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and respects

AN INQUIRY

INTO

THE NATURE AND PATHOLOGY

OF

GRANULAR DISEASE

OF

THE KIDNEY,

AND ITS MODE OF ACTION IN PRODUCING

ALBUMINOUS URINE.

BY GEORGE ROBINSON.

LONDON:
JOHN CHURCHILL, PRINCE'S STREET, SOHO.
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TO

RICHARD BRIGHT, M.D., F.R.S., &c.

Senior Physician to Guy's Hospital.

DEAR SIR,

It is not without some hesitation that I venture to dedicate this unworthy offering to one of your high professional and scientific reputation, but having been a pupil at the school of which you are so bright an ornament, and having participated in the benefit of your instruction there, it seemed but natural that the first fruit of the knowledge thus acquired should be presented to him from whom my previous information on this particular subject had been chiefly derived. And, as medical science owes to your genius and observation nearly all that is yet known of the pathology of the disease, to no one could any further inquiry into its nature be more appropriately addressed than to him

whose name is used by the majority of European writers to characterise and distinguish it.

I should, nevertheless, scarcely have presumed to take this liberty without having first obtained your permission, but I fancied that, should your kindness induce you to grant it, you might by some be considered as countenancing doctrines for which I am alone responsible.

In conclusion I beg to assure you that the insignificance of the present production bears no proportion to the degree of admiration and respect in which you are held by

Your grateful and attached Pupil,

GEORGE ROBINSON.

7th January, 1842.

PREFACE.

In offering these few pages to the notice of the profession, I may perhaps be permitted to say a few words in explanation of the motives by which I was led to attempt so difficult a task, and in excuse of the manner in which I have performed it. This disease is at present attracting considerable interest both in this country and on the Continent, and the opinions of the profession seem to be somewhat divided on the subject.

Several of those who have made it an object of especial study, attaching perhaps too much importance to the presence of a single symptom, and taking too limited a view of disease in general, would seem to consider a condition of the urine characterised by its albuminous impregnation and low specific gravity, to be pathognomic of a certain morbid change in the structure of the kidneys. It must however be stated, that Dr. Bright, the

discoverer of the disease, acting with the reserve and wisdom of experience, remained content with pointing out the existence and describing the peculiarities of its morbid appearances, and their frequent coexistence with dropsy and albuminous urine; and that neither he nor the more prudent of his followers ever contended for the necessary and constant dependence of these, or any other particular symptoms, on that single exclusive cause.

On the other hand, a large but gradually decreasing number of practitioners, either from previous inattention to its study, or from feeling the difficulty occasioned by the want of some defined and precise knowledge of its nature and pathology, still neglect to avail themselves of the assistance which a chemical examination of the urine affords in determining the presence and nature of renal disease, and are still content to treat the dropsical and other secondary affections as primary disorders, without making any attempt to discover and relieve the original disease from which these arise, and of which each one forms a comparatively unimportant part.

If the present attempt at explaining all the

peculiarities of the disease, by attributing their production to the operation of one simple morbid agency, be successful, or even if by its failure contrary and more correct views are strengthened and confirmed, my temerity in venturing to express opinions differing from those of men deservedly eminent in the profession may perhaps be more readily excused.

It is true that the probability of the congestive or inflammatory character of the disease has been alluded to in different works, but to my knowledge no attempt has yet been made to reconcile that view with all the numerous varieties and irregularities that have been observed in different cases: whatever credit, therefore, may attach to the person who first endeavoured to accomplish this end, I may perhaps be permitted to claim.

In the course of the inquiry it was found impossible to avoid entering, to a certain extent, into the subjects of inflammation and secretion; if there be any original ideas contained in the remarks on either of those important questions, I do not pretend to be sufficiently conversant with the literature of the profession to justify me in per-

sonally claiming them, and must therefore trust to the kindness of others for mention of them.

The quotations, which are few in number, are not in all cases given literally, but I trust that the meaning of the different authors has been truly and correctly conveyed.

In conclusion, I hope that any want of elegance in style, or of facility in expression, will be excused in consideration of my desire to express myself as concisely as possible, and of my inexperience as an author; and I can only regret that this investigation should not have fallen to the lot of one qualified for it by more talents and experience, and by greater opportunities for observation and experiment than I possess.

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AN INQUIRY INTO THE NATURE

AND PATHOLOGY

OF

GRANULAR DISEASE OF THE KIDNEY,

&c. &c.

CHAPTER I.

THE healthy anatomy of the kidney — the different views that have been entertained as to the nature of granular disease — improbability of its being of constitutional origin — various divisions of authors — the congestive character of all its forms asserted.

BEFORE entering into any details as to the nature of granular disease of the kidney, it may be well briefly to notice the leading peculiarities in the anatomical structure of the organ, as it is only by bearing them constantly in mind that any morbid changes can be appreciated or understood. The chief points of interest are,

1. The position of the secreting and vascular portion of the organ at its exterior, constituting the cortical portion of the kidney.

2. The arrangement of the divisions of the excretory duct into pyramidal masses, and the ultimate divergence and separation of the tubuli constituting the latter, These tubuli are each of excessive minuteness; and after

running in a straight course into the cortical substance are supposed, by the most eminent modern anatomists, to terminate by becoming continuous with each other so as to form loops.

3. The existence in the cortical portion of minute bodies, the corpuscles of Malpighi. These are usually said to be composed entirely of the convolutions of minute arteries, which have been seen by some observers to leave them again unchanged. They lie in vesicular cavities of the cellular tissue between the tubuli uriniferi, and exist in the kidneys of all vertebrate animals. They have, by some, been supposed to be the seat of the secretion of urine, but no duct can be traced to them, nor can they be injected by the ureter nor the renal vein, and are, therefore, supposed to be simply receptacles for blood. They are described as much larger in diameter than the tubuli uriniferi, and as visible to the naked eye.

Such are the constituent parts of the healthy kidney, as mentioned in Muller's Physiology, which has the latest information on every part of minute anatomy; but there are still several physiologists who doubt the correctness of some of these statements, especially as to the termination of the tubuli uriniferi, and the structure of the Malpighian bodies.

On examining a healthy kidney with the naked eye, there are visible on its surface an immense number of minute round granules, with cellular interspaces, occupied frequently by the ramifications of vessels, chiefly veins; the size of these granules is increased, and they are rendered more prominent by tightly grasping the remainder of the organ, and still more so by injecting any fluid into the renal artery. On dividing or lacerating the kidney, either in its longitudinal or transverse diameter, *it seems to the naked eye* as if each granule on the surface

was the termination of one or more of the tubuli uriniferi—the apparent continuity of the latter to the circumference giving the cortical substance a fibrous or striated appearance; and on lacerating this structure with a fine needle, it is found that the tissue separates most readily in the direction of the long diameter of these fibres or tubes: but on making a transverse section of them, the cut surfaces present a decidedly granular appearance, exactly resembling that which would be produced by dividing a bundle of muscular fibres transversely; nor can any granules be seen by the naked eye, except where these tubes are thus divided.

Such are the appearances presented to the naked eye in a healthy kidney; they are certainly opposed to the descriptions given by minute anatomists, and without intending to throw any doubt on the correctness of their researches, yet it is evident that they are very liable to be deceived, and that so far as the unassisted eye can carry us, its evidence is to be received with more confidence than where high magnifying powers, and complicated optical instruments are employed. There are two additional sources of fallacy which are to be considered in all minute researches into the structure of parts, and which especially apply to the kidney, *viz.* the possibility of a fine injection by the excretory duct passing into the contiguous arteries or veins through the porous coats of the latter vessels, and thus giving rise to an incorrect idea as to the termination of the tubuli uriniferi; and secondly, the practice of submitting thin slices of tissue to the microscope. In this latter case it is evident, that were a thin oblique or transverse section of the cortical portion of the kidney examined by a microscope, then each tube, where divided, would appear as an oval or circular body embedded in the surrounding

cellular tissue, just as the Malpighian corpuscles are described to exist. In short, further researches are required before any positive conclusions as to the minute arrangement of the vessels can be arrived at: the striated appearance of the cortical portion is difficult of explanation, if the usual description of its structure is correct; if these striæ are tubuli uriniferi, and if their termination as seen by the naked eye should prove correct, then the reason of the prominence of the granules on the surface, after injection by the renal artery, must be referred to the fact, that the capillary net-work on the minute divisions of the excretory duct is chiefly composed of arteries, whilst the veins are mostly situated in the intervening cellular tissue of the gland.

