped from the ureter. Were the case always so, we should have no such horrible disease as stone in the bladder. But from a variety of circumstances, the renal concretion is apt to lodge in the urinary bladder, and then, in virtue of the ordinary laws of chemical attraction, it begins to grow by having fresh matter deposited upon it, and very speedily acquires such dimensions, that it can by no possibility be discharged through the natural passages. To the patient and physician, by far the most interesting and important period in the history of urinary calculi extends from the moment of their formation in the kidney, till that at which they are either got rid of by the urethra, or begin to have matter deposited upon them as foreign bodies in contact with a fluid containing large quantities of little soluble and precipitable matter in its constitution ; the *nucleus* of the calculus is that which is of paramount importance. In the state of nucleus, I believe calculus of the bladder to be absolutely and certainly within reach of medicine or of arti-



fice : nuceli, by proper management, can be flooded out, dissolved, or extracted through the urethra.

The calm that follows the escape of a renal calculus from the ureter into the bladder is a deceitful calm ; it will certainly impose upon the patient, uninformed as he must almost necessarily be in regard to the nature, progress, and tendency of his disease ; but it ought not to lull his medical adviser into a security that is most dangerously indulged in for a day, that yielded to for any length of time, will certainly compromise the life of the individual who is relying upon him for guidance and direction. I have often thought that the ease which follows the escape of a calculus from the ureter into the bladder is almost to be regretted. However rebellious this sac may become by and by to the presence of the stone, it gives no sign of dissatisfaction on the entrance of the intruder. Did the pain continue, efforts to secure the onward progress or the dissolution of the stone would not be remitted, and these in the great majority of instances would prove successful ; where they failed, unless particular circumstances opposed the procedure, the bladder would be searched, and the nucleus being seized with a proper instrument, would either be extracted or brought into a part of the urethra where little more than a scratch with the point of a lancet would set it free.

The treatment recommended in cases of renal calculus, therefore, is not to be abandoned merely because the concretion has ceased to give pain, or has become vesical ; it must be persevered in as if



nothing had been accomplished for ten days or a fortnight longer, unless the nucleus has been discharged. At the end of this time a surgeon possessed of something of a mechanical turn and the lightest hand in the world should be requested to search the bladder. If no stone be found, we may rest satisfied that the patient has escaped this time, and we must rely on general constitutional means to secure him against another attack for the future. Should a stone be found, and it is judged to be of small size, diluents, and medicines according to the attendant circumstance of the case, must be continued; the patient with his bladder full of urine, and resting on his hands and knees, should repeatedly endeavour to detach the calculus from the resting place it has found, probably in the fundus of the bladder, by moving or shaking his pelvis from side to side, or up and down; he should then make water suddenly, and in as full a stream as possible. Or the following plan, recommended by the high authority of Sir B. C. Brodie, may be tried:—Let a large bougie be introduced into the bladder, and there be retained. Then let the patient drink freely of some mild diluent, so that the bladder may become loaded with urine. When the patient can bear the distension of the bladder no longer, let him place a vessel on a chair, and leaning forward over it withdraw the bougie. The urine will follow in a full stream, and the calculus may probably accompany it. This mode of treatment Sir B. Brodie informs us he learned from a patient who contrived it for himself, and who by its means got



rid of three considerable calculi for which an experienced surgeon had recommended him to undergo the operation of lithotomy.

By one or other of these means, and occasionally without any of them having been employed, a calculus sometimes becomes engaged in the urethra, but is of such a size that it can advance no farther than the throat of the funnel-shaped portion of this canal leading directly out of the bladder. A delicate question arises under such circumstances as to what is best to be done. The calculus cannot be left in its new position: it has probably caused complete suppression of urine, and immediate steps must be taken either to extract it through the urethra, to cut it out from the perinæum, or to push it back into the bladder. The urethra forceps, for the idea of which, as of so much more, modern surgery is indebted to the ingenuity of Sir A. Cooper will always enable us to seize the stone, and if it be not of too large dimensions, with the aid of a little dilatation of the urethra, to extract it. Should it prove too large to come away easily, no force should be used; it is probably in a position where a trifling incision, attended with no risk to the patient, will set it free; or otherwise, the addition of the nut and screw to Sir A. Cooper's urethra forceps imagined by Mr. Weiss may be taken advantage of, and the stone crushed where it lies. We should always consent very reluctantly to return the stone upon the bladder, from which we are so anxious to set it free, by pushing it back with a bougie. Nevertheless, there is good authority for such practice, and if it be but associated with a vigor-



ous use of diluents, &c. it may be done safely, as I shall show by and by.

Sir B. Brodie, speaking of the extraction of small calculi from the bladder by the means indicated, says that he "cannot but regard the discovery as one of the greatest achievements of modern surgery."\* Mr. Syme, the distinguished professor of Clinical Surgery in the University of Edinburgh, speaks doubtingly of the procedure in question. He says "the groping that will generally be required for the seizure of the stone (or stones) can hardly fail of being very injurious."† I have myself had experience enough in the mechanical therapeia of urinary diseases to be enabled to say that I believe this surmise of Mr. Syme to be too well founded. But let the physician and surgeon only go hand in hand here, and it is impossible to doubt but the greatest good must result to humanity; let the medical means adapted to purge the urinary passages of calculous matter be employed diligently and with a greater amount of faith than they have yet received from surgeons, to whose hands the treatment of calculous disease is almost entirely confided; in this country let every vestige of irritation be subdued, and the calculi if possible be brought into the urethral infundibulum, before an instrument of any kind is used, and then I believe that all that can be accomplished, or that is needful to insure the safety of the patient, will have been done.

Let us now suppose that any efforts made to re-

\* *Op. cit.* p. 243.

† *Principles of Surgery*, 2nd Ed. 8vo. Edinb. 1836.



move a stone which has been traced in its course from the kidney to the bladder should fail, or that no efforts whatever have been made in this direction, which far more commonly happens, we shall then have a foreign body lodging in the bladder, which all experience shows will become a centre for the precipitation of the less soluble constituents of the urine, whereby it will speedily begin to increase in size, and sooner or latter but inevitably prove such a source of suffering to the bearer that life will lose its attractions, and death be looked forward to as a blessed relief from agony.

But the concretions formed in the kidney are not the only nuclei or kernels upon which deposition from the urine contained in the bladder takes place, and through which large vesical calculi are produced. The most singular and unlikely substances have repeatedly formed the centres upon which deposition has gone on. Thus a bodkin or needle, a hair pin, a large corking pin, an ivory tooth-pick, a hazel-nut, one of the grinding teeth, a piece of tobacco-pipe, a piece of the stem of a tulip, and a piece of a bougie, foetal bones, masses of hair, clots of blood, growths from the inside of the bladder, &c., &c., have severally been found in the centres of calculi, which had either been voided, extracted by an operation, or discovered after death. How the tooth-picks, corking-pins, bodkins and articles of that kind found their way into the bladder, I do not pretend to explain. The subjects from whom they were extracted have generally shown fully as much amazement at the discovery as those who were less interested in the matter. Some in-



genious men, fond of explanations, have maintained that they must have been swallowed. The fœtal bones and masses of hair were undoubtedly portions of imperfect included germs, perhaps in some cases of blighted extra-uterine conceptions, which had made their way into the bladder. The pieces of bougie are readily accounted for; the fragments of the tobacco-pipe and flower-stem were used by ingenious fellows in their way, as catheters, and unluckily broke short off within the bladder.

I have in the course of my reading met with general notices of growths from the inside of the bladder, which may be viewed as foreign bodies as regards the urine, or of portions of its internal surface having become encrusted with calculous matter; but I do not remember anywhere to have met with a particular case of the kind. This has induced me to append a drawing of a bladder with a small poly-poid body growing from its inner surface, directly over the orifice of the urethra, and covered with a shell or crust of well formed crystals of the triple phosphate. This calculus with a living organized centre, is interesting in many respects. I took the preparation after which the drawing is made, and which is now deposited in the collection at the Royal College of Surgeons, from the body of a man aged 67, whom I attended in the year 1827, and who died of malignant disease (encephaloid degeneration) of the kidney. He had long suffered from occasional attacks of retention of urine, and symptoms of stone in the bladder. The retention of urine was always the urgent symptom in the case, and probably from having used either an elastic



catheter or a bougie to relieve him, no stone was ever struck in the bladder. Sir Charles Bell, who saw the patient along with me, fancied that he felt the prostate a little enlarged. The man was in such a state of health that palliative treatment was all that could be thought of. He was only troubled by manual interference when it became absolutely necessary to relieve the bladder, and this I at length always accomplished by introducing a small bougie, between which and the sides of the urethra he voided his urine readily; this circumstance gave a hint of the nature of the obstruction; but having met with nothing precisely like what was encountered after death, I believed that it must be the third lobe of the prostate which was enlarged and acted like a valve.

However introduced, in virtue of the general chemical laws which regulate the deposition of saline ingredients from fluids in a state of saturation or supersaturation, foreign bodies in the bladder increase in size, and by and by exciting irritation in the living structures with which they are in contact, make their presence known by certain symptoms which, though they may be slight and equivocal at first, generally before long acquire a character of great intensity and leave little doubt in regard to the nature of their cause. In the earlier stages and before the bladder becomes secondarily affected, little is felt beyond a dull sense of weight about the neck of the bladder, or uneasiness referred to one or other of the parts connected with it, as the hypogastric region, perinæum, or groin. With this the bladder generally shows itself more impatient of dis-



tension than usual; so that there is corresponding frequency of desire to make water experienced, and the last drops of the fluid are scarcely expelled without the sense of weight and uneasiness increasing to actual pain, which then shoots along the perinæum or seems to accumulate and centre in the glans penis. Sometimes when the urine is flowing in a full stream, it is suddenly stopped, plainly from a foreign body in the bladder being carried by the current into contact with the inner orifice of the urethra and there acting as a plug. This symptom is very characteristic of the disease; but it is by no means constant; although by a little management, by placing the patient in a proper position, &c.\* the evidence it affords can often be obtained. Occasionally the urine is tinged with blood; and if this is observed after long continued or rough exercise, for once that it happens from any other cause it will happen twenty times from the presence of a calculus.† When the urine becomes bloody after exercise, without any great increase of pain in the region of the bladder, however, I have generally observed that it was to be taken as evidence of the existence of renal rather than of vesical calculus, and this is a consideration that ought to influence us in our prognosis and procedure in many important particulars for the relief of the patient.

Symptoms of stone in the bladder, though they may be slight at first, do not usually continue long without undergoing a change for the worse. The calls to make water in particular become more and

\* Vide p. 280.

† Brodie, l. c. p. 226.



more distressingly frequent and urgent; nor is the act of voiding the bladder accomplished without a continually increasing amount of pain, the last drops are at length often expelled in agony, and their emission is succeeded by a kind of spasm or cramp of the bladder that endures with but little remission till there is another call to make water, and the torture has to be undergone again. Patients grind their teeth under these circumstances, and with the last drops of urine, the contents of the rectum, of the mucous receptacles about the neck of the bladder, and I believe also of the vesiculæ seminales, are frequently expelled involuntarily, much to the distress and with singular increase to the feelings of exhaustion of the patient. It is now that the urine is very regularly tinged with blood, and begins to contain a larger quantity of mucus than natural, which is deposited from it, intermixed with sedimentary matters of other kinds as it cools, in the shape of a cloud. At this stage, too, the pain in the glans penis is always felt acutely; so that children when they are the subjects of the disease proclaim it, as Sir B. Brodie has observed, not by words, but by their actions. They pull and pinch the end of the penis, and often cause great elongation of the prepuce. The cuticle of their fingers, under these circumstances, often appears soft and sodden from the urine which it has imbibed.\*

It is at this stage of the complaint, too, that the

\* Let me refer particularly to Sir Benjamin Brodie's very graphic account of stone in the bladder in his excellent Lectures already often quoted---a book that has but one fault, that it is too short.



stream of urine as it flows freely is most apt to be suddenly interrupted ; this always happens with a severe extension of the pain to the glans, which then feels as if it were seared with a hot iron ; the pain will also extend much farther in some cases, for example, down the fronts and sides of the thighs and legs, even to the soles of the feet.

With matters going on in this way for some time, the rest broken by constant calls to make water, the body unrefreshed and the spirit subdued by continual pain, it is not surprising that the general health of the patient begins to give way. The appetite declines, the digestive powers fail, fever is lighted up, the urine loses its healthy character, and becomes neutral, or positively alkaline and turbid when passed ; and then the symptoms from bad, which they were before, are all made worse in a ten-fold degree. It is indeed very interesting to know that the stone in itself, *quasi stone*, is to be regarded much less as the immediate cause of the suffering endured, than as one link, and that hardly the most important one in the chain of constitutional derangement of which it is a kind of final evidence. A calculus of crystalline lithic acid, and a nodulated rugged mass of oxalate of lime, often of very considerable magnitude, may exist in the bladder for months, nay, even for years, without interfering with the comfort of the patient. The reason of this is, that these stones are deposited, and increase in size during states of the system which cannot be held normal indeed, but which differ little from health, and seem in some cases even to follow an exuberance of vital energy. But let some degree



of constitutional disturbance supervene, let accidental irritation of the bladder become felt by the system at large, and we have the whole face of affairs altered in an instant.

That which is the climax and conclusion in these circumstances may however happen as the original feature of the disease, when a stone happens to be generated under an irritable and disturbed state of the constitution. Here we have all the most aggravated symptoms exploding, as it were, suddenly upon us; a small calculus of the phosphates not larger than a hazel nut, and with its surface smooth and polished, is enough to reduce a patient to extremity, and even to bring his life into jeopardy within a few week or months of its formation. Nay, the albumino-phosphatic calculi which I have described as having been found by Dr. Hodgkin in the bladder of a boy two years of age, although soft and elastic on the surface, and not to be distinguished by a sound from the general lining membrane of the bladder, proved the source of so much irritation, that the poor little fellow sunk under his disease. There is the most satisfactory evidence to show that the symptoms of vesical calculus never attain severity until the bladder participates in a superinduced state of disturbance of the whole system. There may be at times a considerable amount of local pain, bloody exudation from the lining membrane of the bladder, and an increase in the quantity of ropy mucus secreted, but if the pulse keeps quiet, the digestion continues unimpaired, and the urine, except for the accidental admixture it receives in the bladder, remains healthy,



calculus vesicæ has none of the formidable characters that distinguish the disease when it becomes associated with symptoms of general constitutional disturbance. More than this, the presence of a calculus in the bladder is not indispensable in order to have all the symptoms of the disease in their worst and most uncontrollable shape. John Abernethy ought to have lived for ever, that he might with his voice of authority have kept surgeons in mind of the constitutional origin and connexion of so many of those diseases which we are too apt to view and to treat as merely local in their nature.

The composition of a calculus becomes in this way a kind of index of the nature and severity of the symptoms with which it is associated; as inversely the nature and severity of the symptoms and period at which they set in with intensity are an indication of the constitution of a calculus. The lithic acid and oxalate of lime calculi generally remain for the longest time without proving excessively troublesome, or at all events without shaking the constitution seriously. These substances we might almost be tempted to think were more german to the tissues with which they lie in contact, than any other form of calculus; they often grow to a very large size by successive depositions of the peculiar substance of which their centres consist, their presence not very openly rebelled against by the bladder. These are the species of calculi, too, from which what may be called a kind of *recovery* occasionally takes place. The state of urine on which their production and growth depend being corrected, they become tranquil tenants of the



bladder, and are sometimes supposed to have been dissolved. Foreign bodies introduced from without are never endured in this manner; they immediately cause derangement in the renal function, become incrustated with the phosphates intermingled in many instances with more or less of the lithate of ammonia, and speedily cause so much constitutional disturbance, that they must be got rid of at all hazards. It is interesting to see that the polypous living mass growing from the inside of the bladder which served as a point for deposition in the remarkable case I have spoken of (p. 284.) and figured (Pl. 1.) does not appear to have been felt as alien to the system in the same degree as accidental nuclei introduced into the bladder through the urethra, such as tooth-picks, bodkins, hazel nuts, &c. The deposite upon the polypus is beautifully crystalline, and does not appear to be mingled with any amorphous precipitate. The lithate of ammonia calculus is one of those that rarely attains any magnitude without exciting a high degree of constitutional disturbance; the calculus itself is rare, and has been principally extracted from children, in whom it appears generally to have been accompanied as immediately as the phosphates themselves with symptoms of exaggerated irritation. The xanthic or lithic oxide calculus is probably allied to the lithic acid and oxalate of lime calculi. The stone of this substance extracted by Langenbeck and analyzed by Liebig and Woehler was of considerable size, and was covered with no deposite of any other substance. Had it occasioned much constitutional disturbance, it would have had the



ensign of this in the shape of a layer of the phosphates. The calculus of cystic oxide or cystine I have shown to be somewhat akin to those of the phosphates in the state of constitution accompanying its elaboration by the kidney and deposition from the urine; three or four of the small number of specimens of this stone yet examined have been incrustated with a layer of the phosphates. Finally, the phosphatic calculi, or rather the phosphatic deposits upon all the other forms of calculi, for in the shape of nuclei the phosphates are most rare, in that of incrustations most common, as the state of urine upon which they depend is the sure indication of deep-seated derangement of the general health, so is their presence in the bladder invariably the cause of the acutest agonies connected with the most agonizing disease to which the frame of man is subject.

It has generally been admitted as a law on the high authority of Dr. Prout, that the phosphatic diathesis once established, that is the triple phosphate of ammonia and magnesia and the phosphate of lime, being once deposited on a calculus, matter of another kind is never deposited upon it afterwards. I imagine that this law is not quite so general. If ordinary physical characters may be trusted at all, I have seen calculi in which laminæ of the phosphates were enveloped by others of lithic acid or the lithates, and even of the oxalate of lime. These instances, however, were in public or private collections, and so circumstanced that I had no opportunity of putting the matter to the test of experiment by an analysis. Among authors on the subject, indeed, I find many



examples in entire contradiction to such a law. Marcet, for instance, gives a figure of a calculus the outer layer of which is composed of a mixture of the triple phosphate and phosphate of lime, the next in succession inwards of oxalate of lime, the third of phosphate of lime, the nucleus being a concretion of lithic acid. (See fig. 8 of his viii. pl.) In Brugnattelli's "Litologia Umana" there are also figures and descriptions of several calculi in which the phosphates occur *included* within as well as *including* laminæ of other kinds. One for instance, is described (L. c. p. 33.) the outer strata of which are formed of a mixture of the oxalate and phosphate of lime, whilst the central parts, of the colour of wood, consist of uric acid and phosphate of lime in laminæ so thin that they are scarcely to be distinguished by the naked eye. Another (L. c. p. 34.) is a calculus the outer layer of which, consisting of urate of ammonia, invests a series of brownish laminæ of oxalate of lime, which in their turn include a pure white nucleus of phosphate of lime. A third (L. c. p. 34, fig. xvii.) is a calculus composed externally of a mixture of urate of ammonia and rosy coloured matter—"di un miscuglio di ossiurato ammoniacale e materia rosea,"—next of a white stratum of phosphate of lime, followed by a yellowish stratum of lithic acid covering a central nucleus of oxalate of lime. I have positively and repeatedly observed the urine to deposite a variety of matters at various times,—now the lithic acid and lithate of ammonia, then the triple phosphate, and again the lithic acid and lithate. And if these deposites occur without, so may they also happen in connexion with stone in



the bladder, and leave traces of their existence in the laminæ that compose the concretion.

The symptoms of stone in the bladder are generally so characteristic that it might be supposed they could never be mistaken. Yet are they often deceitful, "for there may be a stone in the bladder without the usual symptoms, and there may be many of the usual symptoms without a stone in the bladder."\*

A boy between four and five years of age was brought to Sir B. Brodie. This boy had a constant inclination to make water; he even screamed with pain as the urine flowed; he was perpetually squeezing the extremity of the penis between his fingers, and the urine was frequently tinged with blood. Sir Benjamin seems to have had some difficulty in satisfying himself that there was no stone in this case, for he examined the bladder as he tells us "again and again." An occasional dose of calomel and rhubarb, with one of rhubarb and the sulphas potassæ cum sulphure in the intervals, put all the symptoms to flight in a few weeks. Cases of the same kind are constantly occurring.