Several hypotheses have been suggested with the view of explaining the primary derangement, and pathological condition on which granular disease of the kidney depends; but as they are for the most part vague speculations, and couched in general terms, without any attempt being made to show their connection with the successive stages of the disease, I shall not enumerate them, but content myself with quoting a few lines from Dr. Bright and Dr. Christison's publications on the subject, to show, from the evidence of these eminent physicians, how much doubt and uncertainty still remains as to its nature.

Dr. Bright, in introducing the cases by which he demonstrated the existence of these structural diseases of the kidney, says, "whether the morbid structure in the first stage gives rise to an alteration in the secreting power, or the organic change be a consequence of long-continued morbid action, is doubtful; probably, that the altered condition of the kidney is the result of causes affecting the skin, &c., inducing disturbance of the balance

of circulation, or producing an inflammatory condition of the kidney; that when this continues long the structure becomes permanently changed, either in accordance with that morbid action, or by a deposit which is a consequence of the morbid action, but has no share in that arrangement of the vessels on which the morbid action depends."

Dr. Christison, in the Cyclopædia of Practical Medicine, defines the disease "as a morbid deposit in the substance of the kidney, generally in a granular form, occasioning atrophy of the proper renal structure, and indicated by its tendency to diminish the solids in the urine, generally by the presence of albumen in that fluid, and frequently by dropsical effusions." From the general tenour of his remarks it would seem to be this author's opinion, that the morbid deposit depends on and arises from a peculiar derangement of the constitution, and that it may occur either with or without local congestion—thus constituting the acute and chronic forms of the disease: to use his own words, "In this respect granular degeneration of the kidneys partakes of the nature of true tubercular deposition—in the lungs for example—that is, though most generally the result of an insidious indolent process, allied as it were to depraved secretion or nutrition, it nevertheless sometimes finds its source in acute reaction." He, in another passage, remarks, "It is not improbable that there is some alliance in nature between the deposit on the valves of the heart, in the substance of the liver, and in the structure of the kidneys, by which the organic disease in each is essentially constituted."

Thus, it will be seen, that Dr. Christison is disposed to believe not only that it is of constitutional origin, but that it approaches in its nature towards tubercle more than any other form of disease with which we are ac-

quainted; and it may therefore be proper to examine how far this theory is corroborated and borne out by the facts which have been observed in the progress of the two diseases.

One strong objection to this view of the subject is the fact, that patients, in whom all the leading symptoms of this disease had existed for some time, have recovered their health so far as to cease to manifest any indications of it, and ultimately died of disease in other organs; but on *post mortem* examination no structural changes have been found in the kidney. Many such cases are related, some are mentioned by Dr. Williamson in the last number of the Edinburgh Medical and Surgical Journal, and by the kindness of a friend I am enabled to add the particulars of a satisfactory case. A lady of delicate health had been affected with general anasarca and albuminous urine: the dropsical affections were treated for some time by elaterium and other ordinary remedies, and at length entirely disappeared, as did the albumen from the urine, nor did either recur though she lived several months afterwards and ultimately died from chronic bronchitis and general debility. On examination the kidneys were found perfectly healthy.

The establishment of this occurrence seems to me to be nearly sufficient to disprove the theory, for we are acquainted with no instance of a morbid and unorganizable matter being deposited in the tissue of an organ, producing by its presence certain symptoms, and then disappearing so as to leave the part apparently perfectly healthy and without the least trace of any organic disease having ever existed in it.

Another strong point of distinction between it and tubercular and analogous diseases, arises from the fact that it has not yet, to my knowledge, been recognised

and detected in any other organ of the body but the kidney, whilst the latter diseases, when once that peculiar state of the constitution on which they depend is produced by any causes, are seldom limited in their operations to one organ, but, on the contrary, are frequently found to affect several distant and distinct parts of the body at the same time.

Tubercles, moreover, are generally first seen in the form of minute specks, distinct and separate from each other, and placed indiscriminately throughout the tissue of the organ affected, whilst the granular deposit is first and chiefly discernable at the exterior of the kidney, and on cutting into the structure of the organ its granular form more or less disappears; and in one variety of the disease requires long maceration to enable it to be perceived.

Finally, tubercles after enlarging and becoming opaque, tend to soften in the centre, and thus give rise to the formation of a cheesy or curdy matter which escapes by ulceration, and is always attended by more or less suppurative action; whilst contraction and induration, which may be considered as manifesting some degree of organization, are the more common terminations of granular deposition in the kidney.

And when abscesses do form in the advanced stages, they are generally found to be produced from the softening down of the deposit *en masse*, and not from any circumscribed portion of disease, as in tubercle; and this point is still further illustrated by one of the varieties of morbid appearances, described as occasionally occurring, *viz.*, that in which tubercular-looking masses exist in various parts of the diseased organ being embedded in, but at the same time distinguishable from, the surrounding deposit.

Probably these facts will be deemed sufficient to justify the conclusion that the granular deposit in the

kidney in this disease, is essentially different in its nature from tubercle and analogous constitutional disorders.

As the appearances found in the kidneys of persons, who during life presented the same leading symptoms, have varied very much, some authors have believed that there are several varieties, if not several forms of the disease, and in this way have endeavoured to explain those difficulties which opposed any more simple view of its nature. Thus Dr. Bright recognised three forms, M. Solon five, M. Rayer as many as six; Dr. Christison assumes the existence of three stages of the same disease, and comprises under one or other of these all the morbid appearances which have been described as peculiar to the disease. He mentions first, the acute stage, and this part of his division seems to be natural and good; but as his second and third stages must pass insensibly into each other, and as the symptoms of each are similar, it is not evident what useful purposes the separate mention of the third can serve. He also includes, in the second stage, two morbid appearances, which differ so much from each other that there seems to be sufficient reason to believe that they have originated in causes of unequal intensity; I allude to that form in which the deposit is more homogeneous than in the ordinary granular kidney.

As to the numerous varieties and subdivisions laid down by the French authors on the subject, it appears to me that to presume the existence, or at any rate to attempt the recognition of as many separate forms of disease as there are varied morbid appearances, is calculated materially to obstruct and prevent any extension of our knowledge of the disease, and that as a theory it can only be justified by the continued failure of all attempts at a more simple arrangement.

From the limited extent of the granular deposit and

other peculiarities distinguishing it from diseases of constitutional origin, it seems fair to conclude that it is a local affection; and from certain facts, to be hereafter mentioned, and from a general observation of its symptoms, causes, morbid appearances, &c., and a comparison of them with those noticed in inflammation of other parts, I have been led to think that the acute stage of Dr. Christison is simply acute nephritis, and that all the varieties of morbid appearances occurring in the chronic stage, may be considered as resulting from so many different degrees in intensity and duration of chronic inflammation of the kidney.

All authors seem to have agreed that the acute stage or form is a congestive, if not an inflammatory disease of an acute character, and have regulated their treatment accordingly. M. Rayer considers it to be a variety or modification of inflammation, and calls it albuminous nephritis. Dr. Christison says, "that it is not improbable that some of the instances, where a dark, flabby, enlarged state of the kidneys has been found in connection with coagulability of the urine, &c., have been nothing more than cases of ordinary inflammation, or pure nephritis:" whilst M. Solon conceives that true nephritis is quite another disease; but his distinctions between them are destroyed by Dr. Christison, who, however, so far from asserting their identity adopts an arrangement which recognises the existence of an acute congestion or inflammation of the kidney distinct from nephritis; and morever says, "In this city (Edinburgh) we have few opportunities of ascertaining the diagnosis between nephritis and granular degeneration, as the former is an extremely rare disease."

This opinion, as to the rare occurrence in this country of idiopathic nephritis, is held by most physicians, at least very few have recognised many cases of it, and the

majority say they have not met with a case of acute idiopathic inflammation affecting the kidney. Why organs performing so important a function, and so largely supplied with blood, which are especially subject to irregularity in their amount of action, and to sudden and extreme increase of vascularity from their sympathy with, and antagonism in function to the skin, should be so remarkably exempt from inflammatory action, when we find all the other important viscera of the chest and abdomen so frequently inflamed from the operation of causes which must act with at least equal power on the kidneys, is a mystery which has never been satisfactorily explained. If all the cases of the acute form of granular disease be considered as instances of idiopathic nephritis, then the latter disease will be found to be at least as frequent in its occurrence as most other acute visceral inflammations.