These cases, besides the interest they possess on the grounds particularly specified, have another peculiar to themselves, in as much as they are very commonly connected with serious disease of the kidney, which too commonly baffles all attempts to relieve it. Mr. Abernethy was well acquainted with such cases. He was in the regular habit of mentioning them in his oral lectures, and in the work in the composition of which I had the plea-

\* Brodie, l. c. p. 236.



sure of holding the pen for him, he observes cursorily: "Diseases of one of the urinary organs are very apt to be communicated to another: disease of the urethra affects the bladder and even the kidneys; and contrariwise disease of the kidney affects the bladder and urethra. I have known instances of purulent matter and blood being discharged with the urine, which came from the kidney, but producing irritation in the bladder, they were supposed to indicate disease of the latter organ." \* Cases of this kind have attracted particular attention since, and their nature is now not very apt to be mistaken.†

It is often matter of difficulty, then, to say positively from the symptoms whether there is a stone in the bladder or not. The only mode of ascertaining the truth is to search the bladder with an instrument contrived for the purpose. The mode of proceeding in this delicate operation is beyond my province; but, to quote the last and highest authority, it will be found fully detailed by Sir Benjamin Brodie in his Lectures. Let me only be allowed to say one word in regard to the *proper time* for sounding or searching a patient who is suspected to have a stone in his bladder. I believe this is a matter in which we are generally apt to act in too great a

\* Lectures on the Theory and Practice of Surgery, 8vo. Lond. 1830.

† See particularly a "Note on Affections of the Kidney" in Sir C. Brodie's Lectures; and Cases by H. C. Johnson, in Johnson's Medico-Chirurgical Review for July, 1836. I have alluded to a case I had lately seen myself, and I had another some considerable time back, where the patient, though he died of malignant disease of the kidney, never once during his lifetime complained of pain in the lumbar region.



hurry. When brought to a patient writhing in agony under all the symptoms of calculus, we shall certainly do him no service by passing a sound into his bladder and even very dexterously tapping with its point upon a stone. The knowledge we have gained, supposing we have found a stone, is useless at the moment; supposing we have not found a stone, we have added greatly to the patient's sufferings by the motions of our instrument in his bladder, and put him into worse plight than he was before. It is far better to gain time in the circumstances presumed; by local and general means to endeavour to allay irritation and relieve pain. We shall search the bladder to much better purpose by and by, when irritation and inflammation are subdued, when the operation, performed by a gentle hand, will cause no great or injurious amount of distress, and when the patient is in such a state that he might with his consent be subjected at an hour's notice to any ulterior means that should be deemed necessary for his relief. And this leads me directly to the subject of the

*Medical Treatment of Stone in the Bladder.*

The notion that means might be discovered of dissolving concretions formed by the urine seems to have been entertained at a very early period in the history of medicine. Opinions upon this subject have fluctuated greatly at different times, and even at the present day are very far from being settled. Some entirely scout the idea of means ever being found capable of dissolving such a substance as large urinary calculus; others maintain that nei-



ther in the nature of these substances considered abstractedly, nor even in the circumstances in which they are placed, is there aught that should render their solution impossible ; nay, so much has of late years been done in this way, that they believe perseverance and repeated trial will in the end vanquish in the great majority of cases the obstacles that have opposed success. I freely own myself among the number of those who hope, who even of their knowledge conclude, that the day will come when by the aids that science affords, urinary calculi will be familiarly destroyed in their seat. If so excellent a chemist as Mr. Brande in England has almost ridiculed the notion of our ever effecting the solution of a stone in the bladder, Fourcroy and Vauquelin in France, and Berzelius in Sweden, have held this feasible, and have encouraged us to persevere; if Monsieur Civiale has declared such a thing impossible, his countrymen M. M. Robiquet and Ch. Petit in Paris, and our own Sir Benjamin Brodie in London have, in different ways, performed the feat.

Many cases are on record in which much relief was obtained and particles of stone were evacuated under the use of *lithontriptic* medicines, or medicines that dissolve the stone ; others where stones that in the beginning of the treatment were too large to pass into the urethra were at a subsequent period evacuated naturally, and bore traces of decomposition on their surface ; finally, others can be quoted in which all the unequivocal symptoms of stone had existed, in which a stone had been re-



peatedly struck by a sound passed into the bladder, and in which these symptoms had all disappeared and the sound ultimately introduced failed to discover any trace of a calculus, though none had at any time been passed. Modern chemistry not only sanctions our entertaining hopes of success in this direction, but arms us with new instruments in aid of their accomplishment.

A host of vegetable infusions and decoctions have enjoyed a questionable reputation in cases of gravel and calculus. Undoubtedly the whole influence exerted by these brewages, and I do not mean to question their occasional usefulness, was due to the large quantity of water that was taken along with them; they were beneficial as simple diluents. So long ago as the year 1720 M. Littre communicated a paper to the Royal Academy of Sciences of Paris, "On the solution of stones of the bladder in ordinary water." All the waters tried by M. Littre had more or less influence on the calculi subjected to their action. Six ounces of the water of the Seine, of the water of Arcueil, of that of Belleville, and of that from a cistern, were formed to dissolve fifty grains of different calculi digested in them, in from forty-five days to three months. In the same year M. Billaret, of Besançon,\* having put a piece of calculus weighing fifty grains into a bottle containing six ounces of the water of the Bougeaille rivulet found it, after the lapse of twenty days, completely disintegrated, and reduced to a kind of slime which

\* Quoted by M. Chevallier, in his *Essai sur la Dissolution de la Gravelle*, 8vo, Paris. 1837, an excellent little work.



fell to the bottom of the bottle. Gruithuisen,† the distinguished reviver, or rather inventor of the operation of lithotritry in modern times, pursued the same path of inquiry. He found that a piece of urate of ammonia calculus weighing 24 grains lost  $4\frac{1}{2}$  grains under the action of the cold water of a common well made to fall upon it, drop by drop, during twenty-four hours, and that the entire mass became friable from this operation. M. Julius Cloquet very recently took up this subject. He employed a stream of pure distilled water as the solvent, and found that a calculus of lithic acid subjected to the action of pure water for five hours a day during a month actually *lost a line and a half in its diameter*.

Many mineral waters have from very remote antiquity been celebrated for their virtues against gravel and calculus. Avicenna says expressly that certain sulphureous thermal springs have the power of dissolving stone in the bladder. In more modern times the property possessed by the waters of Barèges les Bains, Cauterets, Carlsbad, &c. of reducing certain urinary calculi to the state of a viscid gelatinous matter like white of egg, has been abundantly demonstrated. Thus M. Tenon found that a vesical calculus made up of yellow layers, (a lithic acid and lithate of ammonia calculus,) weighing 10 drams 59 grains, subjected to the action of the Cauterets water for thirty days,

† Ob man die alte Hoffnung aufgeben sollte den Stein aus der Blase auf mechanische oder chemische Weise einst noch wegschaffen zu koennen? Medicinisch-chirurgische Zeitung, 4th Maerz, 8vo. Salzburg, 1813.



lost 8 drams 29 grains of its weight. The use of the Bareges water for the cure of calculus was recommended not only by the mouth, but also in the way of injection into the urinary bladder, by P. Desault\* in a separate publication now more than a century old.

Many other mineral waters have also been found efficacious in giving relief from the symptoms of gravel and stone, and in dissolving urinary concretions generally; such are those of Contrexeville, Plombieres, Selters, Obersalzbrunn, &c.; but of all that have been tried those of Vichy in the Bourbonnais seem the most worthy of arresting attention, not only because their powerful effects have been demonstrated in the greatest number of instances, but because these effects have been investigated most recently, and have been vouched for by the most respectable authorities. The reputation of the Vichy waters in calculous complaints, however, is not a thing of yesterday. They were recommended more than two centuries ago by M. Mareschal† in these diseases; but their usefulness in this direction, however it may have been taken advantage of by the inhabitants around the spring, was neglected by science, and lost to the world at large till M. Patissier‡ recalled attention to it in 1818. M. D'Arcet, in a paper in the *Annales de Chimie* for 1826, mentioned the property possessed

\* De la Pierre des Reins, &c, avec une methode simple pour la dissoudre, 12mo. Paris, 1736.

† Physiologie des Eaux Minerales de Vichy, 8vo. Lyon, 1636, et Moulins, 1642.

‡ Manuel des Eaux Minerales de France, 8vo. Paris, 1818.



by these waters of rendering the urine alkaline, and sought to fix the attention of physicians on the subject of treating gravelly and calculous affections by their means. M. Ch. Petit\* next published a tract "On the treatment of urinary calculi and their solution by the alkaline bicarbonates and the Vichy waters in particular." The Essay of M. Chevallier already quoted, and the "Farther Observations" of M. Petit,† complete the chain of evidence on this point. Let us briefly refer to a few of the experiments that have been made to test the powers of these waters to dissolve and disintegrate different kinds of urinary calculi.

1. A quantity of lithic acid gravel was exposed to the action of the Vichy water maintained at the temperature of 97° F. The concretions were speedily disintegrated; the lithic acid was entirely dissolved, and nothing remained suspended in the fluid but a few loose flocculi of animal matter. 2. The half of a lithic acid calculus weighing 1 ounce, 1 dram,  $36\frac{1}{2}$  grains, was placed in a little bag of wire muslin, and subjected to the action of the Vichy water during 151 hours. Dried carefully and weighed after this, the calculus was found reduced to 2 drams, 52 grains; so that in less than a week it had actually lost 6 drams, 47 grains, or more than *two thirds* of its original weight. 3. In another experiment, five calculi, one of phosphate

\* Du traitement medical des Calculs Urinaires et particuliere-  
ment de leur Dissolution par les Eaux de Vichy, &c. 8vo.  
Paris. 1834.

† Nouvelles Observations de guerisons de Calculs Urinaires au  
moyen des Eaux thermales de Vichy, Paris, 1837.



of lime, weighing 1 dram, 18 grains; a second of lithic acid, weighing 1 dram, 8 grains; a third of lithic acid of a brown colour, weighing 25 grains; a fourth and fifth, fragments of phosphatic calculi weighing, the one 29 grains, and the other 13 grains, were enclosed together in a bag of wire muslin, and exposed on the 5th September to a constant stream of the Vichy water of the temperature of about 98° F. On the 11th September the bag being examined, was found completely empty; the calculi of lithic acid had been dissolved; those of the phosphates disintegrated, and their particles washed through the meshes of the muslin. 4. A calculus of phosphate of lime weighing 2 drams,  $4\frac{1}{2}$  grains, laid in a vessel of the Vichy water, which was not changed, had in two days lost 20 grains of its weight. 5. A calculus of oxalate of lime, weighing 1 dram, 22 grains, exposed for a week to a stream of the water, underwent very little change, having only lost 2 grains in weight.\*

Many experiments of the same kind were performed by M. Ch. Petit;† a few of which I select. 1. Two pieces, laminæ of a large lithic acid calculus, weighing 31.38 grammes,‡ after exposure to the action of the Vichy water during twenty-three days, were found to weigh only 8.65 grammes, so that they had lost 72.79 per cent. (Vide Pl. II. fig. 2, where one of these shells, before and after immersion, is represented.) 2. A piece of an ammoniaco-magnesian phosphatic calculus, weigh-

\* Chevallier, op. cit. p. 90 to 106.

† Nouv. Obs. p. 30.

‡ A GRAMME is about 15 grains.



ing 31.50 gram., immersed for eighteen days in the water, was found reduced to 17.25 gram., so that it had lost 45.23 per cent. (Vide Pl. II. fig 3, exhibiting this calculus before and after immersion in the mineral water.) 3. The half of a lithic acid calculus with traces of ammonia, weighing 40.80 gram., immersed for thirty days, was found reduced to 24.65 gram., having therefore lost 39.58 per cent. This calculus had been removed by operation, so far back as the year 1695. 4. The half of a calculus of the triple phosphate with traces of lithic acid, weighing 16.25 gram. before immersion in the water, after exposure to its influence, weighed 6.65 gram., and had consequently lost 59.07 per cent. 5. Half of a triple phosphatic calculus, of a greyish white colour, weighing 9.20 gram., after twenty days immersion, weighed 2.60 gram., and thus lost 71.75 per cent. (Vide Pl. II. fig. 4, where this calculus before and after immersion is represented.) 6. A small calculus of lithic acid, weighing 2.75 gram. after forty-three days immersion, weighed but 0.70 of a gramme, and had therefore lost 74.54 per cent. 7. Half of a calculus of lithate of ammonia, with traces of phosphate and oxalate of lime, weighing originally 3.05 gram., after eighteen days' exposure, weighed 1.20 grain. and had lost 60.65 per cent. 8. Half of a calculus of oxalate of lime with traces of phosphate of lime, upon a nucleus of lithate of ammonia, weighing 4.55 gram., after forty-four days exposure in the Vichy water was found to weigh 4.00, so that it had lost 12.08 per cent. This loss was however entirely at the cost of the nucleus.



Contrary to the usually entertained opinion, M. Petit found that, on the whole, calculi of the triple phosphate of ammonia and magnesia lost more under the action of the Vichy water, *i. e.* of a solution of bicarbonate of soda in water supersaturated with carbonic acid, than those of the lithic acid. For example, five specimens of lithic acid calculi, weighing together little more than 118 grammes, after remaining, on an average, twenty-seven days exposed to the action of the water, lost very nearly 64 grammes, or 53 per cent. of their original weight; but five specimens of the ammoniaco-magnesian phosphatic calculi, which together weighed rather more than ninety-seven and a half grammes, and only remained under the action of the water, one with another, for the space of twenty-three days, lost fifty-eight and three-fourth grammes, of their original or 60 per cent weight.

M. Petit, like M. Chevallier, found that the Vichy water had extremely little influence on calculi of the oxalate and phosphate of lime. This water, however, would dissolve calculi of cystine and lithic oxide with at least as much readiness as it disintegrates and dissolves those of the lithic acid and triple phosphate. Water surcharged with carbonic acid and holding a little bicarbonate of soda in solution is consequently a solvent for calculi of every description save those of the oxalate of lime, which are of somewhat frequent occurrence, of the phosphate of lime, which unmingled with the triple phosphate, when they become soluble, are extremely rare, and probably of the fibrinous or albuminous concretions, which are mere curiosities. Such a water will there-



fore attack something like nineteen-twentieths of all the known varieties of urinary concretion.

The destruction of calculi by this water is found to be not merely nor perhaps even principally by the way of solution, it is accomplished in a very considerable degree, especially as regards those of the triple phosphate, by a kind of disintegration of their component particles. When calculi consist of the oxalate or phosphate of lime, mingled with lithic acid, lithate of ammonia, or the triple phosphate, this water attacks and disintegrates them rapidly, so that the sphere of its activity is still farther extended.

The action of the natural supercarbonated alkaline waters of Vichy on calculi in the bladder, does not seem to be very different from what it is when they are subjected to their influence out of the body. Dr. Ch. Petit of Vichy has a collection of calculous nuclei which were passed by patients suffering from stone in the bladder, whilst under treatment by these waters. The nuclei generally show traces of solution, or disintegration on their surface, and some of them have unquestionably undergone a very considerable reduction of the size and weight they possessed at the time the treatment was begun. In his "Nouvelles Observations" already quoted, Dr. Petit has published the particulars of several of the cases in which these nuclei were discharged, which seem every way worthy of arresting attention. One or two of them I offer no apology for laying before the reader in a condensed shape.

Case I. M. de Montenon, a magistrate, aged 52,



began to suffer from gravel in 1826. In 1829, having for some time endured the tortures of stone in the bladder, he underwent the operation of lithotomy, when several calculi were seized and crushed. The operation was followed by symptoms of such severity that the life of the patient was endangered. By and by he began to pass gravel again, but recovered under the use of the bicarbonate of soda. In 1835 he, for the third time, passed several gravelly concretions, and being now aware of the presence of a foreign body in his bladder, he went to Vichy and began the use of the waters immediately. Five or six glasses of the water and a bath daily, soon rendered the urine alkaline, and after no longer a period than ten days, three small fragments or nuclei of calculi were passed, which from the appearance of the abraded laminæ they presented on different aspects had evidently belonged to larger concretions. M. de Montenon has continued to pass gravelly concretions from time to time, but always finds relief by recurring to the bicarbonate of soda.

Case 2. M. de Longperier, aged 51, came from Meaux to Paris in May 1836 to consult Dr. Ch. Petit on account of symptoms of stone in the bladder, and particularly to learn whether the Vichy waters were adapted to his case. Dr. Petit requested M. de Longperier to have his bladder searched, in order that if it contained stone, as Dr. Petit suspected, its presence might be ascertained. The patient was accordingly sounded by M. Leroy d'Etoilles, who immediately struck a stone, which he believed to adhere near the neck of the bladder, but which did



not seem to be large, and which he thought might readily be crushed. "The Vichy waters," said M. Leroy, "will do you excellent service after the operation, but they are incompetent to destroy a stone." The patient returned home, and through the effects of the sounding and the journey together was laid up with an attack of pain and fever, that left him extremely weak. The patient on recovering somewhat, wrote to Dr. Petit at Vichy, telling him of what had been done, and putting these questions to him: "What, then, Sir, do you think of my case? Do you imagine that it will be enough for me to go to Vichy? or shall I have the operation proposed performed as a preliminary to my visit there?" Dr. Petit did not hesitate to press M. de Longperier to betake himself at once to Vichy, drawing his attention to the circumstance of his sufferings from a simple search of the bladder, and the likelihood of more serious mischief happening from the operation of lithotrity. M. de Longperier accordingly set out for Vichy. He suffered severely during the journey, his urine being frequently bloody, and the jet often interrupted by the stone falling against the vesical orifice of the urethra.

June 20th, M. de Longperier began the use of the waters, taking a bath and seven or eight glasses in the course of the first day. Next day he drank as many as fifteen glasses. The urine, which had been highly acid, was now strongly and constantly alkaline. After a very few days the patient took as many as from twenty-two to twenty-four glasses of the water regularly every day. He soon felt less pain, and by the 30th was quite free from suffering,



even when he walked; the only evidence in fact which he now had of the presence of his stone was its interrupting the jet of urine from time to time. On the 7th July, only seventeen days after the treatment was begun, the patient being in the bath at the time was seized with a strong desire to make water; but this he found he could not satisfy, owing to an obstruction in the canal of the urethra, which caused him violent pain; after several efforts, however, he ended by forcing out the nucleus of his stone, (vide pl. ii. fig. 1, where this nucleus is represented on both sides,) and from this time forwards felt himself completely recovered. He next day performed from five to six leagues at the trot or the gallop mounted on an ass, without inconvenience, and on the 14th of July returned to his home. The nucleus here leaves no doubt in regard to the solvent effects of the Vichy water. The calculus had evidently been attacked unequally, so that such of the laminae as remain appear bevelled off from a central point towards the general circumference. The nucleus was shown to M. Leroy, who perfectly remembered the patient he had sounded. With the frankness and candour which all so justly prize in M. Leroy, he immediately subscribed to the potency of Vichy waters. There are other three cases of calculus of the bladder detailed by M. Petit, but so much akin to the two quoted above, that it is unnecessary to cite them at length. In fact, there can be no doubt of the great power of the natural aerated soda water of Vichy in reducing and disintegrating calculi of the bladder. If effects such as those witnessed in the cases quoted, have



occurred, where the calculi were of but small size, a greater amount of perseverance is all that is required to have the same result in cases where the calculi are of much larger dimensions. The rapidity of action, indeed, of these waters is in the ratio of the size of the calculus subjected to them; and a calculus suspended in a wicker basket in the midst of the spring is hardly in a more favourable position to be acted on, than one lodged in the bladder with a flood of alkaline urine constantly running over it.

The effect of the Vichy and other mineral waters that hold carbonic acid and bicarbonate of soda in solution cannot be regarded as connected with their operation as simple diluents; they act much more rapidly on the lithic acid, lithate of ammonia, and triple phosphate of ammonia and magnesia, than pure water. Besides powerfully increasing the quantity of the urine, they exert a decided chemical influence on its constitution; from acid it is rapidly rendered neutral, and then alkaline; from high-coloured it becomes pale; from having deposited copiously it becomes limpid and transparent, and generally first grows turbid in a marked degree when putrefaction (to which, in warm weather especially, it has acquired a marked disposition) has commenced or made some progress. The Vichy water contains a large volume of free carbonic acid, and very nearly a dram and a half of bicarbonate of soda in each thousand drams of the menstruum.

*Alkalis and Alkaline Earths.*—I have already had occasion to advert to the influence of these substances



in correcting that state of urine which leads to the formation of gravelly deposits, and in giving relief from the consequences of such an event when it occurs. I have farther hinted at their possible and very probable efficiency in causing the solution or disintegration of renal calculi, and within the limits of the last few pages have shown several of the natural mineral waters, which contain an alkali in any quantity, to possess the unquestionable power both without and within the body of effecting the solution and disintegration of the most common kinds of urinary concretions. This leaves little to be said in regard to the substances themselves upon which the virtues of these waters depend. Nevertheless, as the alkalis and alkaline earths are exceedingly accessible remedies, for they are available in an hundred instances for one in which the natural alkaline waters can be prescribed, and as they are nearly as potent in their effects when properly prescribed as these, I shall speak of them at some length.

Alkalis are very old, and have probably at all times been popular remedies for the stone. The relief they afford in this complaint, when taken internally in the state in which they occur in commerce, is too remarkable to have long escaped detection. And accordingly we find that the alkalis were prescribed by the Greek physicians against nephritic pains and calculus of the bladder. They were probably lost sight of in the dark ages, and remained unknown till rediscovered by the alchemists, who seem in the dawn of science to have exhibited them freely. Nevertheless they appear to have



been so sparingly used by regular practitioners, that they may be said to have been entirely neglected until they were brought into high vogue now somewhat more than a century ago by the publication of Joanna Stevens's secret remedy for the stone. When divested of the ignorance and nastiness and cruelty that were bound up with its preparation, it was found to consist essentially of the mineral alkali and quick lime. Pharmacutists soon improved upon Mrs. Stevens's formula, and then there were innumerable *lixiviæ* for the treatment of calculus, which, when examined, were generally found to consist of the *liquor potassæ*, or solution of caustic potash in water.

At this period in the history of the treatment of calculus by means of alkalis, although the active agent was not in the very best possible shape, I find the system pursued to have been on the whole well calculated to prove beneficial. The medicine was very generally ordered in a large quantity of diluent, which I believe to be a most important element in the treatment; thus the patients of Dr. Chittick, who had an extensive practice in calculous complaints, were provided with a set of tin vessels of the capacity of two quarts each, which they used to send alternately filled with weak veal broth to the doctor's every morning for his medicamentation, and this quantity of two quarts was the dose for the day.

By and by it was found that the alkalis taken in the state of subcarbonates, neutral carbonates, and sesqui, or bicarbonates, were much more agreeable to the palate, and scarcely, if at all, less effectual in affording relief during attacks of nephritic colic



and fits of stone in the bladder. This new knowledge was however the very reverse of useful, owing to the way in which it was applied. The caustic and subcarbonated alkalis were of necessity swallowed in ample quantities of fluid, a circumstance quite indispensable to the best effects of alkaline medicines in any shape; now less dilution was found necessary, and a corresponding smaller amount of good was done. A couple of ounces of fluid finally became the vehicle of the dose for alkali.

Chemistry, too, not taking any account of all that had been accomplished, having no experience of what was well known to happen in practice, and but partially acquainted with the matters upon which she ventured to pass judgment, showed herself otherwise than the handmaid to medicine, which she had usually been found, as regards the medical treatment of calculus. In spite of the thousands of cases on record in which a signal mitigation of suffering had followed the use of the alkalis, in many of which there was every reason to believe they had proved beneficial by reducing or dissolving the stone, it was enough for one chemist to publish a mistaken conclusion for a fact, to wit—that calculi of the lithic acid are only soluble in caustic alkalis, and that as pure alkalis taken by the mouth always reach the bladder in the state of carbonates, they can have no influence on any stone it may chance to contain. The faith in the alkalis was seriously shaken by this announcement, and I believe a very considerable increase of human suffering has been the consequence. Their efficacy in counteracting the diatheses that led to the forma-



tion and growth of urinary calculi in many instances, may have been acknowledged, (although this too was denied, and means inadequate to accomplish such an end were substituted,) but it was maintained and came to be very generally believed that little was to be expected from their use in so far as the solution of calculi already existing was concerned.

But nothing seems to me more undeniable in medicine than that great benefit has repeatedly followed the use of the alkalis in cases of stone; and if chemistry cannot explain this fact, *tant pis* for chemistry; we ought not to be shaken out of the conclusions of our experience because chemistry halts. Again, recent experience has proved that in the state of bicarbonates, and dissolved in water holding carbonic acid in excess, the alkalis are even *more* efficacious in each particular instance, and also efficacious in a wider range than when exhibited in the caustic state. Farther, we now know that weak solutions of the alkaline bicarbonates act as certainly and almost as quickly upon urinary concretions of lithic acid as solutions of the caustic alkalis of equal strength. This point was, I believe, first noticed by Wetzlar,\* who found, with Mr. Brande and other chemists, that a strong solution of bicarbonate of potash or soda had little or no effect upon lithic acid, but showed that a weak solution of these salts took it up readily, a circumstance easily explicable when the sparing solubility of the new compound, lithate of soda, that is formed, is taken

\* Beitræge zur Kenntnissd. mensch. Harns, Frft. a. M. 12mo. 1821.



into account. The alkaline bicarbonates have the farther advantage of being by no means disgusting to the palate; the taste of either of them in the proportion of a dram to a pint of any mild mucilaginous drink, as thin barley or rice water flavoured with sugar and lemon-peel, is scarcely to be detected; or they may be taken dissolved in simple water without hardship, or better still in water surcharged with carbonic acid, the sharp sparkling flavour of which covers them completely.

The alkalis, in whatever shape exhibited, have often an unquestionable and very remarkable influence upon the calculi of the bladder themselves, and then upon the symptoms which they usually engender. Under the long continued use of alkaline medicines, calculi of lithic acid have frequently been observed to break up into fragments, which have by degrees been so far reduced in size as to have been subsequently passed by the urethra. As illustrative of this influence, among others of older date is the remarkable case of David Millar, related by the ingenious Dr. Whytt\* of Edinburgh. Millar had long been a martyr to all the symptoms of stone in their most aggravated form; but after persevering in a course of Castile soap to the extent of an ounce and a half daily washed down with three pints or more of lime water, he first felt himself greatly relieved, and then after passing several fragments of calculus at different times, completely

\* An Essay on the Virtues of Lime Water and Soap in the Cure of the Stone, Edin. 1752, and various editions in various years.



freed from all his misery, so that from the year 1742 to 1751, when he died, he remained perfectly free from any symptoms of stone. Another very remarkable case is that of Lord Orford of Woolterton, father of the celebrated Horace Walpole, himself a martyr for many years to stone, which is related by Dr. Stephen Hales.\* After using alkaline medicines for a period of two months, the stone in the bladder, under which his Lordship had long laboured, was so completely broken up, that in one day he passed as many as twenty-six pretty large and nearly cubical pieces at two different times, voiding first eleven of the fragments, and afterwards fifteen. So thoroughly was the bladder relieved of its load in this instance, that when the patient died, which he did shortly afterwards, only two small grains, and these involved in the folds of the neck of the bladder, were discovered. Had not this nobleman's health been broken, and his life brought immediately into danger in consequence of a hurried journey from his seat in the country to London at the command of his Sovereign, from the direct ill effects of which, indeed, he sunk after four months of great suffering, he would certainly have been relieved of his stone, and might have lived on comfortably for years.

The fragments and layers of calculous matter often voided by patients using the alkalis for stone in the bladder, I am aware have been stated on high authority to be new deposits formed under the influence of the medicines employed. That

\* Philos. Trans. 1745, p. 502.



they are so in some instances I do not pretend to deny, that they are so invariably, or even generally, I believe to be a hasty and an erroneous conclusion. Those which I have seen voided during artificially induced alkalescent states of the urine, and I have examined several, have all consisted of lithic acid; and this substance is certainly never precipitated when the urine is charged with an alkali. The white and powdery appearance of the fragments voided is produced by solution and disintegration of their surface, not by a deposite of any phosphatic matter, as has been alleged. Simple experiment at once settles the question as to whether the alkalis cause or do not cause a deposition of the phosphates from the urine. The statement that they have any such effect in lithic and healthy states of the secretion I believe to have been made on purely speculative grounds. It is not borne out by the fact. More than this, the urine that is depositing the phosphates habitually will, in some cases at least, be rendered clear by the use of the bicarbonate of potash or soda, especially if it be taken in water surcharged with carbonic acid. I have tried the experiment, and found this to be the case. The urine of those who drink the strong alkaline water of Vichy is remarkable for its transparency, and freedom from all cloud or deposite until decomposition has made some progress. The urine of the gentlewoman examined by Dr. Bostock, (p. 258,) when she was taking two ounces and a half of subcarbonate of soda every day, was perfectly transparent, and let fall no deposite. I am not very sure that the objections to the use of the alkaline bicar-



bonates in those disturbed states of constitution that are accompanied by the elaboration of urine loaded with the phosphates have not been carried too far, and that the amount of prejudicial influence said to have been exerted by these medicines has not been over-estimated. Magendie prescribed the bicarbonate of soda with success in several cases of white gravel, *i. e.*, of renal calculus consisting of the triple phosphate. The phosphates may indeed, I believe, be sometimes deposited so as to concrete on existing nuclei in spite of the influence of the alkalis; I am almost tempted to doubt whether this ever happened in consequence of it. On the contrary, I see that it is not from urine made turbid by the decomposition of its salts with insoluble bases, supposing this to follow the use of alkaline medicines, that increase in the size of calculi is to be apprehended. It is from urine having little-soluble salts in a state apt to undergo crystallization, and crystallizing the moment they meet with a point of support, that the successive layers of calculi are formed. If by means of solution of potash we saturate the phosphoric acid, and detach the carbonic acid of a quantity of fresh urine that contains the triple phosphate in abundance, instead of having beautiful lustrous pearly white and regular-shaped crystals of this substance formed, we have immediately an amorphous precipitate of magnesia and lime, two particles of which cannot by any means be made to cohere.

The effects of alkaline medicines long continued have sometimes been, if possible, still more remarkable. Dr. Whytt, for instance, relates the case of Mr. Simson, minister of Pencaitland, near Edin-



burgh, in which they certainly *dissolved* the stone in the bladder completely. Mr. Simson began to suffer from symptoms of stone in 1730. In 1735 he was sounded by two surgeons, who both felt a stone, as did the patient himself, with the sound. He began taking Castile soap, and I believe lime water, in the beginning of 1737, soon found relief, and in 1743 never suffered in any degree from his old complaint. Mr. Simson died in 1756, and when his body was opened neither stone nor gravel of any kind was found in his bladder.\*

Since the use of the alkaline bicarbonates has been introduced, we have a considerable number of cases of the same description to adduce, and I make no doubt but the number of these will very much increase in the course of the next ten years. I shall select one or two of the more striking, and beg to refer to the authors I quote for other and more ample details. The first I shall relate was communicated to the Royal Academy of Medicine of Paris, in the beginning of the year 1836, by the distinguished chemist and pharmacist M. Robiquet:—A retired merchant, aged 64, had suffered from symptoms of stone in the bladder since the beginning of the year 1825, which at times occasioned him exquisite suffering. Occasionally, too, he had had a fit of retention of urine from the calculus becoming engaged in the neck of the bladder. This patient was sounded by M. Marjolin, who discovered a stone which he thought favourable for the operation of lithotrity. The patient, however, having

\* Whytt's Works, 4to. p. 447.



been recommended to M. Robiquet, was, under the eye of his ordinary medical attendant, put upon a course of bicarbonate of potash, of which he took three drams dissolved in two litres, very nearly three quarts, of water daily. The urine, from being scanty and passed with great suffering, soon became copious and alkaline, and was voided without pain. This treatment was persevered in for two months; at the end of which time the patient on making water on one occasion felt a severe twinge in the urethra, a little blood was discharged, and at the same instant a small calculus of the size and shape of a lentil. It consisted entirely of lithic acid; and the concentric bevelled layers which were remarked sloping away from the lateral apices towards the edges, showed plainly that it was the nucleus of a larger calculus which had been so reduced in size as to have passed pretty readily along the urethra, although at one time it was incapable of advancing farther than the vesical infundibulum of that canal. The patient from this time was free from suffering of any kind, and so totally without symptoms of stone in the bladder, that M. Marjolin with most laudable forbearance refused to sound him when brought by his usual medical attendant for that purpose.

A peasant aged 62, suffering from all the most unequivocal symptoms of stone in the bladder, was sounded, and the presence of more than one calculus discovered. He was put upon a course of bicarbonate of soda in the proportion of about a dram to each pint of water, a solution of which he took several pints daily. At the end of a month he passed eleven



calculi, or rather kernels of calculi, all very nearly of the size of peas. The sound passed into the bladder in this instance found it empty; the calculi which it had formerly contained were all discharged.

A man, aged 52, was sounded and declared to have several stones in his bladder, which were judged to be about the size of hazel nuts. He was directed to take two drams of bicarbonate of soda dissolved in about two pints of water daily. From this medicine he felt immediate relief. On the eighth day of the course the patient complained of excruciating pain, and utter inability to pass a drop of water. One of the calculi had entered the internal orifice of the urethra and obstructed the passage. The concretion was pushed back into the bladder with a catheter, and the solution of soda was continued. At the end of a month the patient, without suffering any great amount of pain, voided several concretions, and the sound now introduced into the bladder found it completely free from calculi.

It were easy to multiply cases of this kind from the Essays of Dr. Ch. Petit and M. A. Chevallier; but more is unnecessary. The solvent powers of the alkaline bicarbonates especially, associated with the plentiful use of diluents, is indubitable as regards calculi of lithic acid still contained within the body; and there can be no doubt, as I have already said, but that they would act with equal efficacy upon calculi composed of the lithate of ammonia and of the lithic and cystic oxides. Calculi of the triple phosphate of lime constituting what are called fusible calculi, are not *dissolved*, indeed, by solutions of the alkaline bicarbonates; but they are *disintegrated*



and rapidly reduced to powder by their agency, which comes to the same thing. The calculus of the unmixed basic phosphate of lime, the bone-earth calculus, is not acted on by the bicarbonated alkalis; but the concretion is extremely rare. The same may be said of the fibrinous and albuminous calculi, which probably do not occur once in five thousand instances. Calculi of the oxalate of lime are therefore the only kind, of somewhat common occurrence, that show themselves rebellious to these general solvents. Still a certain amount of action does occur between calculi of the oxalate of lime and a weak solution of either of the alkaline bicarbonates; a double decomposition takes place; oxalate of potash or soda being formed and dissolved away, carbonate of lime being precipitated in a pulverulent form. A course of the bicarbonate of potash, therefore, continued for a great length of time, would afford some prospect of relief even from the mulberry calculus.

I am not aware that the *borate of soda*, or borax, has been tried internally in calculous complaints; but it is one of the salts which taken by the mouth, passes unchanged with the urine; and Wetzlar showed that a solution of this substance speedily reduced crystals of lithic acid to a pulverulent state. Devernay exposed a small lithic acid calculus to the action of a solution of borax in water. It soon became white on the surface, and swelled up. The change extended deeper and deeper, and in between three and four days the calculus had fallen entirely down into a loose white powder, which on examination, was found to consist of lithate of soda. This



experiment was several times repeated, and always with the same result. It is possible that this salt, which seems to exert very little influence on the general economy, may yet come to be a powerful means in attacking lithic calculi of the bladder.

But it is not merely as lithontriptics, or solvents and disintegrators of stone, that the alkalis prove beneficial. Where they fail to produce any effect in this way, they often act in a manner hardly less beneficial, namely, as *anodynes* or *sedatives*, if either word be admissible here. Many cases are to be found in the annals of medicine, in which patients, after having suffered severely from stone for months or years, have gradually, under the influence of alkaline medicines, seemed to recover from their malady. Various mechanical and chemical explanations of this circumstance have been given, such as that the calculus had become sacculated, or found a resting place behind one of the lobes of the prostate; or otherwise, that its hard nodulated surface had become covered with a layer of fine silky crystals of an alkaline lithate, or of an impalpable phosphatic powder. But I believe the explanation to belong to the improved vitality of the bladder, consequent on the amended state of the general health which takes place under the beneficent influence of these medicines. What we frequently observe occurring at first, happens here at last. A stone often lodges in the bladder and gains a large size, without greatly or at all disturbing that sac or the system; and *vice versa*, the sac and the system occasionally accommodate themselves to the presence of a large stone, rebelling against its presence no more. These are



the cases in which stones have frequently been supposed, during the lifetime of the individual, to have been dissolved by the agency of lithontriptic medicines, and which have always been quoted with an air of triumph by the enemies of all attempts to remove calculi from the bladder save by a surgical operation, as conclusive evidence of the utter worthlessness of this class of remedies. But surely this is not altogether fair; it is of little moment whether medicine cures disease by destroying the cause, or by rendering the cause inoperative. If a stone in the bladder is no source of annoyance to us, we are little worse off than if we had no stone in the bladder. There are two chances, therefore, of alkaline medicines proving useful; firstly, by dissolving the stone, which I feel persuaded is possible to a degree far beyond what is generally admitted; secondly, by bringing round the system to a state in which the presence of the stone is not felt.

There are many cases which illustrate the truth of the latter position. The celebrated Horace Walpole, after suffering dreadfully for several years from calculus in the bladder, began the use of Castile soap and lime-water, of the former of which he took an ounce, and of the latter three pints daily; that is, he swallowed from two drams to two drams and a half of soda, and to his ordinary drink added about two quarts of fluid, every day. This course he began in 1748, and by and by found that he was not only relieved from the painful symptoms of stone, but that his general health was greatly improved; his appetite, his spirits, and his appearance altogether, undergoing a remarkable change for the



better. It was even generally supposed that his stone must have been dissolved ; but the uneasiness and slight irritability of bladder he experienced after any long journey in a carriage on rough roads showed that this was not the case. However, by continuing to use the medicine from which he had derived so much benefit, he passed a very comfortable existence, in the enjoyment of all his brilliant faculties, and the delight of his friends up to the time of his demise, which took place in 1757, in the 78th year of his age. On inspection after death, the coats of the bladder only appeared to be a little thicker than common ; but the organ contained three large stones. Had these stones been actually dissolved, or cut out of the bladder nine years before, they could hardly have occasioned less annoyance than they did in this instance.

There is another still more remarkable case of the same kind related by De Haen in his *Ratio Medendi*. The subject of this was a poor shoemaker who for seven years had passed a life of agony from stone in the bladder. Between the month of November, 1756, when he was received into the hospital of Vienna, and the month of June, 1757, he took as many as seventeen pounds' weight of soap, and one thousand five hundred pounds of lime water, which is at the rate of about an ounce of soap and seven pounds of medicated diluent every day. After he had followed this course for between three and four months, he felt himself completely relieved from all his sufferings, and indeed as much at his ease as any person who had no stone in his bladder ; he retained his urine the



ordinary time, voided it without pain or difficulty, and finally left the hospital perfectly restored to health, still carrying his stone with him, a fact which was easily ascertained by the use of the sound, but suffering no kind of inconvenience from its presence. Between four and five months afterwards this man was known to be living freely, yet remaining perfectly well; and a year later he continued in the same satisfactory state, so free from every complaint that he did not know he had a stone in his bladder, though its existence was still readily discovered by the sound.

Two other interesting cases will be found in Sir Everard Home's book on the Diseases of the Urethra and Prostate, one of which it would seem occurred in the person of Sir Everard's own father. In these cases the stones were supposed, during the life of the patients, to have been dissolved. They were not dissolved, having been found in the bladder after death, but they were rendered perfectly inoffensive; the individuals lived comfortably to a good old age, and died of diseases unconnected with the urinary organs. In the collection of calculi belonging to the Royal College of Surgeons in London there is a fine specimen of one of the lithic acid kind, which must weigh about four ounces. After causing the individual who carried it much suffering for many years, during which he was incapable of retaining his urine for an hour, this stone became quiet at length, so that through all the latter years of the patient's life, he suffered little or no inconvenience, was able to retain his urine for many successive hours at a time, and ge-



nerally forgot that he had a stone in his bladder at all. Many cases of the same kind have occurred in practice.

Of the *alkaline earths*, lime and magnesia, I have little to add to what has been already said under the head of Renal Calculus. (p. 260.) Lime water has unquestionably some influence upon the stone in the bladder. This article, however, has so commonly been conjoined with the exhibition of soap, that data for estimating the actual amount of its influence are wanting. Whytt in his "Essay on the Virtues of Urine Water" gives many cases where this combination was of great service; to several of these I have referred in speaking of the alkalis. The lime water is principally useful, in so far as the removal of the stone actually existing is concerned, as a diluent. Still the urine, under its continued use, does seem to acquire a certain degree of solvent power. Thus Dr. R. Newcome, Bishop of Llandaff, while drinking two English quarts of lime water daily for stone in the bladder, poured his urine night and morning on a piece of calculus weighing thirty-one grains. In four months it was reduced to three fragments, which together weighed no more than six grains; and one of the pieces steeped in the urine for a fortnight, crumbled into powder.\* I do not know that any corresponding effect has been observed in connexion with the use of magnesia. As correctives of the state of system which leads to the deposition of the elements of certain kinds of urinary calculi, the alkaline earths are certainly useful. They are not

\* Whytt, op. cit. Works, 4to. p. 446.



more useful however in this respect than the alkalis properly administered; and as means of dissolving or disintegrating renal and vesical calculi, they are impotent when compared with the bicarbonate of potash or soda exhibited in abundance of water supersaturated with carbonic acid gas.