It is in the chronic form or stage that the difficulties attending any attempt at referring all its varied morbid appearances and numerous symptoms to the influence of one primary derangement, and from its action explaining their development, are chiefly experienced. All chronic diseases at the commencement of an inquiry into their nature, present these obstacles to a greater or less extent; but, perhaps, there is no one involved in so much obscurity at its first existence, or masked by so many subsequent complications as this chronic stage of granular disease; or, if it may be so called, chronic idiopathic nephritis. I, therefore, trust that some allowance will be made if I fail to prove its nature so clearly as may be done in the case of the acute form, or if I have recourse occasionally to analogy in discussing a subject which will not admit of direct demonstrative evidence being advanced for its elucidation.

CHAPTER II.

A comparison of the symptoms of the acute stage or form of granular disease with those of acute nephritis—of chronic form —impoverished condition of blood how far peculiar to this disease — secondary affections or complications — dropsy as it occurs in the acute and chronic stages.

I SHALL now briefly run over the symptoms of both forms of the disease, and discuss separately such as may seem to oppose the views I have adopted as to its nature.

In the acute stage the symptoms are rigors and other usual signs of inflammatory fever; pain in the loins, more or less increased on pressure; pain across the pit of the stomach; nausea, and vomiting, with an irritable or even inflammatory condition of the bladder; and so far they precisely correspond with those of nephritis. But there are two additional ones which are certainly not mentioned by authors as occurring in the latter disease, *viz.* the frequent coexistence of acute inflammatory anasarca, particularly affecting the hands and face, and a scanty, bloody, highly albuminous condition of the urine. With respect to the former symptom, as idiopathic nephritis is considered to be so rare a disease in this country, it is possible that late writers may not have recognised a sufficient number of cases to enable them to decide whether this anasarca is or is not occasionally present in that disease. At any rate, as it is not an invariable and constant accompaniment of the acute stage; so, supposing the latter to be but nephritis, the presence or absence of this

symptom will not of itself be sufficient to decide the question in any particular case. It may be as well to reserve any attempts at explaining its occasional occurrence till treating of the complications of the chronic form, as the same reasoning will apply to both cases.

As to the presence of albumen in the urine, I trust in another place to be able to show that it may and does occur in nephritis; and, moreover, to draw from the fact of its co-existence an argument in proof of the inflammatory and congestive character of the disease throughout its whole progress. M. Solon mentions four cases of nephritis in which the urine was albuminous; and, in an experiment on a rabbit, which I shall have again occasion to mention, by producing artificially a similar condition of the renal vessels to that which may be supposed to exist in the more acute cases of nephritis, the urine found in the bladder presented precisely the same properties as that secreted in the acute stage of granular disease, being bloody, containing some small coagula, and forming nearly a solid mass on applying a coagulating heat.

In the chronic stage the symptoms in many respects are similar to those of the acute, but diminished in intensity so far as the local affection is indicated, and modified in character by the supervention of numerous complications, each of which will give rise to morbid sensations and phenomena varying with the situation and function of the part affected.

Thus the febrile symptoms will be less marked, or may be altogether absent, or at least imperceptible; and the pain in the loins will be so reduced as to amount to little more than a sense of weight and fulness. The nausea assumes a more chronic disposition, being less frequently attended with vomiting, although in many cases the latter

and chronic diarrhœa form leading complications, and by inducing exhaustion shorten the life of the individual. The proportion of albumen in the urine is less than in the acute stage, whilst the quantity of the latter fluid secreted, approaches to or may even exceed that of health, but is characterised by the small quantity of solids contained in it. According to Dr. Christison, the proportion of hœmatosine in the blood is greatly diminished in the advanced stages, a circumstance which he looks upon to be pathognomic of the nature, and even indicative of the progress of the disease : the blood is also deficient in albumen, and contains a great quantity of aqueous fluid, so that it coagulates faintly, and the clot is loose and gelatinous.

There are but two of these symptoms which can be considered as peculiar to granular kidney ; and of these I would reserve one, *viz.* the condition of the urine, for future discussion, merely stating here that M. Rayer has observed it to contain albumen in other diseases after ceasing to be bloody, a fact which destroys the rule M. Solon lays down, *viz.* that this disease is distinguished from others in which blood may accidentally be present in the urine, by that fluid ceasing to be albuminous when it ceases to be red.

The other is the deficiency of hœmatosine in the blood, which becomes gradually more marked as the disease advances. The correctness of Dr. Christison's experiments is corroborated by the pallid countenances of persons in the last stages of the disease ; but before receiving it as a peculiarity confined to this disease, it will be advisable to suspend our judgment on this point, and to refrain from drawing any conclusions from its existence, till future inquiries shall have decided as to whether the hœmatosine is not equally deficient in all cases of long-continued or excessive albuminous discharge. Till this

is determined, the presumption of the possibility of such an occurrence seems perfectly reasonable; for as the precise nature and origin of the colouring matter of the blood is still an unexplained point in physiology, and as we do not know how the white chyle becomes red blood, or how the latter fluid when extravasated into living tissues loses its red colour, and presents the properties either of pus or fibrine, so it seems perfectly possible for the hœmatosine to escape undetected, in the urine of chronic nephritis, in the form of, or at least mixed with, colourless albumen. The same pallor of the countenance and general anœmial appearance is observed in persons who have been the subjects of excessive suppurative discharge, in women suffering under the effects of protracted lactation or leucorrhœa, and indeed in all cases in which a copious or prolonged albuminous discharge from any part of the system, whether coloured with hœmatosine or not, has existed. It seems, therefore, highly probable that this state of the blood in granular disease of the kidney arises from the loss to the system of that albumen which has escaped with the urine, and not from any specific derangement of the constitution or vital powers peculiar to, or produced by, that disease. The deficiency of albumen in the blood in the advanced stages is, of course, readily explained from the same reasoning, and as the quantity of blood in the system does not vary very much, the albumen is replaced by water till it becomes so impoverished as barely to suffice for the purposes of life, and were no secondary affection to hasten the termination of the case, the patient would die of simple inanition from this cause.

Any attempt at connecting the secondary affections with the local disease of the kidneys is certainly one of the most difficult parts of the subject.

The congested state of the bladder, sometimes amount-

ing to actual inflammation, and attended with great irritability and a frequent necessity for voiding urine, is characteristic of, and prevails to a greater or less extent in all nephritic disorders; and, in certain cases, as in the lodgment of calculi in the kidney, furnishes the only symptom which directs attention to the primary disease.

Nausea and vomiting are also frequently present in other diseases of that organ, and the intestinal canal will also participate in the general disturbance, from its sympathy with the renal irritation; and any importance which might attach to these symptoms as pathognomic of granular disease, is destroyed by Dr. Christison, who mentions in the Cyclopædia of Practical Medicine, on the authority of M. Rayer, that chronic nephritis may give rise to chronic vomiting, simple exhaustion, diarrhœa, and other fatal affections, which have been hitherto supposed to belong to granular degeneration only. Vague wandering pains affecting various parts of the body, and assuming a rheumatic or neuralgic character, form a very obscure and inexplicable symptom or complication of any disease. They seem to be more or less present in all visceral disorders, especially in affections of those organs which are situated near the spine, or are largely supplied with nerves, both of which circumstances occur in the case of the kidney; and probably the only way of explaining their presence is by the theory of reflex nervous action, in supposing that an unnatural impression is conveyed by the nerves of the affected part to the spinal cord, and thence reflected by means of other nerves to distant parts of the body.

A diseased state of the heart and liver would seem to be only accidental complications; their frequent coexistence with this form of renal disease, may be referable to the circumstance, that the individuals in whom the latter

affection most frequently presents itself, are comprised in that class whose habits of intemperance and irregular mode of life predispose most powerfully to the development of organic derangements in the two former organs. And, as there is strong reason to believe, that these two diseases often precede the renal disturbance, and as their preexistence for any length of time, or to any considerable extent, would undoubtedly tend to cause considerable interruption to the circulation throughout the abdominal veins, it is not impossible that they may occasionally induce the supervention of continued congestion of the kidney, particularly when other circumstances cooperate with them in giving rise to that effect, and may thus constitute one of the causes of the disease, if it be considered chronic nephritis. As the subcutaneous and intermuscular cellular tissue and the serous membranes of the body, when in health, have a similar function to perform, *viz.* that of facilitating the motion of contiguous parts, by secreting and containing a peculiar vapour, so as to remain constantly moist and smooth; and as we frequently observe their diseased conditions to accompany each other, to have the same origins, and equally to participate in the advantages resulting from the employment of the same remedies, it may not be deemed improper for me to consider the anasarca and serous effusions, which are so frequently met with during the progress of this disease, as produced in the same manner from the operation of the same cause. In treating these affections, we observe, that the quantity of fluid effused may frequently be made to diminish very much, or even wholly to disappear by the use of hydragogue cathartics, diuretics, and sudorifics, given to such an extent as to produce copious watery evacuations from these three sources; and, on the other hand, if the quan-

tity of fluid discharged from the system by these channels is much diminished, we then find the dropsical swellings rapidly to increase. Applying this knowledge towards elucidating the connection between nephritis and dropsy, if it can be proved that these natural outlets for the discharge of superfluous fluid from the system are more or less closed by the direct operation of that disease itself, or of some of its causes, then a strong argument will exist for believing this obstruction, and the consequent or accompanying dropsical effusions, to stand towards each other in the relation of cause and effect.

In acute nephritis, which generally occurs in persons in whom there is tolerable power in the system, and in which the effusion is highly albuminous, the attack can most commonly be traced to sudden or extreme exposure to cold (perhaps during convalescence from some disease in which the skin is more or less affected), and consequent suppression of the cutaneous transpiration, which is known to be very great in a healthy state. But as nature urgently requires a substitute for this function, in allowing the escape of watery fluid, a greatly increased quantity of blood must be sent to the kidneys, so much indeed as to produce acute congestion in those organs, in consequence of their capillary vessels not being able at once to accommodate their size to the increased volume of blood forced into them, and thus they will be prevented from secreting even their ordinary quantity of urine. These two principal outlets for superfluous fluid being thus shut, it is probable that the quantity of fluid circulating in the blood-vessels would then be unnaturally great, if its thinner portion did not tend to exude through the porous coats of the smaller vessels, and thus escape into any unoccupied cavity, such as those of the serous membranes, cellular tissue, the intestinal tube, or the

ramifications of the bronchi, where there must necessarily be the least resistance.

In this stage, Dr. Christison has found the proportion of fibrine in the blood to be greater than in health; and this fact, with the local irritation caused by the occasional presence of urea in the effused fluid, may perhaps explain why the inflammatory forms of dropsy should prevail here more than in the subsequent stages, or in the chronic form of the disease.

In the latter, Sabatier and Solon consider the effusions to result simply from the blood containing more water than in health, its exudation or exosmosis being favoured by its tenuity. This is probably a correct explanation, but it is not clear that the tenuity of the blood alone would be sufficient for the production of these effects were the kidneys and skin both actively performing their functions at the same time. In some cases the anasarca and dropsical disorders are not present, and from observing their absence in some cases in which the kidneys were found granular, but where the skin seemed to have remained perfectly healthy, and from finding effusion pretty invariably present in those cases which follow scarlatina and other diseases in which the cutaneous vessels are the seat of morbid action, I should feel disposed to consider it as a symptom chiefly, if not solely, present when deficiency of the cutaneous transpiration has been a leading complication, if not the original cause of the disease. M. Rayer believes, that dropsy always occurs in granular disease of the kidney, or albuminous nephritis, as he terms it, and in that only; but Dr. Christison says, that dropsy does not always exist in that disease, and that some have even supposed it to be occasionally present in nephritis, thus doing away with any value that might be attached to this symptom as a

peculiarity of granular kidney. If the above views as to its origin are correct, it is evident that it may or may not occur in nephritis; but that when present it indicates a debilitated or deranged condition of the cutaneous circulation, and therefore will be more generally met with as a symptom of nephritis in those localities, where from a cold climate, a marshy or damp soil, or a proximity to large surfaces of water, the functions of the skin as a secreting organ are more or less impaired.

I have now mentioned and discussed the chief symptoms of the disease, at least such as are supposed to distinguish it from ordinary inflammation of the kidney, with the exception of the condition of the urine, and if it can be satisfactorily explained, then it appears to me, that so far as the symptoms may be considered of importance in determining the point, no serious obstacle exists to that view which assumes the identity of the two diseases.

CHAPTER III.

General views of inflammation, and more particularly as to the condition of the capillaries during its existence—the morbid appearances of the acute form enumerated and compared with those of acute nephritis—experiment—consequences of acute inflammation of the kidney—the morbid appearances met with in the chronic forms enumerated—their capability of division into two leading varieties—the nature and origin of the granules—the explanation of the difference existing between these varieties, and proposed arrangement of all cases of nephritis under three classes: acute, subacute, and chronic—experiment, and examination of the remaining morbid appearances.

Before entering upon the examination of the morbid appearances found in the various stages of granular disease of the kidney (by which, of course, the correctness of any view of its pathology must be tested, and on the capability of explaining which, in the absence of more direct evidence, its chance of adoption must mainly depend) two circumstances must be alluded to here, and carefully borne in mind throughout the inquiry, as constituting the only media by which we can hope to make ourselves acquainted with the precise situation or progress of morbid action in any part. The first of these is a knowledge of the intimate structure of the organ affected; and in the kidney, as before stated, some points as to the ultimate disposition of its constituent vessels are not yet satisfactorily determined. But, of course, in tracing the progressive changes from the healthy to the diseased state, I must assume the correctness of the descriptions given by the latest and most distinguished in-

vestigators of the subject. The other essential requisite is a reasonable explanation of the condition of the vessels of any part during inflammation; and, notwithstanding the volumes that have been written, and the numberless theories that have been advanced for the accomplishment of this object, the facts that may be considered as established are very few in number; and considerable discrepancy of opinion still exists as to the manner in which, and the means by which, the symptoms and effects of inflammatory action are produced. I may, perhaps, therefore be allowed briefly to mention those points which are pretty universally admitted, and in enlarging on them to dwell upon such particulars as may seem best calculated to throw light upon the morbid appearances and disordered secretion, which are next to be investigated.

The following are the circumstances with regard to the nature of inflammation which the best authorities consider proved; *viz.*

1. The dilated state of the capillaries in the inflamed part.

2. The increased action of the larger arterial trunks leading to it.

3. The retardation, or ultimate stagnation, of the circulation through these capillaries.

1. The fact of the dilated condition of the capillaries of the inflamed part being established, there remain but two possible ways of explaining its occurrence; *viz.* to suppose that it arises either from a principle of active dilatation in those vessels, or that it is the consequence of a loss or diminution of their natural contractile power. As we know nothing of the existence of any influence by which active dilatation, as a primary motion, could be accomplished, but have many reasons for believing the capillaries

to be endowed with the property of contractility, it seems reasonable to conclude that it is the more or less complete deficiency of this power in inflammation, and the consequent inability to resist the impulse of the arterial blood, which causes their enlarged and dilated state.

By considering the capillaries as a series of minute porous tubes, whose coats are chiefly composed of muscular, or at least of contractile tissue, acting under the influence of the organic system of nerves, but at the same time from the frequent junction with the latter of filaments from the cerebo-spinal system more or less affected by various causes acting on that system, it seems to me that a fuller explanation of the phenomena observed in health and disease can be given than by any other theory that has been advanced. In health this contractility of the capillaries is ordinarily left to the control of the organic nervous system, but is influenced variously by different *physical* causes, by the passions and other mental emotions, and in certain parts and organs even by the will of the individual. Certain poisons seem to possess the property of destroying the contractile power of muscular tissue, as it were by neutralising the activity of the organic nerves on which it depends; thus some substances, which prove immediately fatal, are supposed, perhaps even proved, to act by paralysing or suspending the irritability of the heart. Lead probably operates more slowly in the same manner on the intestinal tube. Other agents destroy life by the excessive stimulus they form, exhausting the sensibility of the system so that it is no longer affected by ordinary and natural impressions: a powerful electric shock is supposed thus to act: even the stimulus of daylight to nerves long unaccustomed to it, as in the case of prisoners confined for years to dark dungeons, has been sufficient to produce temporary or even complete blind-

ness: a very loud noise, in the same manner, causes temporary deafness: extreme and sudden mental emotions, caused either by joy or sorrow, probably prove fatal in debilitated and nervous individuals from their affecting the system in a similar way.

In inflammation, the relaxation of the capillaries is induced by causes operating as those in one or other of the above classes, but of circumscribed and limited action; of less intensity, and generally of more protracted duration. There is every reason to believe that certain agents applied locally will act as direct depressants or sedatives, destroying the organic contractility of the capillaries of the part with various degrees of rapidity, and by thus rendering them unable to resist the impulse of the arterial blood, a congestion or engorgement of the organ finally results. Such causes would tend to produce a condition identical with that of chronic inflammation, in which the state of the capillaries being somewhat similar as regards their calibre, yet the organ is not so much engorged as in acute inflammation, owing to the heart and large arteries in the former case not acting with any increased power.