*Acids* form another distinct class of medicines proposed for the alleviation or cure of stone in the kidney and bladder. Recent inquiry indeed renders it probable that the carbonic acid of the urine is no accidental but a necessary ingredient of that fluid, and that it plays an important part in holding the phosphates in solution. I have always found much more carbonic acid in lithic than in phosphatic urine. Hales was aware that carbonic acid acted as a solvent of some kinds of calculi, out of the body; and both Percival and Dr. Fr. Home prescribed water impregnated with fixed air in calculous complaints. Mr. Brande also recommended it in cases of white gravel, *i. e.* during the prevalence of the phosphatic diathesis, but his formula for its exhibition, namely, as it is evolved from an effervescing draught, is objectionable, unless we would give an alkali at the same time. Woehler has lately called in question the passage of carbonic acid introduced into the stomach by the kidney at all. He could not discover more carbonic acid in the urine of a person who was drinking plentifully of water impregnated with this gaseous acid, than in that of one who was taking nothing of the kind. Certain acids, however, namely, the phosphoric and the vegetable acids generally,—the citric, tartaric, malic, &c., taken by the mouth, pass off readily by



the urine; so that if we would at any time acidify the urine, these must be the compounds chosen. In prescribing them, we must only be careful not to unite them, or to give them an opportunity of uniting in the stomach with any alkaline base, else our purpose will be frustrated; for so long as there is a particle of superfluous alkali to be got rid of, so long will the urine not only not show acid, but will positively exhibit alkaline reaction.

The mineral acids, although all experience shows that they do not appear in the urine, save saturated with a base, have nevertheless an undeniable influence upon the secreting function of the kidney. I have already spoken of the influence of the muriatic acid in altering the diathesis from the phosphatic to the lithic. A remarkable case of this will be found mentioned in Marcet's work, (p. 161.) The effect of the muriatic acid in causing the formation of lithic acid has sometimes led to mistakes in practice. I have met with several cases in my reading, in which this acid was given so perseveringly, that several ounces of lithic acid were collected from the urine of gravelly subjects in the course of a few months, the practitioner all the while believing that he was purging his patient's system of grit and sand. The alkaline bicarbonates continued for a few days would have altered the whole face of affairs. The principal application of the acids is to effect a change in a prevailing phosphatic diathesis. As solvents of calculi already formed, save in the way of injection into the bladder, they are probably impotent.

*Solution of stone in the bladder by means of injec-*



*tions*.—It is long since the notion of dissolving calculi in the bladder by the direct application of menstrua of different kinds thrown into that sac was entertained. It is long too since attempts to carry this idea into effect were not only made, but successfully made. We have even accounts of comparatively unpolicied nations practising the art of injecting an alkaline lye into the bladder for the purpose of dissolving the stone. In the “Medical and Philosophical Commentaries of Dr. Duncan, vol. iii. Edinb. 1775,” there is the notice of a communication from an individual travelling at that time in Arabia Petræa, who is characterized by the editor, my late excellent old preceptor, as “an English gentleman of candour and experience,” from which we learn that “On the coast of Arabia Petræa, beyond the mountains of Sohar, they have an effectual remedy for the stone in the bladder. By means of a catheter they inject into the bladder a weak lye of alkali or ashes, with the purified fat of a sheep’s tail, and a proper quantity of opium, all compounded together. The catheters are made of gold and are introduced quite into the bladder, so that the composition is safely conveyed to the stone without injuring any part.” This plan of treatment is reported as being found very uniformly successful. Where the calculus is of lithic acid, and the system is persevered in for a sufficient length of time, I cannot doubt of its efficacy.

But we are not left to the testimony of travellers, to whom a certain latitude is proverbially allowed, upon a subject so interesting and important to humanity. Some time before the year 1732 we find



the distinguished Dr. Hales,\* one of the brightest among the many bright spirits England has produced, labouring at the idea of dissolving the stone in the bladder, by throwing into that sac a *menstruum* which he had proved by experiment to be very powerful in its effects upon calculi out of the body. He even invented a double-current catheter which he used in trials upon dogs, and showed that by its means large quantities of fluid could be made to circulate through the bladder of these animals without injury to them. By means of his catheter, for instance, he on one occasion caused as many as nine hundred cubic inches of water at blood-heat to pass through the bladder of a dog in the course of fours hours and a half. He next ventured to try the effects of his menstruum, which consisted of a mixed solution of bicarbonate of potash, sulphate of potash and carbonic acid in water, in the same way. Of this he found that a moderate quantity could be injected and retained in the bladder of a dog for a long time, and that he could transmit twenty-three cubic inches (the largest quantity he seems to have tried) of the solution by the double catheter in a very short space of time, without a single symptom of uneasiness being manifested by the animal.

Twenty years later, namely in 1752, apparently upon a hint from Dr. Whytt, at that time Professor of the Practice of Medicine in the University of Edinburgh, and busily engaged in experimenting on the efficacy of lime water in calculous com-

\* Statical Essays, 3rd. Ed. vol. ii. p. 295. 8vo. Lond. 1769.



plaints, Mr. William Butter,\* then a clerk in the Royal Infirmary, contrived an apparatus for throwing injections, particularly lime water, into the bladder. With this he pushed, at various times, quantities of tepid lime water into the bladders of different patients, as well those who were not affected with calculus as those who were, and he found that this occasioned no kind of uneasiness or pain. The following history in the words of Dr. Rutherford, at this time Clinical Physician in the Edinburgh Royal Infirmary, was given to Mr. Butter for publication in his little work just quoted, and it is so interesting and remarkable, that I extract it entire, without a word of apology for its length.

“Angus M’Pherson, aged above forty, came to the Royal Infirmary about the beginning of February, 1753 ; and because he seemed to have a stone in his bladder, I immediately admitted him into my ward, as one of my clinical patients. He had been in great distress for above four years ; and commonly passed bloody urine, especially after exercise ; so that he was now greatly emaciated by pain, sickness, and loss of blood. He had made his journey from the Highlands to town in great agony ; and, upon his arrival, complained of exquisite pain about the neck of his bladder, had a frequent desire to make water, and what he passed was deeply tinged with blood. I did not therefore think it advisable to sound him at this time, because of the inflammation and constriction of the parts ; but prescribed

\* A method of cure for the stone, chiefly by injections, 12mo. Edin. 1754.



the arabic emulsion, clysters, a dose of manna, &c. whereby, in some days, these symptoms were so much abated, that he could now bear the sounding with a catheter, by which a stone was distinctly felt, and it seemed to be a large one.

“ But though lithotomy had often been practised with success in the Infirmary, and though the patient himself seemed willing to undergo that operation, yet I would not allow him to be cut, choosing rather to make a fair trial of the power of lithontriptics.

“ And because remedies of this kind, when taken by the mouth, and mixed with the mass of blood, and afterwards with the urine, must necessarily lose a great part of their efficacy before they can reach the bladder, I had, for some time, wished for such an opportunity of trying if a stone may not be more speedily and successfully dissolved by injecting the solvent liquor immediately into the bladder. I was the more encouraged to push this experiment, as Mr. Butter, clerk of the Royal Infirmary, had very ingeniously invented a machine, by which almost any one can easily throw a liquor into his own bladder; and with less trouble than it can be done by the hand of another person.

“ I therefore ordered the patient, by the help of that instrument, and according to Mr. Butter's directions, to inject four or five ounces of lime-water every morning and evening into his bladder; while, at the same time, I prescribed the internal use of soap and lime-water.

“ For the first four or five weeks that he followed this method little alteration could be observed upon his urine; but afterwards, when the quantity of the



injected liquor was increased, and when he could retain it no longer, both his urine and the lime-water when rendered began to drop a copious chalky sediment, which plainly showed that the stone was now in a state of dissolution.

“His symptoms, which, from the first, had been continually, though slowly, decreasing, abated more sensibly upon this phenomenon. And, after he had been pretty easy for some weeks, he was again sounded about the middle of April; when, upon careful searching, it was imagined that the nucleus of the stone could sometimes be felt by slight touches upon the catheter. And the patient said he was sure that what remained of it was a very small bit; because he sometimes had a feeling as if it was entering the *urethra*. He continued the same course a fortnight longer, when the sounding was repeated, and no relic of a stone could be felt; and, as he had no complaint, except, very seldom, a little pain and stoppage in making water, he grew impatient to return home. I therefore dismissed him, with orders to continue the same course till those symptoms should entirely cease.”

This relation is indeed striking. The calculus in this case, in all probability composed of lithic acid, under the united influence of alkaline medicines by the mouth, and injections of lime-water by the *urethra*, was first reduced to a mere nucleus, which “it was imagined could sometimes be felt by slight touches upon the catheter,” and which by and by must have been entirely dissolved, for “when the sounding was repeated no relique of a stone could be felt.”



Is it not very strange that with so simple and so precise a narration, now hard upon a century old, proving unequivocally that urinary calculi can be dissolved within the bladder in the living body, there should not be hundreds of cases recorded in the annals of medicine demonstrative of the same fact? I own I am at a loss to account for the deficiency. I have sometimes supposed that those who have had the most frequent opportunities of trying the effects of injections, &c. in destroying the stone, had not been over-anxious to avail themselves of them in this way. Lithotomy is so brilliant an operation; all the world of young, and very generally even of old surgeons, are so anxious to perform it, that we can fancy anything in the shape of a proposal, or an attempt to annihilate a stone in the bladder by the silent and unseen agency of chemical affinities being received as a kind of heresy, appearing like an opportunity lost, like putting a candle under a bushel instead of into a candlestick that all in the house might see.

Physicians, too, have, I grieve to say it, of late opposed themselves very generally even to the hope of curing stone in the bladder by means of internal medicines, whether taken by the mouth or thrown in by the urethra. Dr. Walter Charleton, in his "*Spiritus Gorgonicus*," indeed, went the length of denouncing as "*impii et blasphemii*," those who denied the power of lithontriptics. This is going rather too far; but extremes always meet; and when we turn to the latest and most authoritative of the writers on urinary diseases of our own country, we find the subject of the cure of calculus in any way



save by operation, if indeed that can be rightly called a cure, either merely glanced at as hopeless, or scouted as chimerical. Dr. Marcet will not hear of such a thing; and the subject I think is not even alluded to in the first edition of Dr. Prout's work; in the second edition it is discussed in less than a page.

Fourcroy and Berzelius, two of the greatest names in chemical philosophy, thought very differently and far more favourably of the idea of curing stone in the bladder by means of injections. The former\* from actual experiment urged the consideration of the point very earnestly on his brethren of the profession. The latter† says—"The attempts that have hitherto been made to dissolve calculus in the bladder, have not answered expectations; but I am intimately persuaded that they have not been repeated often enough to allow of those accidental circumstances which are never to be foreseen, but which always occur [and oppose success in new courses] from becoming perfectly known, and either guarded against or vanquished."

Gruithuisen, the distinguished reviver or inventor of the operation of lithotrity in modern times, in one of the most entertaining papers I ever perused, the title of which I have already quoted at length, speaks with the enthusiasm characteristic of the man, of the solution of the stone by means of injections. The object he had in view when he contrived implements for perforating stones in the bladder was not their destruction in the way of grinding

\* *Sys. des Conn. Chim.* tom. x. Paris, An. IX.

† *Djurkemi*, D. ii.



or breaking, but that he might open up a passage to their centre for suitable solvents. Gruithuisen modified the double-current catheter of Hales, so as to direct the shock of the high-pressure column of fluid he proposed, immediately upon the calculus. Gruithuisen, however, does not seem to have actually tried the experiment of dissolving a stone in the bladder in the way he mentions. In looking at the figure he has given of his catheter, I am at a loss to imagine how he intended to pass it into the bladder. It has a process sticking off from it at one side very like the prong of a fork, which must have rendered its introduction very difficult.

The next case after the one by Mr. Butter and Dr. Rutherford, detailed above, in which injections were actually employed as part of the treatment of calculus, is that by Messrs. Magendie and Amussat.\* By means of a double-current sound, they passed first a warm mucilaginous injection into the bladder of an English gentleman, which contained an adhering calculus, and then an injection acidulated slightly with sulphuric acid, using from twelve to fifteen litres of fluid (twenty-one to twenty-six pints) at each sitting. This had an excellent effect, putting an end to the muco-purulent discharge from the bladder, and always bringing away a large quantity of calculous detritus with it. By means of a canula, small rasps or files were also introduced into the bladder, and portions of the calculus by their motion detached every day, and subse-

\* Mentioned by M. Leroy d'Etolles in his *Exposé des divers procédés employés jusqu'à ce jour pour guérir de la Pierre*, 8vo. Paris, 1825.



quently washed out by the use of the double catheter. Unfortunately the patient at this interesting point in the treatment, was summoned away from Paris, and we have no farther account of his progress, which is very much to be regretted.

The next case in which the cure of stone in the bladder was attempted by means of injections, occurred in the practice of Sir B. Brodie. This case I refer to with the greatest satisfaction, as being quite conclusive; it sets the question as regards the power of injections to dissolve a stone in the bladder at rest for ever; the means employed were perfectly adapted to the end proposed, their persevering use was crowned with complete success. The destiny of our own dear native land would indeed seem to be the aggrandizement of the divine art of healing in those directions especially, that are most interesting to mankind.

Sir Benjamin Brodie had found that a stream of fluid, composed of two minims or two minims and a half of nitric acid dissolved in each ounce of distilled water, not only did not excite, but actually relieved inflammation in the lining membrane of the bladder, and that calculi composed of the mixed phosphates exposed for some time to the action of such a menstruum were first diminished in size by undergoing solution, and at length reduced to minute fragments (and he might have added, soft flocculi of animal matter.) About this time Sir Benjamin was consulted by an elderly gentleman labouring under a complication of disorders of the urinary organs, one of which, the moment a catheter could be passed into the bladder, was



discovered to be *calculus*. The urine was alkaline, very offensive, and contained large quantities of viscid mucus, with which were blended small particles of phosphate of lime. It was impossible, under these circumstances, to think of any operation for the relief of the patient; and Dr. Prout, in consultation with Sir Benjamin, agreed that it was a case well fitted for the experiment with the nitric acid injection, which Sir Benjamin had proposed to himself to make on the first favourable opportunity. Sir Benjamin therefore procured a double catheter of pure gold, and having passed this into the bladder, he threw his solution of nitric acid very slowly into it, by means of a bottle of elastic gum, using the same liquid again and again. After the solvent fluid had been thus infused several times, it was found, when tested by ammonia, to contain the phosphates in abundance. The patient suffered no material inconvenience from the operation, which was continued for from fifteen to thirty minutes on each occasion, and repeated at intervals of two, three, or four days. At last, in making water, the patient voided two small calculi, or rather calculous nuclei, composed principally of phosphate of lime with a little of the triple phosphate, which it was impossible to doubt had been acted on and in part dissolved by the acid injection. In fact they had only come away by the urethra in consequence of having undergone a reduction in size.\*

\* Sir B. Brodie's triumph in this case was first communicated to the world in one of the numbers of the London Medical Gazette for the Month of June, 1831. The case is of course contained in his Lectures already quoted.



I am so happy as to be able to adduce a still more recent instance in which injections into the bladder were successfully used in a case of calculus. This occurred in Malaga, under the care of Dr. Rodriguez.\* The patient was prepared by having injections of a decoction of althea root or of pearl barley thrown into his bladder, for four days; after this, half an ounce of white soap, two ounces of spirit of wine, and one ounce of lemon juice, were added to the decoction employed upon each occasion, and the dose of lemon juice was gradually increased. The stone during the progress of the treatment was tapped upon or struck gently twice a day. By these means the patient recovered completely in the space of forty days. This case is not altogether satisfactory. A citrate of soda is an indifferent solvent for any stone. The supercitrate of soda, which was at length infused, would indeed have acted on a calculus of cystine or lithic oxide. The alcohol was an unnecessary addition at the least.

I have thus been able to adduce three instances, connected unquestionably with as many different diatheses, in which, under the influence of injections into the bladder, combined in the one case with the exhibition of alkaline medicines by the mouth, (which was probably a part of the treatment necessary to success) uncomplicated and without such assistance in the other two, in all of which complete success attended the persevering efforts that were made to afford relief. With the

\* Julius and Gerson's Magazine, Heft 2, S. 330, Hamb. 1834.



progress of time our knowledge of the menstrea calculated to act as solvents of different calculi, and of the circumstances under which each of these is applicable, has been immensely extended ; so that I cannot but regard the prospect as most cheering. By the united effects of medicines by the mouth, injections into the bladder, of a nature adapted to the kind of calculus included, and the aid of another agent, which I am immediately to mention, the day cannot be far distant when art will triumph in perhaps the majority of instances over all the difficulties that have hitherto opposed the removal of calculi in the bladder without recourse to a most painful, and on the average, very dangerous operation. The agent I am now to notice is

*Galvanic Electricity.*—The discovery by Messrs. Carlisle and Nicholson of the power possessed by voltaic electricity to effect the decomposition of water, immediately followed up as it was by the application of this agent by Davy to the resolution of many substances till then regarded as simple elements, naturally suggested itself as a means of destroying the stone in the bladder. M. Bouvier Desmortiers\* is said to have been the first who proposed to apply the powers of the pile in this direction. He even made some experiments on the subject ; but the effects he produced were very tardy. Gruithuisen, in the remarkable paper already quoted, aware apparently of M. Desmortiers' suggestion, contrived a canula for transmitting two

\* Examen des systemes sur la nature du fluide Electrique, 8vo. Paris.



isolated wires into the bladder of a person labouring under calculus, and bringing the exposed extremities of these into contact with the stone. "There is scarcely a stone," says this writer, "that will be found to resist a battery of 300 pairs of plates; deep holes are made in the surface of most of them by the contact of the wires during a few minutes; but if 300 pairs of plates be in any instance found insufficient, then let a battery of 600 be used, and before this the most refractory calculus will certainly melt like butter." (l. c. p. 308.) The Messrs. Prevost and Dumas \* were the next who made experiments on urinary calculi by means of the galvanic battery. The battery employed by these gentlemen consisted of 130 pairs of plates, and was kept in action by a fresh addition of exciting fluid every hour. The stone they experimented on weighed 92 grains, and was of the fusible kind, or consisted of the mixed phosphates. The platinum wires from the poles of the battery were made to touch the calculus on either side, being distant from each other between six and eight lines. The calculus thus situated was plunged into a vessel of pure water, and the battery charged. The action having been kept up for twelve hours, the calculus was taken out, dried, weighed, and found to have lost 12 grains in weight, a like quantity of insoluble phosphatic salt being contained in the bottom of the vessel in which the decomposition had been thus far effected. The action of the battery was continued for sixteen hours more, when the calculus was found reduced to so

\* *Annales de Chimie et de Physique*, tom. xxiii. p. 203.



friable a mass that it fell down into fragments and small crystalline grains with a touch, the largest not being of the size of a pea. So much for the success of the experiment out of the bladder. The object was now to try whether that pouch would endure the presence of the conducting wires from a battery in action. The urethra of a dog was accordingly cut into as it passes over the pubic arch, and a canula inclosing the isolated conductors proceeding from a battery of 135 pairs in full action, introduced into the bladder. This was accomplished without causing any notable discomfort to the animal, especially when care was taken to have the bladder previously distended with water. A piece of fusible calculus was next secured between the conducting wires of the battery, passed in this state into the bladder of a bitch, and the apparatus put into action. The animal betrayed symptoms of pain at first; but by and by she became quiet, and the experiment was continued for an hour. On being withdrawn, the calculus showed unequivocal traces of decomposition. The experiment was continued on each of the next succeeding days, an hour at night and an hour in the morning, when the state of the calculus from its increased friability prevented any further continuance of the process; it was completely disintegrated. The dog was killed some days afterwards, and the bladder being examined was found perfectly healthy; it did not seem to have sustained the least injury. The process of decomposition being carried on with the calculus immersed in a solution of nitrate of potash, was found to be much more rapid. Messrs. Prevost and



Dumas speak of preparations for farther experiments on the decomposition of urinary calculi; but I have searched in vain for any additional notice of the subject from this quarter.

M. Bonnet,\* however, of the Hôtel-Dieu of Lyons, seems to have repeated the experiments of Prevost and Dumas, he having succeeded by means of the pile or battery in dissolving or disintegrating a piece of calculus consisting of the triple phosphate which weighed eight grains, introduced into the bladder of a mare; this, I think, was accomplished in a very short space of time—an hour, if my memory serves me aright. M. Bonnet also found that he could inject for several days in succession a solution in [a litre? of] water of as many as six ounces of nitrate of potash into the bladder of an animal without either exciting inflammation or causing uneasiness.

I have myself tried some experiments on the solution of calculi by means of the galvanic influence which are satisfactory enough. One obstacle to the employment of this means must always have been the difficulty of arranging the cumbersome apparatus of troughs composing a galvanic battery, so as to make it easily available for the purpose in question; another difficulty was that of maintaining the action of the battery without constant interference. The object here is continuousness not intensity of action, and the current of galvanism that will decompose water, will certainly decompose any cal-

\* Comptes rendus des Seances de l'Acad. R. des Sciences, 11 Avril, 1836.



culus consisting of an acid united to a base. I therefore made use of the neat and very simple arrangement of Professor Daniel's galvanic battery devised by Mr. Golding Bird,\* which decomposes water readily, a continuous stream of oxygen and hydrogen escaping visibly from the ends of the wires in connection with the opposite poles, which will go on acting for a fortnight or three weeks, and which from its portability has immense advantages, and might be placed between the thighs of a patient laid at his ease on his bed to have his stone dissolved. The results I obtained upon calculi of the phosphates, plunged in a vessel containing a solution of common salt in water, urine, and a solution of nitrate of potash, were satisfactory enough; these calculi were slowly but certainly decomposed and disintegrated. The calculus of the lithic acid is one of the most rebellious to the action of galvanism; but what I have had occasion to say with regard to the influence exerted on this kind of concretion by the bicarbonated alkalis either taken simply by the mouth, or associated with the use of injections of the same salts, or of lime-water, renders us very independent of assistance from the galvanic battery against calculi of the lithic acid.

Should each or any number of these means used with diligence, with discretion, and under the guidance of knowledge, fail to accomplish the removal of the stone, which when the disease has been of long standing and the stone is of certain descriptions must be expected to happen, there

\* Phil. Trans. for 1837, p. 39.



will be nothing left for the patient, if he still persevere in his purpose of being rid of the cause of his misery, nor "through fear of pain would lose this intellectual being," but to make up his mind to undergo the operation of lithotomy or lithotritry.

The latter operation, from which so much was anticipated at first, and which was so flattering to the timid, would not seem hitherto to have answered expectations. Whether it be that cases have been too indiscriminately submitted to treatment by its means, that the operation has been held applicable in too wide a range of circumstances, that its dangers are actually greater than they appear to be, or that it has hitherto been too much in the hands of men who were not physiologists and pathologists besides being handicraftsmen, it is quite certain that lithotritry or lithotripsy has on the whole proved even more fatal on the average than the old operation of lithotomy used to do. And I think no practitioner of lithotritry or lithotripsy can boast of his thirty, forty, fifty, nay of his hundred cases operated on in succession without an intervening accident. Frere Jacques cut thirty-eight successively without losing a patient. Cheselden in fifty-two cases operated fifty times with success. And Professor Dudley, of Louisville, in Transylvania, United States, according to the statements published by Dr. Bush, would appear not only to have done the operation more frequently than any man of his time, but to have done it with a success altogether unprecedented ; of one hundred and fifty-three cases operated on by Dr. Dudley, one hundred and forty-



nine are reported to have done well; only four died; this is not even half of the very small mortality that occurred in the practice of Cheselden. Dr. Dudley ought, however, to be very successful; he is extremely cautious in his choice of cases, and never even passes a sound to ascertain whether there be actually a stone in the bladder or not, until every symptom of constitutional disturbance is allayed by general treatment. Dr. Dudley's practice is so excellent in this respect that I extract the account of it published by Dr. J. M. Bush in an *American Journal*, to which I cannot more particularly allude, inasmuch as I only possess that part of the volume which embraces Dr. Bush's communication:—"When a patient applies to Professor Dudley with the ordinary symptoms of stone, to ascertain its existence the first step of course is to explore the bladder with a metallic sound. This simple but indispensable operation, however, he never performs, in any case, for several hours after the arrival of the patient; and not even then, if there be pain in the organ or the slightest fever. For it is considered highly detrimental to the sufferer, to disturb the constitution while thus deranged, even with an instrument usually so harmless. Should the general condition of the patient's body not otherwise forbid, the day after his arrival he is sounded, having taken a general warm bath the evening previous. But if he be suffering with paroxysms of the stone, and his blood-vessels exhibiting febrile action, with a deranged state of the alimentary tube, more energetic treatment is required before the instrument is passed into the bladder. Nauseating potions of ipecacuanha or tartar



are exhibited, and should these fail to reduce the pulse and restore cutaneous action, or a proper condition of the bowels, aided by the bath ; an emetic, or cathartic, or both are then superadded, with light and abstemious living. By these means two objects are effected. The first, is a prevention of any irritating results from the examination of the bladder ; the other is that so much is gained in the preparatory management of the general system. Until he is completely satisfied that all the organs are in the healthy performance of their various functions, he will not operate."

All this is excellent, and every way worthy of imitation by surgeons in general. If Cheselden cut twenty-six patients in London, as they presented themselves to him, and without weeks, far less months of medical and dietetic preparatory treatment, he would certainly have cut fifty in the country, with a little fastidiousness in his choice of subjects, and particular pains to prepare them for the operation. Nevertheless the average mortality from lithotomy in all hands appears at present to be about one in eight ; and when it is considered that children of all ages, among whom the operation is almost always fortunate in its issue, are included in this reckoning, it is evident that among grown men the operation is very formidable and very fatal. Lithotritry cannot boast of anything even like this very moderate general success. There have as yet been no Frere Jacques, and Cheseldens, and Martineaus, and Listons, and Dudleys among lithotritists. The deaths in the hands of the leading lithotritist of Europe M. Civiale, are reported to be *at least* in



the proportion of one in four. In all hands the mortality from lithotrity has been that of pestilence, something like one in two.

But surgeons who are at the same time anatomists and physiologists are now including the operation of lithotrity within the limits of their profession, and will undoubtedly by and by learn to appreciate the cases and circumstances in which it may be most advantageously employed, and thus make it a means of sparing pain to some at least of the unfortunate sufferers under calculus. My own most anxious wish, however, were that we should see our highest glory here as elsewhere in the bloodless surgery of the present day, in preventing the necessity of an operation of any sort. Under favourable circumstances I have myself implicit confidence in the means we possess of doing this. These have been amply detailed in the preceding parts of this long but most important chapter. With due attention to every requisite, with perseverance in the use of the appropriate remedies, I repeat my conviction that gravelly concretions generally, and the majority especially of the smaller sized vesical calculi may always be so much reduced in size, that they may be extracted or voided by the urethra, and thus the suffering and risk to life inseparable from a most painful, and, on the average, still fatal operation be avoided.



## PART SECOND.

### FUNCTIONAL DERANGEMENTS TO THE ORGANS WHICH EXCRETE THE URINE.

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#### CHAPTER I.

##### OF IMPEDIMENTS TO THE DISCHARGE OF THE URINE.

DYSURY, simple difficulty in making water, *Strangury*, extreme difficulty in making water, and *Ischury*, absolute inability to make any water at all, are three names which are to be understood as expressing but so many degrees of a variety of morbid states, the most prominent feature in each of which is a difficult or obstructed discharge of the urine. Simple difficulty of voiding the urine—*Dysuria*, occurs in the course of many particular diseases, and occasionally as an effect of accidental local, and even general irritation. Dysury, for example, is not uncommon as a symptom in fevers, and probably depends on the acrid qualities of the small quantity of urine then secreted, inducing a kind of phlogistic state of the lining membrane of the neck of the bladder and urethra. Dysury is very often observed among infants and young children as symptomatic of irritation in the kidney, and is then



very usually connected with the production of crystals of the lithic acid, or at all events with the elaboration of high coloured, acid urine, which, when discharged, deposits red sand on the napkins, and on the sides of the utensil. An occasional cause of dysury is the irritable state of the system generally, and of the urinary organs in particular, which is occasioned by a disordered state of the digestive functions. Another well known and constantly occurring cause of dysury, sometimes of strangury, and now and then even of absolute ischury, is the inflammation excited in the kidney, and over the mucous surfaces of the renal pelves, ureters, bladder and urethra, by the internal administration of cantharides, or the absorption into the system of this acrid poison from a blistered surface. By much the most frequent cause of the three grades of dysury, however, is an impediment to the flow of the urine of a local and independent nature, situated in the course of the urinary passages. The whole subject of the impeded flow of urine, considered as a local and particular affection, may be advantageously discussed under the head of Ischuria, which, as the last and highest degree of Retention, must be supposed to include all the others.

*Ischuria, Retention or impeded discharge of Urine.*

Retention of urine takes place from two principal causes; first, the existence of an obstruction in some point of the urinary passages; second, the want of proper expulsive power in the bladder, owing to an atony or paralysis of its muscular tissue.



1. The *Retention of urine from obstruction in the course of the urinary passages* is of various kinds, and presents a certain variety of symptoms according to the point at which the impediment occurs, and also according to its peculiar nature. The obstacle, for instance, may have its seat in the course of the ureter, at the neck of the bladder, or in the canal of the urethra; and it may consist of an organic constriction of some part of the ureter, of a calculus or clot of blood impacted within it, of the pressure of a tumour upon it externally, of enlargement and inflammation of the parts about the neck of the bladder, of stricture of the urethra, or as in the case of the ureter, of a calculus filling its canal.

Retention of urine from obstruction in the course of the ureter presents itself in practice occasionally; any diminution in the calibre of this canal from organic causes is, however, a very rare occurrence; the obstacle to the flow of the urine when seated here is almost invariably mechanical, and consists in the presence of a calculous concretion which, having escaped from the pelvis of the kidney where it had been formed, is of too large dimensions to be transmitted by a channel so narrow as the ureter. When calculi are arrested in the ureter, they are in general found impacted either in the upper part of the canal, immediately after it leaves the renal pelvis, or at its lower part, just as it is terminating in the urinary bladder. Retention (Ischuria) followed by speedily fatal suppression of urine (Anuria) I believe to be an occasional consequence of the former of these accidents. Retentions that end fatally at last, after a long train of misery



from suppuration and entire destruction of the kidney, are constantly occurring as effects of both the former and the latter.

The entrance of a calculous concretion into, and its passage through, the ureter are generally proclaimed by acute pain, and the train of symptoms particularly described under the head of Renal Calculus. Sometimes, however, the pain accompanying events of this kind is so trifling, that their occurrence escapes us, and we are only led to conjecture that they have actually happened, when we find a patient labouring under the symptoms of retention of urine, or of stone in the bladder. When the obstruction to the flow of the urine is situated high up in the course of the passages, the symptoms may be expected to be those of suppression (Anuria) rather than of retention (Ischuria) of urine. There will, however, be a greater amount of local uneasiness or actual pain extending down the flanks and thighs into the bladder and along the penis, and also more general distress than are ever observed in cases of proper anuria. Feelings of *distention*, too, and as it were of fulness and swelling, though nothing appear externally, will be very certainly complained of, and may sometimes give a hint in regard to the true nature of the disease we have to deal with, touching which we should otherwise be very much in the dark. In ischury or retention from obstructions situated high up in the course of the excretory passages, the secretion of urine not being entirely suspended, this fluid will continue to come away irregularly in smaller or larger quantities; an interval of one, two, or three days will hardly



elapse without the discharge of a drop of urine, as happens in true anuria; should we, upon any occasion, in the course of the attack, have three, four, six, or eight ounces of urine making their appearance at once and rather suddenly, followed by no farther discharge for some time afterwards, we shall be pretty certain that it is impeded discharge—Ischuria, not suspended secretion—Anuria, that we have to do with; at all events we shall know that the symptoms of suppression which are so apt to supervene in these cases are induced by the antecedent retention.

When the impediment to the flow of urine is situated lower down in the course of the ureters, as at the point where they terminate in the bladder, the symptoms of retention are more unequivocal. There is no rising or fulness in the pubic region, indeed, and a catheter carried into the bladder draws off either no urine, or only a few drops of that fluid; but there are most distressing sensations of numbness and distention, and complaints of a dull and gravitating pain in the lumbar regions, intermixed, from time to time with more violent shootings, which extend into the thighs and along the perinæum to the glans penis. More than this, after the symptoms have endured for some time, attentive examination commonly enables us to discover some fulness and enlargement of the flanks; and all the painful sensations are aggravated when pressure is made upon these regions. In this case the ureters are distended with fluid; sometimes they acquire enormous dimensions, and then the renal pelvis participating in the affection, the whole kid-



ney comes to be implicated; its tubular structure disappears, and its cortical substance, like the brain in hydrocephalus, forms the parietes of an urinous cyst perhaps as large as the head. This is the form of disease which is often spoken of as *dropsy of the kidney*. A remarkable case of the kind will be found described by Stoerck in his *Anni Medici*, under the title of a "*Pessimus renum hydrops*," in which all the mischief that befell, seemed to have followed repeated attacks of gravel. The patient had suffered severely several times from this complaint, which seemed commonly to have induced some degree of retention, accompanied with heat, thirst, and the symptoms of general fever, in the course of which, only a very small quantity of very high coloured urine was formed; sometimes none would be voided for two days. At last the patient had a fit attended with fever, vomiting, hiccup, and delirium, which on the fourth day proved fatal. On opening the body after death, the substance of both kidneys, almost wholly destroyed, was extended into a thin membranous cyst. The kidney of the left side was of the size of a child's head, that of the right side about the magnitude of the two fists. The ureters and pelves of the kidneys were alike distended with a serous inodorous fluid. At the point where the left ureter entered the bladder, a callous induration of the extent of an almond was discovered, which almost entirely closed the canal, and hindered the onward passage of the urine. The right ureter was firmly constricted, inflamed, and semigangrenous at the distance of about an inch from the bladder. The bladder itself was hard and much con-



tracted. There is a very beautiful representation of the distended kidney which follows obstruction of the ureter in some cases, as the subject of one of the plates illustrative of Dr. Rayer's "*Traité des Maladies des Reins*," now in the course of publication. The discharge of urine in these cases is rarely entirely impeded; variable quantities are either evacuated naturally, or are drawn off by the catheter from time to time.

A much more common cause of retention of urine than any obstacle in the course of the ureters, is an obstruction occurring at the neck of the urinary bladder. This obstruction is of different kinds. Sometimes it arises from the pressure of the uterus in the female, or of growths connected with that organ, or the vagina; sometimes the rectum, loaded with fæces, has pressed upon the outlet of the bladder to such an extent that the flow of urine has been arrested. Sometimes the impediment arises from foreign bodies lodged in the bladder, such as calculi or growths from its internal surface, as in the interesting case I have already mentioned, in which a pendulous tumour, the size of a cherry, and incrustated with calculous matter, hung from the anterior wall of the bladder so critically as to act like a ball and socket valve to the inner orifice of the urethra. (Vide Plate I.) More commonly still, the obstruction consists in an enlargement of the prostate gland; or it is connected with a state of phlogosis and irritation of the membrane lining the urethral infundibulum, and of spasmodic contraction of the muscles about the neck of the bladder, which act as its natural sphincters. But



of all the causes of retention of urine, the one most frequently met with in practice is probably a stricture of the urethra. The ischury that is occasionally encountered in hysteria is so plainly part and parcel of a general disease, that it almost lies without the pale of consideration in a treatise such as this.

However produced, the retention in these cases is of two kinds, (a) *complete*, and (b) *incomplete*, which, in order that mistakes in diagnosis and serious errors in practice may be avoided, it is of great consequence to distinguish. In the *complete ischuria* no urine, or only a few drops are passed with excessive straining, and at intervals, by which no relief is afforded to the sufferer, whose state is constantly, and in an augmenting ratio, becoming worse and worse. In the *incomplete ischuria*, the patient passes from time to time a considerable quantity of urine, probably as much as some persons in health make at once, but without relief to the general fever and restlessness, or any abatement of the distention and local pain in the hypogastrium, though the symptoms are not very urgent. In this case close examination discovers the bladder only to flow over, like a kind of compensating cistern, never to be completely emptied. There is here a certain mixture of deficiency of expelling, with excess of retaining, power. This is the kind of retention from which persons of a certain age so frequently suffer.

Retention of urine in its exquisite form, induced suddenly by opposition to the course of the urine from the bladder, is one of the most painful as well as one of the most formidable diseases to which



man is subject. The urinary secretion is one of those which requires to go on uninterruptedly, in order that the body may be preserved in a state compatible with the performance of those wonderful functions, the aggregate of which constitute its life; and over no parts of the animal machine is there a more vigilant watch set than over those that are connected with the excretion of the urine.

The symptoms of retention are so well marked as scarcely to require particularisation. The patient has probably been suffering previously from some inflammatory affection of the urinary passages, generally of the urethra, or he has been exposed to the ordinary causes of irritation and inflammation, namely, cold, fatigue, &c.; probably he has been drinking, or he has been in a situation which made it inconvenient or impossible for him to obey a call to empty his bladder. However this may be, the next time the call to make water is felt, or when it becomes pressing and must be obeyed, the patient to his dismay finds that he cannot pass a drop; he tries again and again, but with the like ill success; all his efforts prove unavailing, and, long continued, only exhaust his strength and aggravate his sufferings. The hypogastrium in particular is the seat of exquisite pain, which extends into the lumbar regions upwards, and into the thighs downwards. Pressure above the pubes greatly increases this pain, the call to make water being at the same time more urgently felt. Unless the patient be extremely corpulent the bladder can generally now be distinguished rising above the pubes like a hard ball. With a continuance of the retention, this ball en-



larges, and sometimes acquires such dimensions that in the more chronic forms of the disease the patient has been supposed to be labouring under an ascites, which has even been on the point of being made the occasion of a surgical operation. Before matters have gone thus far, however, the symptoms have commonly been of such urgency as to have brought the life of the patient into danger ; unless relief, indeed, has been obtained by the evacuation of the urine, either through the natural channels or through a route provided by art, ulceration and perforation of the coats of the bladder or of some point in the course of the excretory passages will have occurred and given rise to an infiltration of urine into the cellular tissue of the pelvis, abdomen, or perinæum, an event that in most instances is necessarily followed by the destruction of the patient.

The immediate cause of this acute form of retention of urine, when it does not proceed from any mechanical obstruction at the neck of the bladder or in the course of the urethra, consists in an inflamed condition of the mucous lining of the neck of the bladder, aided by something like a spastic state superinduced in the sphincters of the bladder, the pubo-urethrales or Wilson's muscles, which descend from the pubis, and grasp the membranous portion of the urethra. The chief cause of the obstruction in every case of this kind, however, is the congested state of the mucous membrane, which from its high vascularity and the sponginess of its texture about the neck of the bladder especially, may almost be viewed as constituting a kind of uniform web of erectile tissue. The sufficiency of this membrane in a state



of erethism or phlogosis to block up a passage and to resist expulsive efforts, may be judged of by the power it possesses in the nostrils of impeding all access of air, and withstanding the whole force of the respiratory muscles in a case even of slight catarrh. This cause of retention has been very much overlooked in practice.

Retention of urine of the kind just described brooks no delay in its treatment. The disease must be met promptly and efficiently. It is very common to make an attempt to pass a catheter into the bladder the first step in the treatment. I have always been decidedly opposed to this procedure. The disease is one of irritation, and has often become formidable solely from the use of the means now proposed for its relief. The use of the catheter, too, is always inefficient as a measure conferring permanent benefit. "The relief afforded by evacuation," says that excellent practical surgeon Mr. Syme,\* "is generally of very short duration," feelings of distention very soon compel recourse to be had to the instrument again. It is, in general, far better to delay this measure for a while. If the patient be a strong man, or if the pulse be full and the symptoms urgent, venesection is the best and most powerful means we possess of giving relief, and has the immense recommendation of rendering every other we may afterwards employ more efficient. Immediately after general bloodletting, a dozen or twenty leeches should be applied to the perinæum between the verge of the anus and scrotum, and the patient

\* Principles of Surgery, 2nd Ed. p. 203, Edin. 1837.



placed in a bath at the temperature of from 98° to 104° F. without waiting for the fall of the leeches, as they will be found to suck quite as well in the water as out of it. Whilst still in the bath the patient should have a dose of the tincture of muriate of iron, or perhaps still better of the tincture of the ammoniacal muriate of iron, which often seems to exert a kind of specific influence in these cases. The muriate of iron sometimes acts as an emetic; but this is of little consequence, nay, it is sometimes useful; a second dose may often be advantageously administered, whether the first have been rejected or not. The patient should farther be made to drink a few cups of any mild warm diluent. These measures, diligently enforced, the bath being continued for three quarters of an hour, or an hour, are in a very considerable number of instances followed by relief; the patient begins to pass a little water in the bath, and when taken out of it and put to bed between the blankets he is not generally long of finding himself in a condition to make more. Should this not be the case, however, an ounce of castor oil, as among the most speedily efficient of the purgative medicines, should be given by the mouth, and as much more, combined with thirty or forty minims of tincture of opium in a pint of tepid gruel, thrown up as a glyster; a saline purge, such as six or eight drams of the soda tartarizata in infusion of senna, with the addition of half a grain of tartrate of antimony, acts on the bowels, kidney, and skin at once, and will often, as I know by experience, be found a powerful means of restoring the flow of urine; free action on the mucous membrane of the bowels and on the



skin are of the last consequence in affording relief in every form of urinary obstruction.