The more numerous causes of acute inflammation, however, are those which at first act as stimuli, but which from their long continued application or great intensity more or less speedily exhaust the irritability of the contractile tissue of the capillaries, and thus induce relaxation and distention of the latter; whilst the heart and large arteries, either from sympathy with their condition, or from the immediate operation of the same cause, or from the unnatural stimulus of distention caused by the local impediment to the circulation, contract with more than ordinary power, and force the blood into the debilitated vessels in greater quantities, and with more vigorous and quickly repeated impulses. In illustration of the operation of the causes of inflammation in external parts, it

may be well to trace the progressive action of one which is a very frequent cause of nephritis, *viz.* cold applied to the surface of the body. When applied to the skin of a healthy person, cold causes the vessels to contract, and to remain so till it is withdrawn, during which time of course they contain less blood and secrete less copiously; they then relax so as to contain more blood than before, and the heart having been stimulated by increased distention acts more rapidly and vigorously, so that the circulation through the skin is for a time increased: but if the application of the cold be continued for any length of time, and if no opposing agency, such as active exercise, warmth, &c. be allowed to counteract its effects, then we find the supply of blood gradually to diminish, the capillaries to remain more or less permanently contracted, and as a consequence the nutrition and special function of the part to become imperfectly performed, and at length almost totally suppressed. As before stated, the immediate consequence of diminution or suspension of the secretive function of the skin is an increased flow of blood to the renal vessels, and if the quantity or impulse of the blood thus determined exceed a certain point, or last beyond a certain period, it will evidently tend to exhaust the contractility of the capillary vessels through which it must pass, just as over-distention of the bladder renders it incapable of expelling its contents; and thus a state of engorgement, or in other words, inflammation of the kidney, is produced.

2. The increased action of the arterial trunks leading to the inflamed part seems almost capable of direct demonstration, but how it is produced, or by what means the quantity of blood sent through the renal artery, in the case just alluded to, is rendered greater than that circulating in vessels of proportional calibre, is a mystery which we cannot explain, and which must therefore be referred

to vital agency. The effect of this action in producing a more intense degree of congestion of the vessels of the part we can readily understand, for the diameter of the column of blood in the capillaries being increased, and the latter vessels having lost their natural contractile power by which the passage of the contained fluid must be to a certain extent facilitated, a two-fold source of impediment has to be removed; and the increased impulse of the arterial blood failing to effect this, will naturally distend still further the enfeebled coats of the vessels, so that more blood will be contained in them, and will thus aggravate instead of remedying the evil.

A tolerably satisfactory proof of the dependence of inflammation and its consequences on the destroyal of that balance naturally existing between the contractile power of the capillaries and the quantity of blood poured into them, is furnished by a recent improvement in the treatment of swelled testicle, or acute testitis, or epididymitis according to some authors. Instead of trusting solely to general and local bloodletting, nauseants, &c. used with the view of diminishing the heart's action, and thus reducing the quantity of blood poured into the vessels of the part, which is at the best an indirect way of relieving the gorged vessels—in this method the treatment is principally local, the patient of course avoiding any causes of excitement, and being kept on low diet. The inflamed and enlarged testis is firmly compressed in every direction by straps of plaister, and is found considerably reduced in size at the end of a few hours, so that the plaisters are loose; the pressure is again applied, the bulk of the organ still further reduced, and generally in the course of three or four days the gland is of nearly the natural size. By this mode of treatment the atonic and relaxed capillaries are so supported and compressed, that the blood is forced

out of them into the veins, whilst the same pressure prevents the entrance of any considerable quantity of fresh blood into them, and they gradually recover their tone; if the inflammation has not lasted long enough for coagulation to have taken place in the vessels, or for any considerable effusion to have occurred, the reduction of the swelling and the simultaneous disappearance of the other signs of inflammatory action progress with great rapidity.

Nothing, perhaps, can show more clearly than this the connection between the engorgement of the capillaries and the development of all the signs of inflammation; this fact is drawn from the treatment of acute inflammation, caused in the human body by the operation of a natural agency. Perhaps the following experiment, to which I have already once alluded, and which I shall have again occasion to mention, may help still further to establish this point. I tied the renal vein of one kidney in a rabbit, leaving the artery uninjured; it died fifteen hours afterwards: the kidney operated on presented all the signs of acute inflammation, and was the only organ affected. The same experiment was repeated, and with precisely similar results, death taking place within two hours of the same time as in the former case. Being engaged at the time in studying the nature of the disease which is the subject of these observations, I had removed one kidney from another rabbit, and placed it in a damp place with the view of inducing continued congestion in the remaining organ. The animal was killed at the expiration of a fortnight, as I could not conveniently allow it to live longer, and although it did not remain alive long enough to answer the object I had in view, yet from this and the foregoing experiments, I think it is fair to infer, that the earlier death of the two

rabbits, in which I produced *all the physical conditions of acute nephritis*, ensued from the nervous system, and the constitution sympathising with, and being rapidly worn out by, the local disorder, and not from the suspension of the function of the inflamed organ, for the other kidney was perfectly healthy and free to secrete. We find a fatal termination to follow sometimes, almost equally rapidly, in acute inflammation of any important part taking place in an irritable subject; and from the similarity in the morbid appearances and terminations of these experiments to those of acute nephritis, and from the disappearance of the symptoms of inflammation in the testicle when the engorged vessels are mechanically emptied, does it not seem highly probable that inflammation is produced by, and in fact is neither more nor less than, an intensely distended and congested state of the vessels of the part?

3. More or less retardation of the circulation through these vessels is a natural consequence of their enlarged calibre, but the explanation of the tendency to coagulation observed in the blood contained in them is more difficult, and indeed, in the present imperfect state of our knowledge of this vital process, is impossible. It appears pretty certain that there is a reciprocal action between the containing vessels and the contained blood in living bodies, by which the fluidity of the latter is preserved; but to no purely chemical or mechanical influence can this agency be referred.

It is essentially a vital process, and consequently affected by causes acting on the system at large, as well as by those of a local nature. In acute inflammation the tendency to coagulation in the blood of the part is perhaps more marked than in health, and recent researches have shown the quantity of fibrine present in it to be greater;

but how far the latter circumstance exerts any influence in producing this effect is very uncertain. A certain degree of rapidity of the circulation seems necessary for, or at least generally attends, the preservation of the fluidity of the blood: thus in aneurism, and other cases of slight retardation of the current, we find slow coagulation to go on in the dilated sac. The fibrinous clots found in the hearts of individuals, who have sunk very gradually, are by some attributed to the same cause. But there are exceptions even to this rule: thus the blood found in the tunica vaginalis in hæmatocele will retain its fluidity more than twenty-four hours if it be excluded from the atmosphere and allowed to remain in the membranous bag: and in some diseases, and in death produced by certain poisons, the blood never coagulates spontaneously, thus clearly manifesting the vital character of the action and its independence of physical conditions. Perhaps in all cases in which coagulation occurs in the vessels of a living animal, it may be considered as a consequence of a debilitated or impaired state of the coats of these vessels, how acting in producing this effect we know not, but probably arising primarily from causes affecting that organic nervous system in which the life of the body chiefly, if not altogether, resides.

The only general effect of the existence of inflammation in any part to which it is necessary to have recourse in explaining the morbid appearances of nephritis, is albuminous or sanguineous effusion into the cellular tissue of the inflamed organ; the latter, in a healthy state of the blood, probably only occurring when the distention of the minute vessels has been so great as to cause their rupture at some points; the former kind of effusion being secreted by the vessels while entire and

unbroken. It is unnecessary, and would be tedious to trace the changes which these effused matters undergo, as they vary in different cases according to the strength of the constitution, the period of the disease at which they were formed, the condition of the blood, and a number of other circumstances.

It may perhaps be laid down as a general rule, that in a healthy person, when the increased action of the vessels of the part has ceased, absorption of the more fluid parts of the effusion goes on pretty rapidly, and that the more solid portion which remains becomes gradually reduced in bulk by the closer approximation of its particles, till it eventually presents almost cartilaginous induration, whilst in an unhealthy state of the system the coagula are found disposed to soften and ultimately assume more or less completely the properties of purulent matter.

After these general remarks on inflammation we may next proceed to examine the morbid appearances present in the different forms of granular disease of the kidney, and see how far they can be explained by that theory which supposes them to be the ordinary effects of the above general cause.