Should we still be foiled in our attempts by these means to get away the urine by the natural passage, we can then have recourse to the bougie or catheter. It is hardly within my province to speak of this part of the treatment, though I hold that the healing art is one and indivisible; but I may be allowed to recommend, on the strength of my experience in former years, the introduction of a soft plaster bougie of moderate size as a preliminary at all times to the use of any metallic catheter, which is a much less manageable instrument, and, as it is commonly constructed, with large open eyes in the sides near the point, apt to do a great deal of mischief to inflamed and highly irritable surfaces. A bougie having been passed into the bladder and left there for a little time, the urine will often be found to come away by its sides, and when the instrument is withdrawn to follow it in a rapid succession of large drops and even in a slender stream. The success in this mode of proceeding is less brilliant, but I believe it to be more certain, and far more advantageous for the patient. The flow of urine once restored, perseverance in the use of the warm or hip bath, of fomentations to the perinæum, anodyne glysters, and gentle aperients by the mouth, will soon place the patient beyond danger.

The introduction of a bougie, however, though it is not followed by the discharge of a drop of urine, is to be viewed as a great point gained; we have an assurance, that the canal of the urethra is per-



vious, and that instant relief is to be obtained by the brilliant operation of passing a catheter. I shall not dwell on this point, save for a moment to urge on the younger members of the profession, who may do me the honour to glance at these pages, the strong necessity of caution in the practice of this *always delicate*, and with parts affected by disease and changed in their relative position by distention, generally *very difficult operation*. The resources of art are not exhausted even when every effort of the most skilful hand, guided by knowledge, not dominated by force, has failed to carry a catheter into the bladder, an artificial passage for the pent up fluid can still be made; and though *puncture of the bladder* may, as words, sound more formidably to the ear than the *passage of a catheter*, still I hold the operation of puncturing the bladder to be a trifle and free from danger in comparison with the evil, and immense risk encountered under everything like forced catheterism of the urethra. The celebrated P. Desault used to maintain, indeed, that there was no case in which a skilful surgeon could not reach the bladder with a catheter. During the eight years that he had held the rank of head-surgeon at the Hôtel-Dieu, he had only punctured the bladder once, and that was very shortly after entering on the duties of the office. Unconcerned spectators, however, drew other inferences from the results of Desault's practice; there were not wanting some even among his pupils who saw "*qu'il se confiait trop dans sa methode*"—that he trusted too implicitly in his skill, and that on many occa-



sions, persisting in his purpose of entering the bladder, he was so unlucky as to make false passages."

Supposing then that neither bougie nor catheter can be passed into the bladder, the only thing that remains is to *puncture the bladder*. The bladder is at the present day only punctured in one of two ways; from above the pubis, or from the rectum.\* The puncture from the rectum is the operation always performed in this country, unless when rendered impracticable by enlargement of the prostate gland. In this case the region above the pubis is selected. The selection of the rectum for performing puncture of the bladder has always appeared to me a needless refinement, and a very round about way of obtaining an obvious end. The puncture above the pubis is indeed a most simple operation. Mr. Abernethy, and I seek and offer no higher guarantee for the superiority of this over the puncture by the rectum, always did it, and often with no greater amount of apparatus than a pocket scalpel and a lancet. He did not even leave a canula in the bladder, in every case; the escape of the urine and collapse of this sac sometimes preventing him from finding readily the opening he had made into it; but he never saw any ill effect from this neglect—no effusion of urine into

\* The best advocate of the Puncture from the Pubis is the celebrated A. Bonn of Amsterdam, in his paper, 'Over de Pis-Opstopping. en den Blaas Steek', in Verhand. v. h. Genootsc. ter Bevord. der Heelkunde II. Deel, Amst. 1793; of the Puncture from the Rectum the distinguished A. Murray, in his Diss. Chirurg. de paracentesi cystidis urinariæ, Upsal, 1771. A masterly criticism and contrast of the two methods will be found in Sommering's excellent work, Ueber die toedtlichen Krankheiten der Harnblase, &c. 8vo. Frankf. A. M. 1809.



the cellular substance, nor indeed any bad consequence from the operation. When patients died, as they did of course sometimes, their demise could always be fairly imputed to the delay of the operation, or to the degree of disease previously existing in the urinary organs. Sometimes Mr. Abernethy used the trocar; but when there was any difficulty, from the bladder being small and not very distinctly to be felt, he preferred a pointed two-edged knife or a lancet for making the puncture, to the trocar thrust in the presumed direction of the bladder. The only improvement Mr. Abernethy made on his first mode of operating, was immediately to close with the point of his finger the orifice he had made in the bladder with his lancet, and through this to pass a varnished tube. He concludes thus: "All the experience I have had has tended to convince me that the puncture [of the bladder] above the pubis is an innoxious and ready mode of discharging the urine when it cannot be discharged by the natural passages."\* When the obstruction arises from stricture anterior to the membranous part of the urethra, this portion of the canal may sometimes be cut down upon in the line of the raphe, in the manner suggested by Sir A. Cooper; when the distended passage will be felt like a chesnut under the finger and may be pierced with a trocar. The only objection to this practice is the difficulty attending its execution.†

With regard to the treatment of the hysterical

\* On the Operation of Puncturing the Bladder, in Surgical Observations.

† Syme, l. c. p. 317.



ischuria, I have but one remark to make. It is, that no man who would be master of his time, who values his own peace, or sincerely desires the speedy recovery of his patient, will ever consent to use a catheter. Once employed, this instrument will have to be employed night and morning, at least for months, perhaps for years afterwards. The warm bath, the cold shower bath, cold douche to the pelvis, nauseating doses of tartrate of antimony, and blisters to the sacrum, in conjunction with the measures adapted to the general malady, compose the treatment appropriate to these cases.

2. *Retention of Urine from want of expulsive power in the Bladder.*—This kind of retention, in its pure and uncomplicated shape, occurs without any disease about the neck of the bladder, or in the course of the urethra, impeding the exit of the urine; it is entirely dependent on a weakened or atonic state of the expulsive fibres, and a want of consent between the action of these, and that of the sphincters. This weakened or atonic state of the expulsive fibres of the bladder is the effect of many causes. A very common one is inordinate and long-continued distension of its cavity; a call to make water not having been obeyed in due season, the muscular coat of the bladder is over-stretched, and loses its contractile power more or less completely in consequence. Whoever has been imprudent enough to resist too long nature's warning to the effect indicated, must have observed that when he did next make water, though his bladder was exceedingly full, and the desire to empty it more than usually urgent, he had generally to wait



some considerable time before the stream of urine began to flow; that when the stream did flow, it was not of its ordinary size; that the urine came away more slowly than usual, not merely relatively to the larger quantity passed, but absolutely; and that again and again when the discharge seemed at an end, by waiting for a few seconds and renewing the expulsive nusus, a fresh quantity of urine was evacuated. This short history is very instructive; the individual has been on the point of suffering a retention of urine, dependent principally on an atonic state of the muscular fibres of the bladder, induced by over-distension, but also complicated to a certain extent, with spasm of the sphincters, and in all likelihood with some degree of phlogosis, from sympathetic irritation, of the general lining membrane of the bladder, by which the tendency to retention as well as its amount are increased. Atony of the muscular fibres of the bladder is induced by many other causes, among the most frequent of which are blows upon the perinæum, injury done to the bony cincture of the pelvis, concussion and damage of the spine, disease of the vertebræ, and organic lesions of the spinal cord. But the most frequent, and also the most important of all, is that which is induced by the progress of years, by that decay in the muscular powers of the body generally, and of the bladder in particular, which attends upon old age.

The partial retention of urine from which persons advancing in years so commonly suffer, depends principally, though not entirely perhaps, on a weakened or atonic state of the muscular coat of



the bladder; diminished irritability must also be reckoned for something in the disease. It is a very insidious malady, and often even exists to a considerable extent without the individual being aware that he has anything particularly the matter with him. He has probably observed, that for some time the attempt to empty the bladder in obedience to the natural summons, has not been so speedily followed by the act, as in former years; that the stream has been deficient, both in size and force; that a considerable effort with the abdominal muscles has been required to pass urine at all; and that renewed efforts when the stream had ceased, brought it on again. Very probably, too, he has observed, that on making any effort, as in coughing, laughing, or sneezing, a little urine has made its escape involuntarily, and sometimes without his being aware of the circumstance at the moment. If this state of things is allowed to continue, the calls to make water become more frequent, and less and less urine is passed each time; the patient is also more troubled with involuntary discharges of urine; and by and by there is not only atonic retention, but also *incontinence* of urine; the bladder is constantly full, and the fluid escapes with each motion of the body. Occasionally the incontinence is less, and the retention more, and then the bladder goes on to be distended in a continually increasing degree, till it reaches a capacity that could scarcely have been believed possible. Haller for example had seen a human urinary bladder that contained twenty pounds of fluid; Frank met with a case where the dilated bladder gave the patient an appearance of being



affected with an ascites; twelve pounds of urine were drawn off from this bladder at once, and then it was not empty; and Dr. William Hunter in his work on the "Gravid Uterus," has given an admirable representation of the bladder distended with urine stretching from the cavity of the pelvis to the scrobiculus cordis and filling the abdomen like the pregnant uterus of the eighth or ninth month.

The consequences of the continuance of such a distended state of the urinary bladder are sooner or later fraught with much suffering and great danger to the patient. The symptoms with which he is assailed are those already described as accompanying retention from obstruction to the flow of the urine, but modified, as might have been expected, by the different circumstances under which they occur. The continued and excessive distension of the bladder, however, seems to arouse the dormant sensibility at last, and then the organ becomes the seat of severe and unremitting pain. There is constant desire to make water, which, although small quantities are occasionally voided, is scarcely the less urgently felt on this account, the utmost efforts of the patient not enabling him to pass more than a few spoonfuls, or a cupful at a time. The patient then becomes restless, and seriously ill; his strength declines, he looks anxious, hollow-eyed, and worn out from want of rest; his appetite fails, he feels sick and vomits, a cold perspiration covers his body, &c. The ureters have by this time been obviously hindered in their office of transmitting the urine; they become distended like the bladder, and are sometimes of dimensions enough to admit



the finger, or even two fingers; the pelvis of the kidney is in like manner enlarged, and this important organ undergoes alterations, first in its secreting functions, and then in its intimate structure, which before long prove of themselves incompatible with the recovery of the patient. The symptoms of his malady go on from bad to worse; inflammation is lighted up at length in the over-distended bladder; and this fastening itself particularly in one or more points, these suffer ulcerative absorption, or are stricken with gangrene; and then comes the escape of the poisonous urine into the cellular tissue, and the patient is irrecoverably lost.

In this form of retention, and in all its degrees, the cure rests more or less entirely on the use of the catheter. The effect of this useful instrument can indeed be aided by other means, but these are all unavailing of themselves. So long as the bladder continues preternaturally distended with fluid it is in vain to expect that its contractile powers will be recovered. The very first measure, therefore, to be adopted is to introduce a catheter into the bladder. I have already insisted on the gentleness and consummate skill required to effect this most important operation in cases of retention arising from an impediment to the flow of the urine; force under any circumstance is inadmissible; where there is no obstacle to be overcome, as in retention from atony of the bladder, it can only be exerted against parts that ought to be spared, and if persevered in, implies destruction to the unfortunate patient.\* Sup-

\* I would beg here to recommend strongly the form of exploring bougie contrived by the late Th. Ducamp of Paris, a



pose a catheter happily introduced, and a large quantity of water drawn off, which it will be to the inexpressible relief of the sufferer, it is quite certain that the respite will be but temporary ; the urine will continue to be poured down from the kidneys, and the bladder, flaccid and powerless, as it will not offer any obstacle to the influx, neither will it prove of any avail in procuring the expulsion of the fluid. What then is to be done ? is the catheter to be withdrawn, and introduced as often as occasion requires ? or is it to be left in the bladder, and, being fitted with a plug, the urine to be drawn off from time to time ? This question will be found discussed in books of surgery. To leave the catheter in the bladder, is generally to be regarded as an evil ; but if it have been introduced with difficulty, it is well left in its place for five or six days, when it may be changed for another ; or being removed altogether, the instrument may henceforward be used from time to time as required. It is a common practice only to draw off the urine twice in the course of the four and twenty hours. This may be well in so far as the convenience of the medical attendant is concerned ; but it is otherwise as regards the patient ; and with man of much ingenuity, who died too young. This consists of a hollow flexible stem, having a little floss silk like a hair pencil drawn into it, and dipped in a composition resembling shoemaker's wax. This little mop being moulded nicely to the diameter of the instrument passed into the urethra, and pressed very lightly against any obstacle encountered, never fails to bring back an impression in relief of the parts with which it has been in contact. Vide Th. Ducamp. *Sur les Retentions d' urine*, &c. 8vo. Paris, 1823, which an accident only prevented me from presenting in an English dress, with the results of my experience of his method of treatment some twelve or fourteen years ago.



this treatment I am satisfied he has not nearly so good a chance of final recovery as he has when relieved much more frequently. Very few men indeed in health make water so rarely as twice in the twenty-four hours; five and six times among the classes in easier circumstances are much more common; namely, on rising in the morning; at stool; once or twice in the course of the morning, immediately before dinner, the business of the day being done; and on going to bed at night. Among labouring people the bladder is emptied, I should imagine, on an average, seven, eight, or nine times in the day and night. Let a hint be taken from this physiological fact, and the patient have all the chance for final recovery that art can yield him by having his bladder evacuated *four* or even *five times* a day.

In addition to the catheter, various local and general means may be used with advantage. The patient should be put upon a course of tonic medicines, of which the bark and Tinctura Ferri sesqui-chloridi, or Ferri ammonia-chloridi are among the most valuable. With these may be associated the infusions of Uva-ursi, Pareira brava, and Diosma crenata, which, besides their general tonic effects, act in some sort specifically upon the urinary organs. A blister applied to the sacrum has often done great good, and the cautious use of cantharides internally may even be tried with advantage. The bowels should be kept gently open by means of confection of senna, or castor oil. Such general and local means as give tone to the system at large and its individual parts should be pursued. The tepid, and then the cold bath, the cold water douche to the perinæum



and pubes, night and morning, regular exercise, early hours, and a temperate or even abstemious mode of life, comprise the sum and substance of these. Above all things, perseverance in the plan of treatment adopted is to be understood as of the first necessity. When a healthy bladder has suffered unusual distention even for so short a period as only a few hours, it is often very slow in recovering its full contractile force,—many days may elapse before it regains its power of expelling decidedly and at once the last half ounce or ounce of urine; but when the distention has continued for weeks, and has converted a peculiarly irritable organ into an inert and almost unconscious sac, it is easy to see that a long interval must necessarily intervene before the whole amount of healthy power can be regained. There is every encouragement to persevere, too; for instances are on record, in which, after *acraturesis* or inability through loss of power to void the bladder had continued for two years, no urine having been passed in all that time save by the aid of the catheter, the paralysed parts recovered their tone, and the disease ended.\* One more caution, and I have done with the subject. Let the patient, when he has recovered, never refuse instant obedience to a call to make water.

\* In quodam, urino sine cathetere reddi non potuit per biennium, quo tempore elapso, vires partium resolutarum restitutæ sunt, et morbus finitus est. Heberden, Comment. sub. voc. DE URINA.



## CHAPTER II.

## OF INABILITY TO RETAIN THE URINE.

IN no particular of the wonderful mechanism of the human body are prescience and beneficence more conspicuous than in the provision of receptacles in which the refuse of the food, and the superfluous fluid, holding dissolved in it the effete matters of the system, may accumulate and be retained, until time and opportunity serve for their final discharge. The ureters and the small intestines, which the wants of the system compel to be in constant operation, might have terminated immediately and at once upon the surface; all the requirements of the system would have been as completely answered by such an arrangement, as they are by the admirable contrivance that exists in a colon and urinary bladder; but what miserable wretches should we not then have been, what objects of disgust to ourselves and all about us!

We have just discussed certain derangements of the urinary receptacular apparatus attended with inability to evacuate its contents; an opposite state to this occurs, in which there is inability to retain the urine. This morbid condition is generally spoken of by systematic writers under the title of

*Incontinence of Urine.*—ENEURESIS.

Incontinence of urine is a characteristic and accompaniment of more than one morbid state of the



bladder and urinary apparatus at large. It is even generally a consequence of the distended condition of the bladder which exists in chronic retention of urine from atony ; the bladder fills to the point at which its retentive and expulsive powers are balanced, as it were, at which no urine escapes ; beyond this, however, the urine begins to dribble away, and on the least exertion of the patient, it is forced out in a gush. This is the kind of incontinence of urine generally met with in elderly subjects ; and it is obviously subordinate to retention, and only to be remedied by removing the original infirmity,—by restoring the power of the bladder duly to rid itself of its contents.

The incontinence of urine often met with among men in the prime, as well as the wane of life, which is associated with disease of the nerves or sources of the nervous influence distributed to the lower limbs, cannot be regarded as an idiopathic affection. It appears and vanishes with the appearance and disappearance of the paralytic disease of the legs. Sometimes the whole of the phenomena are plainly referable to injury done to the spine ; at other times, they arise of themselves without any obvious cause, and gradually increase till the body, from the flanks downwards, becomes completely paralytic, deprived alike of sense and motion. Some cases have nevertheless occurred in which the incontinence of urine was certainly of the kind usually associated with weakness of the lower extremities, yet in which no symptom of diminished power in the legs was apparent. The bladder, in these cases does not seem to become distended at all, or at least, not beyond the



very small degree required to overcome the trifling resistance opposed to the escape of the urine by the collapse of the urethra and parts about the neck of the bladder. The discharge of urine here takes place unconsciously to the patient, just as in the form of incontinence already particularly mentioned; but the paralytic condition upon which it depends is local, not general; it implicates the urinary bladder to all appearance singly.

Sometimes the incontinence of urine is connected with a preternaturally excitable state of the bladder, which then refuses at any time to admit more than a very trifling quantity of urine before the call to void it is felt, and this is generally so sudden and so imperative, that it must needs be obeyed or the contents are expelled whether the individual will or not. This kind of incontinence is usually associated with a certain amount of what is called *irritability of bladder*, a disease dependent on a variety of causes, which will be found mentioned under the proper head. Occasionally, however, it occurs as one among the general indications of the nervous temperament, and is intimately connected with that form of the affection I shall mention as met with among children and young persons of either sex. The disease also presents itself among females after laborious parturition or rapid delivery; but then not purely; for it is always allied to some degree of *Spasm of the bladder*.

By far the most common kind of incontinence of urine encountered in practice is that with which children and young persons up to the age of puberty are troubled; though the disease often remains but



little abated long after that important æra in the life of man is passed. This though a trifling malady in itself, and so far as the general health of the individual is concerned, is often one of importance enough, from the physical suffering and moral misery it occasions to the party troubled with it. For ignorant pedagogues and harsh parents by the cruel and unmerited punishments they inflict, and the scorn and ridicule they contrive to accumulate upon the unfortunate child who suffers under it, frequently make its consequences truly serious. I have seen much of this complaint, but never knew it benefited by chastisement; and I cannot here refrain from expressing my regret and amazement that professional men of character and humanity should so generally have given their countenance to corporal punishment in any shape or in any measure as a remedy for a natural defect. I have known boys who had been beaten unmercifully for wetting the bed, sleep or rather pass the night in their clothes on the floor, or in a chair, for several nights afterwards, till worn out with fatigue they found themselves compelled to undress and take natural rest, hoping always that as they had escaped one or two nights, passed between sleeping and waking, they might possibly get through another and yet sleep soundly. But in vain; the very first night after betaking themselves to their bed, they were as unfortunate as ever; and then came the renewed beating, and, far worse to bear, the ridicule and scoffing of companions or other members of the family.