The morbid appearances, which occurred in individuals who have died within a day or two after the development of the symptoms of the disease, constituting its most acute form, are thus enumerated by Dr. Christison :—

"The kidneys are flabby, friable, and much enlarged; they are darker and more vascular externally, and with points and star-like spots of ecchymosis; internally they are of a dark brownish red, or almost reddish black, gorged more or less with blood, which drops from a cut surface in unusual quantity; and they often present throughout their whole structure, but more especially in

their cortical portion lines and specks of a still darker colour and not easily removed by washing. Sometimes this congested state of the kidney prevails throughout the whole organ equally; at other times the cortical structure seems chiefly affected, and presents a more distinct and coarsely striated appearance than natural, probably from blood being injected or extravasated in lines into the fundamental cellular tissue. The cortical structure is almost always broader than in the healthy state, as if it were distended towards the circumference by its gorged condition."

The appearances found in the kidneys of those who have suffered from anasarca and albuminous urine, consequent on scarlatina, are described as resembling very much those of the acute stage. In the article on this subject, in the Cyclopædia of Practical Medicine, the same author remarks that a granular deposit is present even in these acute cases, though it cannot at once be distinguished from the surrounding structure, as it is of the same colour, but may be recognised when the kidney is injected, as the fluid does not enter the granules.

There is no one of these appearances which can seriously oppose the supposition of their being the ordinary consequences of acute congestion. The enlargement and sanguineous infiltration of the organ evidently result from the great accumulation of blood in its vessels during life having caused rupture at some points, and the consequent escape of their contents into the surrounding cellular tissue.

From reflecting on the great obstruction to the circulation through the minute vessels of an inflamed part, I was led to imagine, that by preventing the return of blood from the kidney in one of the lower animals, and taking care not to injure the artery in the experiment,

a condition of the organ, similar to that present in acute nephritis, would be produced, which might throw some light on those points in which the latter disease differed from the acute stage of granular kidney. Accordingly I cut down to and exposed one kidney in a rabbit and tied the renal vein, returning the organ immediately into its natural position with the artery uninjured. The animal died about fifteen hours afterwards, and on examination the kidney in question was the only organ found affected; it was intensely congested and very much enlarged, being nearly twice the bulk and weight of the healthy organ; of a dark red or blackish colour, in some places soft and easily torn, and the granular appearance on its surface more distinct than natural, as if from enlargement of the granules. On making a section it was throughout intensely gorged with blood, which seemed infiltrated into the cellular tissue of the organ: there was a little bloody urine in the bladder which contained two or three minute coagula, and became nearly a solid mass on applying heat. This experiment was repeated with precisely the same results as to the condition of the kidney, but from the ureter having been divided and tied, the urine secreted could not be examined. Perhaps the value of any conclusions drawn from these facts is increased from the circumstance of M. Rayer and Dr. Osborne having found fibrinous clots filling the renal veins in those who had died in the acute stage, an occurrence which shows that a very imperfect and retarded, if not a completely obstructed, circulation through those vessels had existed during life.

The granular appearance of the exterior was also more distinct in the congested kidney, arising from the distention of the granules naturally existing there. M. Rayer has likewise observed the Malpighian corpuscles to be

congested in this acute form; and as they are composed chiefly of minute arteries, does it not seem very probable that the granules which Dr. Christison failed to inject (possibly from the renal *artery*), were merely these bodies enlarged from the distention of their constituent vessels in which the blood had coagulated, and from which, owing to their minuteness, it could not be washed out, preventing by its presence the entrance of the injected fluid into the granules?

Such are the morbid appearances of the most acute form when it has proved rapidly fatal; but it is a point of some importance to learn the nature of the changes which take place in cases where the patients are not so rapidly cut off by the disease.

There is an interesting case of acute idiopathic nephritis related by Mr. Snow, in a late number of the American Journal of Medical Sciences: the patient died at the end of nine days, the secretion of urine during that time having been entirely suppressed, and symptoms of poisoning from the retention of urea in the blood having preceded death. On examination, the left kidney was atrophied, and on inquiry it was ascertained, that several years before she had an attack of some nephritic disease, which from the symptoms mentioned by her friends was probably of the same nature as that which proved fatal. In the recently inflamed organ, the cortical portion to about half its extent was opaque, whitish, and seemed infiltrated with lymph, a little serum oozing out, but no pus; there was a white deposit in diffused patches, and a few small scattered spots over the whole cortical part; the tissues of the organ were rather fluid and friable; there was a minute quantity of dirty, dark, brownish urine.

These appearances correspond very closely with those

observed in a rabbit in which I exposed the kidney and passed a thread under the renal vein, allowing it to remain there with the view of inducing slow obliteration of that vessel and a simultaneous congestion of the kidney. It died nine days afterwards, and on examination, the kidney operated on was, if any thing, rather smaller than natural; its surface seemed to want the smooth convexity of the healthy organ, as though its bulk had been recently diminished; on the exterior, and diffused through the substance of the cortical tissue, were irregular white patches of lymph, and the remains of several ecchymoses, the colouring matter of which had been partly absorbed. The other kidney was considerably congested, and the urine in the bladder moderately but distinctly albuminous, both heat and nitric acid being applied.

These may be looked upon as the appearances which would generally result in cases where the inflammation has been very acute, and the patient has lived long enough for absorption to have diminished the bulk of the congested organ, constituting as it were the transition stage between the enlarged and engorged state of the kidney on the one hand, and its diminution and atrophy on the other. Were the obstruction to the circulation through the kidney and the consequent accumulation of blood in its vessels less intense in degree but longer-continued, then the increased size of the organ would be more permanent, and this would seem to occur in cases in which chronic nephritis has commenced as the primary disease; whilst atrophy and diminution, as in the left kidney of the case just quoted, seems more rapidly to follow acute congestion. And the reason of this is tolerably evident; for the obstruction to the circulation being more complete in acute inflammation, coagulation

takes place more quickly in the minute vessels of the part, which are thus, to a certain extent, obliterated and rendered incapable of receiving the fresh arterial blood necessary for nutrition; whilst in chronic inflammation the coagulation of the blood in the relaxed capillaries goes on very slowly, and as fibrinous deposit in cases of retarded circulation through vessels takes place first on their lining membrane, gradually advancing to the centre, and thus contracting the calibre of the tube, it is evident that in chronic inflammation the filling up or occupation of the *dilated* capillaries by fibrinous coagula must necessarily cause an increase in the bulk of any organ which is mainly composed of these vessels; and that this increase may continue till such time as the aperture for the passage of the current of blood becomes very much reduced, and at length ceases to exist, when absorption will proceed slowly to diminish its size by removing the aqueous or soluble parts of the fibrine, ultimately producing contraction and induration.

The morbid appearances of the chronic stage, as mentioned by Dr. Christison, may be thus summed up:—

The deposit is found at first to affect the exterior of the cortical portion; the kidney is now sometimes enlarged, or only of the natural size; if larger, it is softened and even friable; if diminished, firmer and harder: its colour is somewhat paler than that of health; its surface mottled with gray or yellowish gray deposit, and often traversed by white indurated streaks like cicatrices. When the capsule is removed, its surface is mottled brown, and gray or yellowish with spots of vascularity, and is granular. On making a longitudinal section the breadth of the cortical portion is various; sometimes there is a mere line of healthy tissue, and instead of the usual reddish brown colour, and coarse parallel striæ, it

is of a gray or yellowish colour, without striæ and obscurely granular; and there is no distinction between this structure and that dipping between the tubuli uriniferi. If the kidney be injected, the fluid does not enter the granular portion. The granular structure is more distinct on tearing it, but is sometimes absent, and we have instead its surface smooth, and a friable homogeneous yellowish mass occupying the place of the healthy tissue: sometimes the morbid deposit is thrown out between the tubular masses or their rays, so as to expand their bases before the striated appearance has gone, and there the striæ are found finer and less distinct. The healthy tissue is absorbed at the same time with or after the morbid deposit; and lastly, that deposit itself—at least its fluid part—is absorbed, and contraction and diminution of the organ occurs. It is then hard, sometimes almost cartilaginous; the remaining tubuli are of a pale-flesh red colour; sometimes there are only one or two of them left, and their striæ are more fine and less marked from the deposit between them; sometimes only an empty sac, at others an encysted abcess are the sole remains of the kidneys; sometimes firm tubercular-looking masses are found diffused through the softer granular matter. The other morbid appearances are irregular, and vary with the different organs implicated in the derangement of the system: the liver is frequently found tuberculated and diseased, the heart hypertrophied often with dilatation and valvular disease; the mucous membrane of the intestines reddened; the bladder contracted, its coats thickened, and its mucous membrane vascular; effusion of watery fluid into various parts without any vascularity of the membranes, pleurisy, emphysena of the lungs, pneumonia, &c., &c.