It is commonly imagined that children and young



persons afflicted with incontinence of urine only suffer from the malady in the night. This is certainly not the case. In this kind of incontinence the urinary secretion and excretion, are invariably and alike deranged ; not only are the calls to make water more frequent and pressing than in health, but the urine is always more copious and of lower specific gravity than is proper ; it very rarely contains the due proportion of characteristic animal ingredients, but is colourless and watery. The disease therefore does not only depend on the higher irritability which has been held the apanage of early life ; such irritability would not attach to the detrusor fibres of the bladder only, but to those of the sphincters also, by which the balance would be maintained ; it is in fact generally associated with derangement in the secreting faculty of the kidney, which must be corrected in order that the evil may be removed.

The treatment of incontinence of urine must of course vary with the nature and cause of the affection. Does it depend on chronic retention or overflowing of the bladder, this condition must be remedied in the way already indicated. Is it connected with functional or organic derangement of the nerves distributed to the bladder singly, or to the bladder in common with the lower limbs, the treatment must be of a kind to reach the disease in its seat—the spinal cord. Here powerful counter-irritation is by far the best remedy we possess ; “the actual cautery,” says Mr. Syme,\* “applied on each side of the spinous processes of the lower lumbar

\* Principles of Surgery, n. 339.



vertebræ affords the best chance of relief." Where the timidity of the patient opposes an obstacle to the use of this most efficient and only in appearance formidable means, the moxa may be proposed as the next best in effecting counter-irritation that goes deeper than the surface; then we have caustic issues; and to conclude, a succession of blisters, which are often of great service.

Among the internal medicines recommended in this form of disease, the cantharides is the one which unites most suffrages in its favour. Tonics of all kinds, too, particularly bark and steel, are often prescribed with good effect. Every measure that may conduce to give tone to the frame generally, and to the weakened part particularly, is at the same time to be enforced; diet, clothing, exercise, &c., are all to be carefully attended to. The cold douche to the perinæum, and to the sacral and pubic regions, as in the case of retention from atony, will often be found a valuable auxiliary.

The treatment of the incontinence of urine which is connected with what is called irritable bladder will be spoken of immediately. When the failing is seen to be one among the indications of the highly nervous, and as sometimes happens, of the hysterical temperament, it must be attacked through the general system, and by the remedies and regimen adapted to the bodily state with which it is connected. When it supervenes after laborious or very rapid parturition, which it often does, time, and the local application of cold water to the perinæum, or cold injections into the vagina, will work a cure, which, however, may be materially hastened by



the use of some of the medicines that act more particularly on the mucous linings of the urinary passages. I have in several instances prescribed an infusion of half an ounce of buchu leaves and the same quantity of roughly powdered cubebs pepper in a pint of boiling water, a small teacupful being taken two or three times a-day, with very great benefit.

In all these forms of incontinence of urine, it is of the last consequence during the progress of the treatment, and particularly at the last, should we be baffled in all our endeavours to effect a cure, that the patient be freed from the consequences of a perpetual stillicidium, or dribbling away of the urine. Without some contrivance for this purpose, life becomes a burthen to the sufferer, who is most noisome to himself, and unapproachable to others, from the stench of corrupting urine which he bears about with him, as if it were a portion of himself. With males, the means of relief are not so difficult of attainment as with females. During the night the common urinal can be placed between the thighs, and is so manageable an instrument, that not a drop of urine need escape, except by accident, upon the bed-clothes. During the day, since we have the means of fashioning caoutchouc in the manner we please, a bottle made of stout calico without, payed over with india-rubber within, or a simple bottle of this substance as it comes to us from South America, can readily be obtained and worn like a suspensory bandage from the waist, with the effect of rendering the patient's state endurable, and even comfortable. A piece of the impervious india-rubber cloth, com-



monly called *Macintosh*, after the patentee, about a yard, or a yard and a half square, ought always to be put under the patient's hips at night, and will be found a great comfort. It is easily kept sweet and clean by washing, and being a bad conductor of heat, the patient can rest on it directly, and so avoid soiling even his body linen.

The treatment of the incontinence of urine with which children and young persons are frequently afflicted in their sleep, is a subject of much interest and of no slight importance. As usually happens with obstinate diseases, the causes of which are obscure, an immense variety of means of cure have been promulgated as infallible, in cases of nocturnal incontinence of urine, so that out of the over-ample plenishment of the arsenal, we are apt to find ourselves at a loss to make a selection. From the abundance of the instruments, however, we have a certain assurance that each in its turn has been found ineffectual; and this, on putting the matter to the test of experience, is immediately found to be the case. Where natural means fail, too, and where such remedies as have an obvious mode of operating are found of no avail, we have here as elsewhere superstitious, absurd, cruel, and often disgusting procedures recommended, and still occasionally had recourse to.

Reason and common sense, however, will do much to mitigate the disorder of nocturnal incontinence of urine. Children so affected should not be allowed to drink much, especially in the afternoon and evening; neither ought they to have food shortly before going to bed, for I have observed a late meal



to be a very common cause of the accident we would avoid. The disorder will not, however, be cured by these precautions alone ; as essentially depending on functional derangement of the kidney, on the elaboration of watery urine, it must be treated methodically, and by the appropriate medicines. We have probably no remedies more potent in correcting what is amiss in these cases than a combination of tonics and sedatives. A bitter infusion, acidulated with muriatic acid, and having a very small quantity of tincture of opium added to it, is an excellent medicine, and with attention to the state of the stomach and bowels, and the regulation of the diet, will often be found to render any farther search for a specific unnecessary. A couple of table spoonfuls of a concentrated decoction of uva-ursi, to which are added ten drops of the tincture of the muriate of iron, two or three times a-day, is another formula which I know to be greatly worthy of trust. Iron, and particularly the muriate or chloride of iron, is probably the best of all the tonics we possess when the uropoetic system is at fault. Such are the medicines upon which, in conjunction with cold bathing of the perinæum and pubes night and morning, and in some few instances a blister, which should be of ample size, to the sacrum, I have relied in this complaint, and very generally with success. In some instances, however, I own that nothing of all that was tried seemed to produce any permanent benefit ; the frequency of the mishap might be diminished for a time, but the parties could not be depended on. In these obstinate instances I have fancied I could sometimes



trace the enuresis as a hereditary infirmity. The children seemed to have little control over the sphincters of the bladder at any time, wetting themselves when spoken sharply to, or frightened.

Among the heroic medicines recommended in enuresis, the cantharides is probably deserving of the most attention. It is best prescribed in the shape of a pill, half or three quarters of a grain of the powder being combined with some bitter or anodyne extract, and taken twice a day. One of the last medicines I observe recommended in the nocturnal incontinence of children is the *strychnos nux vomica*.\* This, in small doses, is tonic and astringent; in larger doses it acts peculiarly and with great energy on the nervous system. I have no experience of its use myself, but should think it likely to prove beneficial. Among what may be entitled the more direct, or purely local means available in this infirmity may be mentioned the introduction of a bougie or sound into the neck of the bladder. We have even been recommended to coat the point of the instrument with some stimulating substance, such as the tincture of cantharides applied in repeated layers, one being allowed to dry before another is laid on. In common with every member of the profession laying claim to a liberal education in the present day, surgeons no less than physicians, I am the determined enemy of the unnecessary introduction of instruments of all kinds into the urinary passages, especially in early life. It is only when incontinence of urine in childhood

\* Mondiere, in *La Presse Medicale*, 1837.



can be remedied in no other manner, when every thing reasonable that has ever been suggested, has been tried, and failed to do good, that we should sanction the use of instruments. Then, and only then, a gentle and skilful hand may be trusted to pass a bougie into the bladder. No impediment being suspected to exist in the urethra, no force can on any account be allowed.

The position of the subject of nocturnal incontinence of urine, as he lies in bed, has been held of some consequence. Sir Charles Bell even imagined that he could cure the infirmity by attention to this point alone. "The occurrence," (the escape of the urine,) says Sir Charles, "never takes place but when the boy is asleep upon his back : the cure is a simple one ; he is to accustom himself to sleep on his face or side ; the urine is not passed, nor is he excited to dream of making urine while he keeps this position."\* This explanation of the influence of position, and by implication, of the nature of the whole infirmity, is by much too mechanical ; and besides, the statements in the short passage quoted will not be found to be borne out by experience. Children affected with nocturnal incontinence of urine, pass their water sleeping in every position, probably even more frequently when they happen to be lying on their face, than at any other time. Whoever trusts to position only for the cure of incontinence of urine among children, will be sure to be disappointed.

\* A Treatise on the Diseases of the Urethra, p. 17, 8vo, New Ed. Lond. 1820.



The only other means that remain to be mentioned are the mechanical contrivances for compressing the urethra, and so hindering the escape of the urine. Much mischief has been done by the application of ligatures and *jugums* in boys. The best of the mechanical contrivances for preventing the discharge of the urine, is that in which a firm but not a hard pad is kept applied by means of a spring to the urethra in the perinæum. I am even willing to allow that considerable benefit may be derived from this apparatus in some cases of incontinence, and though not permitted to be worn habitually, it may sometimes be recommended to young persons at particular times, as when they are visiting from home, to insure them against the occurrence of their infirmity.



## CHAPTER III.

## OF IRRITABILITY OF THE BLADDER.—CYSTERETHISMUS.

THE group of symptoms classed and described by authors under the title of *Irritability of Bladder*, presents itself in a considerable variety of circumstances, and is unquestionably connected with divers causes in different cases. The chief symptoms of the irritable bladder are—pain of various degrees of intensity in the region of the bladder, which shoots upwards into the loins, downwards into the fundament, and forwards along the thighs and urethra. Considerable, sometimes intense pain, in voiding the urine, which seems to burn the neck of the bladder and often the whole length of the urethra, is also very uniformly complained of. The urine passed in such circumstances is seldom natural in appearance or quality. It is generally turbid, frequently albuminous, and on standing, commonly lets fall a copious precipitate, which, on close inspection, is discovered to be either purulent in its nature, or to consist of the amorphous lithic, mingled with the phosphatic, salts.

With these local symptoms there is usually associated a considerable degree of general constitutional disturbance: the patient is feverish, and out of health; he has probably had a shivering fit or two in the course of his illness, and after this has continued for some little time, he loses flesh and ac-



quires a haggard and care-worn look, which of itself proclaims to the practised eye the serious nature of the disease under which he is suffering.

The symptoms in this case commonly give rise to the suspicion of calculus in the bladder; and this leads to the introduction of instruments, by which the patient's sufferings are greatly aggravated;\* sometimes of de ceased prostate, which frequently happens; sometimes they are obviously connected with inflammation extending back along the urethra, and fixing itself about the neck of the bladder; and very frequently we have the clearest indication that the immediate seat of the disease is the kidney, and that all the distress felt in the bladder is but symptomatic of mischief going on in that important organ. A man, forty years of age, complains of pain in the region of the bladder, which often extends to the loins and thighs; micturition is painful; the flow often stops suddenly, and cutting pain in the urethra, and inability to make more water for some time afterwards, ensue. The urine is turbid when passed; is found to be albuminous, and drops a white purulent deposit on standing.—A lady is in the habit of voiding her urine in small quantities, with severe pain in the urethra, &c.; she is several times sounded, but no stone is discovered in the bladder; sometime afterwards she is seized with pain in the course of the ureter, and then she voids a calculus, with immediate relief to all her sufferings.† It is quite certain that disease of the

\* Syme, *ut sup.* p. 339.

† Brodie, *Abstr. of a Clinical Lecture. Med. Gaz. Oct. 14, 1834.*



kidney is often manifested by pain, and disturbance in the function of the urinary bladder and excretory organs. I have had occasion to allude oftener than once in the course of these pages to cases of this description. I am inclined to think however that with the hint from Mr. Abernethy, succeeded as this has been by the "Note" of Sir Benjamin Brodie, and the "Cases" of Mr. H. C. Johnson, the influence of this kind of sympathy in leading to errors in diagnosis has been exaggerated ; at all events it will mislead no longer. Extensive disease of the kidney, too, I ought to observe, often exists without much or any derangement in the functions of the bladder and urethra ; and it is unquestionable that irritable states of the neck of the bladder, characterized by the symptoms that have just been mentioned, do frequently occur without the accompaniment of any kind or show of morbid implication of the kidney. Nor is there generally any great difficulty in distinguishing the primary disorder from that which is secondary in such cases. Irritability of the bladder is often directly traceable to such causes as the use of highly seasoned food, or of peculiar medicines,—the turpentine, the balsams, and cantharides especially ; to acute specific inflammation of the urethra, and in many cases "to the unskilful use of bougies and caustic."\*

The treatment of irritable bladder must be undertaken on the principle of removing the particular cause to which in any case it can be referred, and

\* Bell, l. c. p. 21.



at all times of allaying the irritation and inflammation upon which the troublesome symptoms immediately depend. The measures are all to be of a soothing character; the patient should observe a strict regimen, his food consisting of the lightest and most unstimulating articles,—the white meats, fresh fish, milk, farinaceous compounds, &c.; his drink being restricted to barley water. The application of a few leeches to the perinæum and the hip bath, are often of great use. The bowels are to be kept gently open by the use of manna, castor oil, or confection of senna; and as a powerful means of allaying irritation in the class of cases that now engages us, a small starch glyster containing a few drops of laudanum may be thrown into the rectum from time to time. If we would give an anodyne by the mouth, the compound powder of ipecacuanha, or a combination of opium and camphor, will generally be found among the best forms for exhibition. By and by we may try some of the articles that run off readily by the kidneys and yet soothe the mucous membranes as they pass, namely, the balsam of copaiba, the uva ursi, and especially the buchu, which last I have several times seen followed by the best effects in such cases. Sir B. Brodie has also strongly recommended the decoction of wild carrot seeds.\* Another means of direct medication, from which more might probably have been expected than it has accomplished, is *injection of the bladder*. This may be undertaken with simple tepid water or with some bland mucilaginous decoction, as of quince

\* Abst. of Cl. Lect. ut supra.



seeds, linseed, &c., repeated once or twice a-day; the quantity thrown up being gradually increased, and the time of retaining it lengthened. By this simple procedure, much may unquestionably be gained; the bladder from having rebelled against half an ounce of fluid, will sometimes by degrees be brought to bear half a pint. It must not be trusted to alone, however, for then it never proves more than a palliative of very temporary avail; conjoined with the repeated application of blisters to the sacrum and pubis, and a regulated plan of living, in which are included proper food and proper medicine, injection of the bladder becomes a very valuable, and often even a necessary, auxiliary in any attempt at enabling the patient to pass a more comfortable existence.

When we can trace the irritable state of the bladder to mischief in the kidney, setons and issues in the lumbar regions, and other means adapted to such a state of affairs, must be added to those immediately directed against the sympathetic disease.



## CHAPTER IV.

## OF SPASM OF THE BLADDER.—CYSTOSPASMUS.

IRREGULAR spasmodic action of the muscular fibres of the bladder occasionally occurs as the leading symptom in a group denoting immediate or sympathetic derangement in the functions of this viscus. As I have met with this affection, it has been characterized by sudden spasmodic contraction of the detrusor fibres, attended with cramp-like pain in the region of the bladder, of greater or less intensity, but by no means always very severe, and followed by an immediate and uncontrollable gush of urine. This has occurred among women after a rapid or laborious confinement. But essentially of the same nature, in all likelihood, is that form of spasmodic disease of the bladder, described by Mr. Guthrie\* as occurring among male subjects, in which the organ would appear to contract so violently at the moment it is becoming empty, as to force an instrument, unless grasped pretty firmly, full two inches out of its cavity, and even to impress a catheter with a jerk, as if it had come in contact with a stone, whence, doubtless, have arisen those errors in diagnosis, which have been followed by operations for calculus where there was none to extract.

The disease commonly described under the title

\* Anatomy and Diseases of the Neck of the Bladder, 4to. Lond. 1835.



of cystospasmus, or spasm of the bladder, is of a somewhat different nature, at all events the second order of vesical fibres, those namely that act as sphincters, seem to be fully as much the seat of the spasm as those which constitute the detrusors. The disease, as its title implies, makes its attacks in fits, and suddenly. The patient has generally indeed been suffering for some days, under a certain degree of uneasiness, or pain in the bladder and parts immediately connected, that would be styled oversensitiveness, were it particularly attended to; but now he is seized with a sharp constrictive pain in the hypogastric region, shooting down into the perinæum, and extending along the urethra to the glans, which sometimes attains such severity, as to make him groan or cry out with agony. Instead of there being any involuntary expulsion of urine as in the former instance, there is always retention here; occasionally the inclination to make water is very keenly felt, but cannot be gratified. This inclination, when it occurs, appears to be independent of any accumulation of fluid in the bladder, for a catheter introduced under these circumstances (which it never ought to be) probably gives issue to but an ounce or two of urine. The secretion of urine is not arrested, however; the fluid accumulates in the ureters and pelvis of the kidneys; for the pain by and by extends up into the loins, and by sympathy down the fronts of the thighs, and the cessation of the fit is almost always followed by the discharge of a considerable quantity of somewhat watery urine.

If the fit continues for any length of time, the



distress and suffering of the patient become extreme; he is restless and agitated, answers quickly and shortly when addressed, and is covered with cold clammy perspiration. The spasm often extends to the rectum, which then expels its contents suddenly and in spite of the patient, occasionally contracting so violently as to cause its own eversion.

The symptoms in the beginning are very similar to those that characterize a fit of stone of the greatest severity; and my observation would lead me to infer that the pains of child-bearing, renowned though they be, are trifling in comparison with the agony that is then endured. By and by the symptoms are occasionally blended with those of anuria, and then the sinking of the powers, the hiccup and the dull and abstracted look of the patient, proclaim him to be in extreme danger.

A fit of this kind has sometimes continued so long as of itself to have fairly worn the patient out; a succession of attacks at brief intervals is also attended with great hazard to life. Fever of bad character usually sets in at length, and this aggravated, and probably deriving its type in some degree from the presence of urea and urinous salts in the blood, owing to the impeded function of the kidney, speedily proves too much for the strength of those patients, reduced by long suffering, and advanced in years, who mostly suffer from spasm of the bladder. When the disease recurs frequently or persists for any length of time in a less violent form without proving fatal, it is apt to end in atony or paralysis of the bladder.

The causes of spasm of the bladder are various,



sometimes obscure, sometimes sufficiently obvious. The affection, when it attains to any height, is very commonly accompanied by more or less of acute or phlegmonous inflammation of the bladder; and whatever will excite inflammation of the bladder will excite spasm,—stimulating food, diuretic medicines, exposure to cold, &c. Inflammatory affections of the urethra often excite spasm there, and this extends by sympathy back along the course of the canal to the bladder. I have known it occasioned in great severity by a stimulating glyster thrown into the rectum; and in a mitigated and passing form, it is familiarly known to be excited by diarrhœa accompanied with a good deal of irritation about the rectum. The acute pain shooting back from the bulb of the urethra, and involving not only the bladder but the sphincters and levatores ani, which men affected with stricture and chronic inflammation of the urethra occasionally suffer, instead of experiencing the proper orgasm on the completion of the sexual act, is also undoubtedly owing to spasm of the kind we are considering. Spasm of the bladder, too, is frequently indicative of mischief in other organs more or less intimately associated with the suffering organ. This remark applies especially to the kidney and bowels, and the fact ought not to be lost sight of in connection with the occurrence of the complaint. A suppurating kidney is sometimes first detected by the matter discharged from it exciting irritation and cramp in the bladder. Diseases of the rectum are very common causes of a painful spasmodic affection of the bladder. Sometimes the affection has appeared



to depend on the presence of entozoa, which had made their way either from the neighbouring intestines (*lubrici*) or from the surrounding cellular tissue and muscles (*strongyli*) into the cavity of the bladder. The horrible agonies attending calculus in the bladder, or a *fit of the stone*, seem to depend in a great measure on cramp or irregular spasmodic action of the muscular tissues of the bladder and neighbouring organs, induced by the mechanical stimulus of the foreign body propagated from the mucous surface with which it is in contact.