In discussing these changes with the view of endea-

vouring to discover their precise situation and nature, it seems to me more advantageous to retain the original division of Dr. Bright, and to consider the appearances found in the kidneys, in the chronic forms, as referable to one of two leading varieties. In one class of cases the cortical substance is made up of granules of various size and shades of colour, ranging from red to purple and yellow, the kidney being generally somewhat diminished and indurated; in the other, the organ is usually somewhat enlarged in bulk, its cortical substance consisting also of granules, but a flaky white interstitial deposit exists between them, masking their presence and rendering the structure apparently more homogeneous: after maceration, however, the interstitial deposit being washed away, the granules, as in the former case, are found to constitute the greater part of the cortical substance. So that the chief points of distinction between the two varieties are the greater induration and contraction in the one case, the granules being in close apposition with each other; whilst, in the second form, the size of the organ is somewhat increased, and the cellular tissue between the granules is replaced by what I may perhaps venture to call ordinary albuminous effusion.

Two questions here present themselves, and must be answered before any further progress can be made with the inquiry. What is the precise nature and origin of these granules? and, secondly, How are the various appearances found in the two forms just mentioned to be explained from the operation of one and the same cause? With respect to the first question, involving as it does the subject of the minute anatomy of the kidney, and bearing on points not yet finally settled, I cannot hope to offer a very satisfactory answer; but, before admitting it to be a new kind of morbid deposit characterized by

its granular form, it is proper to examine all the constituents of the healthy organ, and by carefully noting any peculiarities in the development of the disease, to endeavour to trace back the morbid action to its primary seat. The granular appearance first manifests itself on the surface of the kidney, and is always most distinct there; it is generally described to be limited to the cortical substance; and as this is a point of some importance, it will be necessary to refer back to one or two of Dr. Christison's remarks. He says, there is no distinction between the obscurely granular matter in the cortical portion and that dipping between the tubuli uriniferi, and that sometimes the morbid deposit is thrown out between the tubular masses or their rays, &c. I believe he also mentions that the deposit sometimes extends to the suprarenal capsules and adjacent cellular tissue. If these facts are correctly stated, if the matter deposited in the surrounding cellular tissue, or in the tubular portion of the kidney, after maceration, or any simple preparation, is found to consist of distinct and definite granules, with or without an interstitial albuminous deposit, then the explanation which I am about to submit as to the origin and nature of the granules, supposing them to be limited in their occurrence to the cortical portion, must necessarily fall to the ground.

On the other hand, if the existence of distinct granules has not been recognized nor proved to occur in these parts, and if a mere roughness on laceration has been considered sufficient to establish the granular nature of the deposit, then it is still possible that the true granules may not extend further than the cortical portion; and, supposing that to be the case, I would suggest the probability of their being nothing more than enlarged Malpighian corpuscles. The structure and disposition of these

bodies have been mentioned before. M. Rayer considers them to be in a congested state in the acute form, an opinion which their greater distinctness on the surface fully warrants. We have only, therefore, to apply the ordinary principles which distinguish chronic from acute inflammation to enable us to trace the progressive stages of their enlargement and change of colour. They are described as composed nearly entirely of the convolutions of minute arteries, the terminal ends of which leave them to ramify on the tubuli uriniferi: whenever, therefore, any obstruction to the circulation through the capillaries of the renal vessels occurs, either from some cause impeding the return of venous blood, or from increased action of the renal arteries forcing in fresh blood quicker than the capillaries can accommodate themselves to the quantity, it is evident that these minute arteries, which are probably of considerable length, and through which a considerable quantity of blood will have to pass, must contain a greatly increased volume of that fluid, and that their enlargement must produce a corresponding increase in the size of the corpuscles which are chiefly formed by their convolutions. There seems to be a well-marked analogy between the enlargement of these bodies in chronic nephritis, and the increased size of the acini of the liver in chronic inflammation of that organ; in both cases these minute parts are made up of vessels, and the same explanation of the change effected by continued congestion is applicable to either. The chief points then on which I would rest this opinion are the two following, *viz.* the similarity existing between the granules in the diseased and the Malpighian bodies in the healthy kidney as to situation and distinctness, both being confined to the cortical substance and most evident on its surface; and, secondly, the possibility of explaining their

enlargement and change of colour by the ordinary theory of inflammation. Till these reasons are deprived of their force by the discovery of fresh facts, not admitting of explanation by that theory, it seems to me to be contrary to the principles of philosophical inquiry, and calculated to be injurious to the future progress of medical science, to assume the specific and independent nature of this granular deposit. In the course of the subsequent observations different facts will be mentioned, which seem to establish the correctness of this opinion, and till they are refuted and the impossibility of applying this simple mode of explanation is rendered manifest by the accumulation of additional characteristic peculiarities, it seems more advantageous to adopt it than to confess our ignorance of their nature by considering the granular appearance as the result of a process of morbid degeneration or nutrition.

I now come to speak of the peculiarities of the two varieties before mentioned: in both I suppose a degree of congestion to have existed for a sufficient length of time to produce enlargement of the Malpighian corpuscles, by the coagulation of the blood contained in their distended vessels: their various shades of colour are caused by the imperfect absorption of the colouring matter of the blood passing through all the intermediate tints from red to white as in other situations. But, in the first case, from the contraction and induration I should feel disposed to consider the disease as one of long continuance, and from the absence of any interstitial deposit it appears highly probable that a sufficient degree of inflammation, to produce albuminous effusion, had never existed in the organ, but that from some slight obstruction, retardation of the circulation through, and consequent fibrinous deposition in, the vessels of these

corpuscles had gone on slowly and gradually to the destruction of the surrounding healthy tissue by absorption from their pressure. In the second form, the cause having been more intense in its action, and the examination of the organ having probably taken place at an earlier period, the appearances are very different. The congestion has been so great as not only to cause enlargement of the granules, but also to induce albuminous effusion into the intergranular cellular tissue, and of course the extent of this effusion will vary in different cases. This form may be considered as holding an intermediate place between the former or more chronic, and the acute stage first described; it may therefore be termed subacute nephritis. Hence a practical division of cases of nephritis, founded on their morbid appearances, into three forms or degrees. 1. The acute, in which the engorgement of the vessels has been so great as to cause their rupture, and sanguineous infiltration of the organ. 2. The subacute, or that accompanied with more or less interstitial albuminous deposit: and, 3. The chronic, in which the congestion has never been sufficient to produce any permanent kind of effusion. Suppuration may supervene on any of these forms, but in general only occurs in the two former. In an apparently healthy rabbit I once found both kidneys affected with the second form or subacute nephritis. The surface of both organs was of a yellowish white colour, the granules larger than usual, and between them an albuminous deposit: on making a longitudinal section the same structure was found to occupy the whole of the cortical substance, except a very narrow line at its junction with the tubular portion which was of the natural colour. The urine in the bladder was not albuminous.

In reflecting on the subject I was led to try the effect

of injecting various coagulating agents into the renal vessels, and see whether the morbid appearances of any of these forms could be artificially produced in the healthy organ. Accordingly I injected nitric acid of various degrees of strength into healthy sheep's kidneys, and the appearances thus produced seem to me to be of some consequence, as supporting the views I entertain of the nature of the chronic forms of the disease. When nitric acid, diluted with only eight or nine parts of water, is injected into the renal artery, the granules on the surface of the kidney become quickly enlarged and prominent, so as to project above the rest of the surface, the intergranular substance retains its natural colour a considerable time, but ultimately this becomes changed to that of the granules, or a yellowish white. If the acid be three times more dilute, the granules on the surface do not project so much, but gradually they are enlarged, and the colour of the whole organ becomes changed to a pale yellow, and then corresponds precisely with the condition of the kidney in subacute nephritis. I did not macerate these kidneys, and therefore cannot say whether the granular appearance was confined to their surface or extended throughout the cortical substance. This experiment, as far as it goes, tends to clear up two points in the pathology of the disease. If a granular appearance of the surface, similar to that met with in disease, can be produced in a healthy organ, by distending the granules naturally existing there, and at the same time decolourising the blood they contain, is it not fair to conclude that the granules seen in chronic disease are the natural ones enlarged and otherwise altered by the slow operation of the same agencies, though effected by nature with different means? And as the interstitial deposit produced in the healthy organ by the coagulation of the

albumen present in its cellular tissue exactly resembled in its colour, consistence, and other physical properties the deposit met with in one form of the disease, are we not justified in assuming their identity till such time as chemical analysis, or other satisfactory mode of inquiry, shall establish their distinct and separate nature?