The treatment of cramp or spasm is to be conducted on the same general principles as have been already laid down in the chapter on irritability of the bladder. The remote causes when accessible, are to be removed; when this cannot be done, they are to be palliated. A regulated mode of life, attention to the state of the bowels, and the disuse of instruments, which will be found so commonly and so needlessly associated in the treatment of every form of disease of the urinary organs, added to soothing local applications, such as the hip-bath, fomentations to the perinæum, and anodyne glysters, will go far in many cases to remove the disease; nay, they will often remove it altogether, even when its connection with particular remote causes can be traced. A poor man applied to me first, now several years ago, labouring under irritability and spasm of the bladder, obviously connected with stricture in the urethra, for which he had been under treatment again and again, having had the orifice of his urethra slit open several times, caustic bougies applied at various points in the course of the



canal, and bougies "as thick as a poker," according to his tale, passed into the bladder. He was at this time in the daily habit of passing a bougie for himself of a very moderate size; for the treatment was no sooner suspended, than strangury, and sometimes, when he had been guilty of any imprudence in diet, absolute retention of urine supervened. I persuaded him to make me the custodier of his whole stock of sounds and bougies, which of one sort and another was ample, as a preliminary to prescribing for him. Leeches, tepid bathing, and warm poultices to the perinæum, a milk and farinaceous diet, with barley-water for drink, castor oil enough to keep the bowels gently open, and a course of balsam of copaiba and liquor potassæ, were the measures and medicines ordered. By and by the distress and pain in the region of the bladder abated, and the patient, to his great joy, found that he was passing his water more freely than he had done for several years. Some weeks having elapsed, and the stream of urine contracting gradually, though without any renewal as yet of the irritation in the bladder, the introduction of a bougie became necessary. A first, a second, and a third stricture were encountered, one after another, and dilated so gradually, that no more than a certain measure of uneasiness, not amounting to pain, was ever excited by the passage of the instruments. No bougie beyond the middle size was passed. The stream of urine was restored to its natural state; the patient recovered his looks, his flesh, and his spirits, and remained perfectly well for more than a year. But then came forgetfulness of all he had



suffered, greater freedom in his mode of life, a renewal of the dysury, and with this, threatenings of the old mischief in the bladder. The same plan of treatment again pursued, was again followed by the same success as in the former instance; and as the patient is now satisfied that his health is in his own hands, and that mechanical measures are but temporary in their effects, and relief from them not always certain, it is to be hoped he will use his knowledge wisely.

If the spasm of the bladder is connected with gout, and the attacks of the disease have been irregular or altogether suspended of late, we have been recommended\* to apply a blister over one of the old seats of the malady, or a cautery to the loins.† If the affection of the bladder can be traced to primary derangement of the kidney, our means will of course be directed to correct what is amiss there. Chronic inflammation will be attacked by the use of cupping, blistering, setons, &c.; deranged function by diet, tonics, iron, &c. Should we suspect a calculus in the pelvis of the kidney as the cause of the symptoms, which very often happens, we may try to lessen its size by the diligent use of the means recommended under the head of Renal Calculus, and to effect its dislodgement by the application of dry cups along the loins, the employment of the hot air or vapour bath, &c. The spasm itself will be best relieved by the local abstraction of blood by

\* By Dr. Clark in *Essays and Obs. Phys. and Literary*, vol. iii.

† Fischer, *Comm. de Nervis Lumbalibus*. Quoted by Soemmering, l. c.



leeches applied to the margin of the anus, and the use of anodynes and antispasmodics by the mouth and by the anus. The tobacco glyster has been recommended in this complaint, but is always a distressing, and oftentimes far from a safe remedy, especially when used of the strength usually set down in pharmacopeias, formularies, &c., namely, a dram of the dried leaf to a pint of boiling water. Practitioners are not generally aware of the powerful effects of tobacco on the unaccustomed frame of man ; and whoever prescribes such a dose as the infusion of a dram, were it in a quart instead of a pint of boiling water, can never have seen it exhibited. The patient, in fact, only escapes destruction by the infusion inducing paralysis of the sphincter ani, which is followed by the discharge of the poison. In my student's days, I knew a young man fond of experiments, who very nearly lost his life by trying the effects of an infusion of *less than a scruple* of tobacco upon his own person ; another experimental genius I saw not long ago brought very low by an attempt to *consume his own smoke*, as he said ; he swallowed no more than two or three mouthfuls of the smoke of a cigar, when he became deadly ill, and for hours he lay, covered with cold perspiration, the pulse only perceptible in the great arterial trunks of the body.

The common antispasmodics, valerian and assafoetida, are sometimes useful. When the disease is connected with inflammation of the mucous membrane of the bladder, the muriated or ammonia-muriated tincture of iron, as in so many other diseases of the



urinary apparatus, will be found a useful medicine. Should the disease threaten to pass into atony, then the uva-ursi, diosma crenata, pareira brava, the turpentine, cantharides, and steel tonics, in conjunction with blisters to the sacrum, are particularly indicated.



## CHAPTER V.

## OF CATARRH OF THE BLADDER.—CYSTORRHŒA.

UNDER certain kinds of irritation, consisting essentially in deranged vascular action of the mucous lining of the bladder, the natural function of this membrane is so much increased as to constitute a true pathological state, which is commonly described under the title of *Cystorrhœa*, or *Catarrhus vesicæ*.

Catarrh of the bladder has been considered by some writers as a rare disease. Hoffman, for instance, characterizes it as a “*Morbus rarissimus*,” (Med. rat. Syst.) It is commonly enough observed at the present day; the hospitals both of London and Paris are rarely without several cases in their wards; and I have seen as many as four or five under Dupuytren in the Hôtel-Dieu at one time. As an idiopathic affection, it generally occurs in the chronic form among men above 50 years of age, and often proves one of the torments of declining years. Still catarrh of the bladder does occasionally present itself in an active shape; but this is mostly in younger subjects, and is generally associated with more or less of spasm or irritability, (inflammation of the muscular tissues?) when the symptoms are apt to present a character of great severity.

When the disease occurs with the acute type it generally follows some imprudent interference with a urethral inflammation of a specific kind, and is



then commonly attributed to a sudden suppression of the discharge ; but it is in reality induced by an increase and extension of the inflammation, upon a moderate degree of which this depends, induced by the use of stimulating injections, the introduction of bougies, &c. Occasionally, again, the disease would seem to be connected with erratic gouty inflammation fixing itself in the bladder.

The symptoms of acute inflammation of the lining membrane of the bladder, however induced, are those of ordinary phlegmon, with all the miseries superadded, which necessarily follow the impeded performance of a function indispensable to life. The general symptoms are those of common inflammatory fever ; the particular ones are severe pain in the region of the bladder and dysuria, or perhaps complete retention of urine. Should the discharge of urine not be wholly interrupted, the fluid seems actually to scald the channels through which it passes, and the contraction of the bladder which occasions its expulsion is attended with absolute torture. The urine is always scanty, and high coloured, and within a day or two of the date of the attack, it is observed when left to stand to deposite a much larger quantity of mucus, which is also of a far more tenacious quality than usual. Sometimes the urine even in an early stage of the disease is observed to be ammoniacal ; but this is a much more common character of the fluid after the disease has continued for some time, and assumed the chronic type.

Like other acute diseases, active catarrhal inflammation of the bladder runs its course in no long



space of time,—ten, twelve, or fourteen days generally see its active stage concluded. In common with inflammatory affections of other mucous surfaces, the decline of acute inflammation of that of the bladder is marked by great activity in the secreting office of the tissue affected. The quantity of mucus then discharged by the urethra is often prodigious, being sometimes equal to a fifth, a fourth, and even a third of the whole quantity of fluid evacuated. This mucus becomes so thick and tenacious at last, and adheres so strongly to the bottom of the utensil after it has subsided from the urine with which it was mingled in the first instance, that the vessel may be reversed without a particle of it being detached ; like the sputa in acute pneumonia it often forms a kind of tremulous jelly.

But idiopathic catarrh of the bladder is just as rare in an acute, as it is common in a chronic form. Its invasion in the latter shape is generally insidious and often attracts little attention for a considerable length of time. Some degree of uneasiness or pain in the region of the bladder is indeed complained of, and there is some dysury, the urine seeming to flow less freely than usual and perhaps looking flocculent when passed. But by and by the uneasiness becomes pain, and the difficulty of making water amounts to strangury ; the quantity of flocculent mucous matter which is mixed with the urine, now also increases greatly, and subsiding from the general mass of the fluid, collects at the bottom, as in the acute disease, and forms a tenacious substance that will bear drawing out into ropes a foot and more in length without breaking. With the persistence of the disease, the mucus appears more opaque in



some places than in others; an occasional speck or streak of blood is also frequently seen in the midst of the discharge, which has now acquired a gelatinous consistency, and the tenacity of bird-lime.\*

Meantime the whole of the symptoms of the disease have increased in severity. The calls to make water have been becoming more and more frequent and urgent, whilst the difficulty of satisfying them has been augmenting in the same proportion; a spoonful or two of fluid is all that is voided at a time, and of this, as in the acute disease, a fourth, and even a third consists of ropy slime, which has been known to be discharged at the rate of six, eight, and even ten pounds daily, for weeks together. The patient's sufferings are apt about this time to be still farther increased by the change which the urine now so generally undergoes in its qualities; its urea suffers decomposition, and others of its animal matters putrify within the bladder, whence the formation of a quantity of carbonate of ammonia, &c., by which it is rendered both highly acrid and intolerably offensive.

The disease may continue in this state for a long time with little change in its general features, but never without serious detriment to the health of the patient, and even ultimate risk to his life; between the enduring excitement of pain, constantly recurring calls to relieve his bladder, and the wearing

\* It is not impossible that in this state of affairs the whole lining membrane of the bladder is actually pouring out pus, which by the action of ammonia developed from the decomposition of a portion of the urea, or an increase of the natural saline impregnation of the products of mucus surfaces, is made to assume the guise of tenacious mucus. See the ingenious paper "On Albuminous Fluids," by Dr. Babington, in the Guy's Hospital Reports, vol. iii.



influence of a profuse discharge, he falls into a state of hectic and marasmus, that if not speedily arrested necessarily proves fatal to him.

The causes of chronic catarrh of the bladder are often obscure. In many cases, it can only be ascribed to peculiarity of constitution, which is then of the gouty kind. Often it is an obvious consequence of inflammation and organic changes in the urethra; very frequently it is connected with enlargement of the prostate, which, by impeding the flow of urine, and probably preventing its entire discharge, gradually induces an atonic state of the muscular part of the bladder, and erethism of the mucous lining, from imperfect or undue performance of function. A certain amount of catarrh appears to be almost a necessary accompaniment of continued atony or paralysis of the bladder. Very commonly the discharge is found to depend on the mechanical irritation of a calculus in the bladder, and occasionally it is sympathetic of irritation in the pelvis of the kidney. The disease again is one among the many consequences of indiscretions committed in earlier life. Those who have lived freely, who have drunk hard, and abused the sexual appetite in former years, are often the victims of catarrh of the bladder. Whether the repercussion of tettery eruptions of the skin, upon which Continental writers lay so much stress, influence its production to the degree alleged, I cannot say. The free use made in England of purgative medicines in the treatment of cutaneous diseases, indeed of diseases generally, probably prevents our witnessing to the same extent as our Continental brethren those effects which are ascribed to the rapid removal of



chronic eruptions of the skin, and the sudden suppression of habitual discharges of any kind.

In treating catarrh of the bladder we must be guided a good deal by the form under which the disease presents itself. With the acute type, the line of practice is clearly indicated; the disease is active inflammation of the mucous membrane of the bladder, and must be met by means appropriate to inflammatory diseases generally—by the abstraction of blood from the system at large, and then from the neighbourhood of the organ particularly affected; by spare diet, cooling drinks, and the other items in the antiphlogistic regimen; by the exhibition of mild aperients, soothing glysters, &c. In this form of the disease it is of the last importance to avoid whatever can add to the irritation of the parts immediately affected, and already in a state of peculiar excitement. Symptoms of retention of urine are therefore to be ministered to by the use of the warm bath, and anodyne glysters. The introduction of bougies and catheters into the urethra and bladder should be regarded as a serious evil, and a thing to be by all means avoided. The previous history of the case, and the nature of the symptoms at the moment, will generally enlighten us sufficiently in regard to the immediate cause of the attack, and decide the propriety or impropriety of manual interference; there is in fact no plea for interference of this kind at all, except total retention of urine, and then only after every other means of obtaining relief has been tried and found fruitless. The first violence of the symptoms abated, leisure will be found by and by to ascertain the state of the urethra, and to search for a stone in the bladder.



When the disease has come on gradually, and is essentially chronic in its type, active treatment is of no avail. The remote causes of the mischief must be sedulously enquired into, and removed where this is possible; if stricture or a morbid state of the urethra be discovered, means must be taken for its methodical treatment, the immediate and more urgent symptoms of the complaint being meantime palliated. If a calculus in the bladder be discovered, the treatment appropriate to this state of things must be instituted. Should the disease however be plainly adynamic and dependent on a chronically inflamed state of the mucous membrane of the bladder, with exaggeration of its natural function, then the peculiar measures which reason suggests and experience warrants as useful in such cases, must be sedulously employed.

General blood-letting is seldom or never required in this disease; but the local abstraction of blood by leeches, and cupping-glasses to the perinæum is a measure too much neglected; unless in old and much enfeebled subjects, it will always be found most useful as a first step in the treatment, and one greatly calculated to ensure success to every measure that is to follow. The warm hip-bath at least, and better, the general warm-bath, should always form a prominent item in the therapeia. The action of the bowels must be maintained by gentle aperients; castor oil is the medicine usually ordered, and it answers well; sometimes it is advantageously replaced by a few drams of the tartrate of potash and soda in a little infusion of rhubarb, as this tends to excite the functions of the kidneys and skin as well as of the bowels. The patient should be supplied



with a sufficiency of any mild demulcent drink, and his diet should be abridged in quantity, and selected from the least stimulating and most digestible articles of food. These measures, assisted by rest of body and tranquillity of mind, will almost certainly be followed by a great improvement in the condition of the patient; and we shall then find ourselves at liberty to try the influence of one or other of the particular medicines or modes of treatment which have been found of service by different practitioners. Among the most useful of these are general tonics; the gently stimulating diuretics and diaphoretics furnished by the vegetable kingdom; and the aromatic infusions, extracts and balsams that have long been reputed of avail in so many of the diseases of the urinary organs. The bark, the calumbo root, and the gentian as it is combined in the *infusum gentianæ compos.* of the London Pharmacopeia, are severally and together invaluable medicines.

The infusions of the *uva-ursi* and *diosma crenata* also deserve much of the dependence that is usually placed upon them. Where the balsam of *copaiba* agrees, it is probably inferior to no medicine prescribed in this disease; but it is exceedingly nauseous and disagreeable in the mouth, and very often disorders the stomach. Reduced to a semi-saponeous state by being rubbed up with *liquor potassæ* and mucilage, I have observed it generally to agree better, and certainly to act more speedily and beneficially, than when given alone. Dupuytren used to rely very much on turpentine in this disease. When I followed his clinique in 1822-23, this medicine and a "*sonde à demeure*," or catheter left in the



bladder, constituted the principal parts of the treatment he employed. The extract of conium is a medicine that has been much vaunted by several practitioners. The trials I have made of it generally, would lead me to infer that it is of very little avail under any circumstances. Iron is the most valuable of the mineral tonics, and its combination with hydrochloric acid, or with hydrochloric acid and ammonia, as it exists in the *tinctura ferri sesquichloridi*, and *tinctura ferri ammonio-chloridi* of the London Pharmacopeia of 1836, cannot be too highly commended. Allied to the latter of these preparations, is the hydro chlorate of ammonia, which was first strongly recommended to the profession in cases of the kind that engage us, as also in chronic disease of the bladder generally, and enlargement of the prostate, by Dr. A. F. Fischer\* of Dresden, who relates a very remarkable case in which the patient, an old man, apparently reduced to extremity and held beyond the reach of art, recovered completely under the use of this medicine. Another case, nearly of the same description, is recorded by Dr. G. Cramer† of Ronsahl, in which the patient, though 53 years of age and greatly broken in health, found speedy relief from the same medicine, and ultimately did well. In two additional cases of shorter standing, the sal-ammoniac was prescribed, and with the like good effects. Many other testimonies to the powers of this salt might be referred to in the journals of Germany, where sal-ammoniac

\* Treue Mittheilung eines als maechtig erprobten Heilmittels gegen ein vieljaehrigen Leiden der Prostata und Harnblase, in Rust's Magazin 11ter Bd. S. 284. Berl. 1821.

† Hufeland's Journal, Dec. 1824, S. 35.



is frequently prescribed internally. Blisters applied to the sacrum and perinæum ought not to be neglected. Where the disease is obviously connected with an atonic state of the bladder, the use of the catheter becomes absolutely necessary; no good can be done by any of the best calculated means, so long as the bladder remains half distended with ammoniacal and corrupted urine. This must be drawn off, and the operation of injecting the bladder may subsequently be recurred to with every prospect of proving beneficial; this operation indeed is often of great service in all the forms of the disease.

Catarrh of the bladder is mostly an obstinate disease; it may almost always be much alleviated; but it is not often entirely cured; even when the patient has recovered to all appearance completely, very slight causes will bring it back. We ought therefore to be armed, and especially to arm our patient, against disappointments of this kind.

THE END.



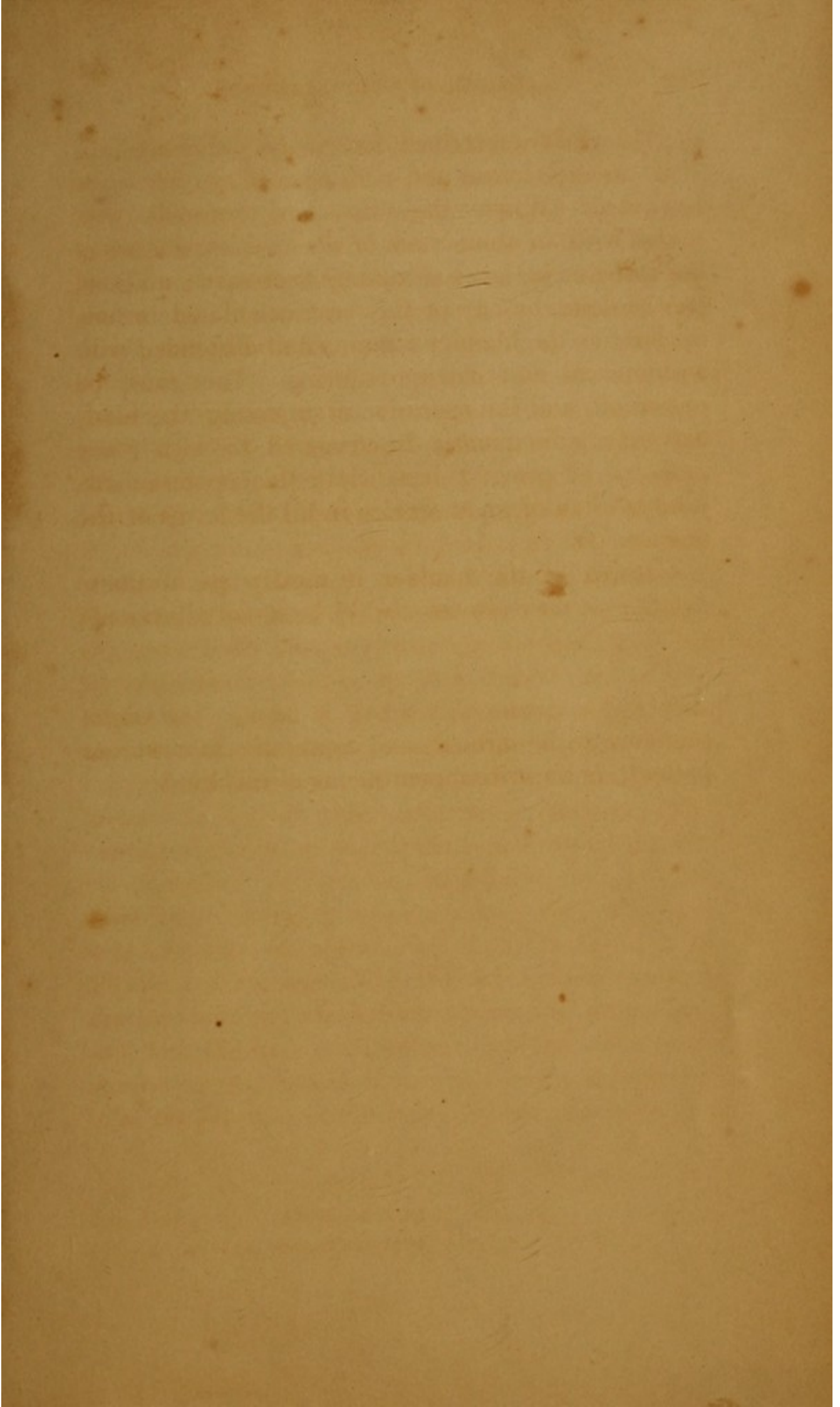




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