Having thus attempted to explain the peculiarities of the two leading varieties of morbid appearances met with in the chronic forms of the disease, and having mentioned some facts in support of my opinion, I will next briefly run over the remaining morbid changes, and then conclude this part of my subject by a comparison of them with those of chronic nephritis, as given by Dr. Christison on the authority of M. Rayer.

The first appearance of the deposit at the exterior of the kidney is a consequence of the greater vascularity of the cortical portion, and the minuteness of the vessels at that point; it is in the capillaries that stagnation of the blood first occurs, and it is from their distension that effusion is produced; and as they are situated towards the surface of the organ, and as the granules are more numerous, or at least more distinct there, it can be readily conceived that derangement of the renal circulation shall produce its first visible effects there. When the highly vascular tissue of this part becomes replaced by albuminous deposit, which of course receives an infinitely smaller quantity of blood (so little indeed as not to admit a coloured injection into its vessels), the secreting portion of the gland, which will be that nearest to the exterior and contiguous to the deposit, will then be placed in precisely the same situation with regard to vascularity, and therefore to morbid as well as healthy action, as the outer part of the organ was at the commencement of the disease. That is to say, if the same cause of congestion,

whether it be increased arterial action or venous obstruction, continues in operation after the deposit has occupied a certain extent of the cortical substance, then the contiguous vascular tissue, by which secretion is performed, will in its turn be more or less rapidly destroyed by the obliteration of its vessels in the same manner. But, in addition to the continued action of the original cause, the substitution of a very faintly organized matter for highly vascular tissue will of itself tend to induce congestion and engorgement of the remaining healthy structure of the organ, for the arteries bringing in as much blood as when all the vessels of the gland existed, it necessarily follows that an increased quantity must be sent to those which still remain pervious, and thus when once the congestion has produced a deposit in any part of the structure, the mere existence of this may alone tend gradually to involve the whole kidney in the disease. It is in this manner that the progress of the deposit and its ultimate extension to the tubular portion is to be explained; and the highly congested state of the remaining tissue, mentioned as one of the morbid appearances met with in the advanced stages, affords a proof of the correctness of this reasoning. Sometimes the congestion will be more intense at one point than at others, from the vessels not being all equally affected by the same cause, and then albuminous effusion may take place at an early period between the rays of the tubular masses, so as to cause their divergence.

White indurated streaks like cicatrices are described as occasionally met with in the chronic disease; they probably arise from extravasation of blood having formerly taken place at the points where they occur, the colouring matter and its more fluid parts being absorbed, and the remainder becoming condensed and indurated

so as to present the same appearance as old coagula in the brain or other organs.

The capsule of the kidney is sometimes adherent to the surface, so as not to be separated without laceration of the glandular substance, and albuminous matter is found effused into the adjacent cellular tissue, both of these being evidences of the pre-existence of inflammatory action.

We know that in certain unhealthy states of the constitution the albumen thrown out in inflammation is incapable of organization and degenerates into pus, and accordingly in cases of nephritis, as in hepatitis, abscesses may form and involve more or less of the organ, so that nothing shall remain of it but a bag of pus, or if the latter has escaped during life there will then be only an empty sac.

In the article on nephritis, in the Cyclopædia of Practical Medicine, Dr. Christison quotes the following morbid appearances from M. Rayer :—In acute nephritis, the surface is lobulated and mottled with pale bloodless patches. In chronic, the kidney is generally diminished, somewhat hardened, and occasionally almost cartilaginous; on its surface granular, rugous, or botryoidal, generally pale and anœmial, sometimes with red mottling; the cortical substance is diminished, so that the tubular portion approaches the external surface of the kidney, the investing membrane being sometimes adherent.

These appearances, as far as they go, must support that view which assumes the identity of inflammatory and granular disease of the kidney.

I have now mentioned separately all the leading appearances presented by the kidney in the various forms of granular degeneration of that organ, as enumerated by authors, and at the same time have attempted to ex-

plain, as far as I was able, the manner in which inflammation or congestion would probably act in producing each. If this explanation of the origin and nature of the morbid appearances is considered satisfactory, then those points of distinction between granular degeneration and nephritis, which authors have drawn from the examination of the affected organ in various cases, will no longer apply, and the correctness of the pathological views here advocated will be rendered probable.

CHAPTER IV.

The causes of granular kidney — their identity with those of nephritis.

In treating of the causes, those of nephritis must be also mentioned: they may be divided into three leading classes.

1. Those acting directly on the kidney itself, producing irritation and inflammation of it, such as blows on the loins (four instances of which are mentioned by Solon as causing albuminous urine); calculous or other foreign deposits in the kidney; large or long continued doses of stimulating diuretics, such as cantharides or turpentine; (a case of albuminous urine, apparently referable to large doses of the latter medicine, presented itself to a friend of mine); and the use of spirits, especially of gin.

2. Those affecting the kidney by sympathy in function, or continuity of surface, such as the continued application of cold and moisture to the skin, and all those diseased conditions which tend to diminish the cutaneous transpiration: diseased bladder, or prostate gland, or stricture of the urethra will each by its long continuance react upon and produce congestion and disease in the kidney. In examining the urine in a number of cases of old and severe stricture I was struck with the frequency of its albuminous impregnation; and doubtless in many cases of the more chronic forms of nephritis, this disease, the existence of which can only be ascertained by a particular inquiry, has not only kept up the renal irritation resulting from other causes, and thus prevented

the arrest of the morbid action by remedies, but has also been itself the original source of the nephritic affection.

3. Those inducing congestion of the kidney, by preventing or obstructing the return of blood through its veins; and under this head numerous diseases, of which the renal congestion is only a complication and a secondary effect, are to be included—such as abdominal tumours of various kinds, which by their bulk or position press upon and interfere with the circulation through the large ascending veins, as fungoid disease, a large abscess below the liver pressing on the vena cava, and a greatly distended stomach accompanying ulcerative disease of the pylorus, of each of which I have seen an instance. Any disease of the liver obstructing the flow of venous blood especially if joined with valvular disease of the heart, aneurisms of the abdominal aorta, pthisis, pneumonia, chronic pleurisy, &c., &c., may each tend during their progress, especially if other causes cooperate with them, to produce renal congestion and albuminous urine, and as an ultimate consequence structural disease.

CHAPTER V.

Condition of urine in this disease — its albuminous impregnation — various theories on the subject—general views of secretion—the *modus operandi* of inflammation in causing albuminous effusion illustrated by the various effects of different degrees of congestion on the cellular tissue, serous and mucous membranes, and other parts—general rule explanatory of the occurrence and degree of albuminous effusion — the probability of the processes of nutrition and growth being primarily effected by the same agency — a peculiar arrangement of the vessels favourable to congestion being generally found to accompany albuminous secretion, as of semen and synovia — a similar condition also attending the unnatural presence of albumen in secretions, as in colostrum, and in the saliva of ptyalism — general rule for its presence in the urine — application of this rule to acute and chronic nephritis, to other diseases of the kidney, and to the various other cases in which the urine has been found albuminous — exceptions to the rule — explanation of the low specific gravity of the urine observed in the advanced stages of chronic nephritis — probability of its existence in debilitated conditions of the system arising from other diseases.

PERHAPS the most important, and certainly not the least difficult part of the subject, is the explanation of the peculiarities in the composition of the urine secreted in the different stages of this disease, comprising its albuminous impregnation and its low specific gravity.

It may be well, before entering on the exposition of the views which I have been led to adopt on this point, to mention briefly the various theories which have been advanced for the purpose of solving the difficulty caused by the unnatural existence of albumen in this secretion.

The one, perhaps most generally adopted, supposes that this effect is the result of a peculiar irritation of the kidney, induced by, or at least connected with the granular deposit in that organ. No reason however is given why the same disordered state of the gland should not be produced by other diseases affecting it, and indeed the theory seems refuted by the fact of the proportion of albumen in the urine being often diminished in the advanced stages, when the granular deposit occupies most of the organ, and any irritability of the kidney, consequent on its presence, will be at a maximum; whereas the contrary should occur were there any fixed relation between the proportion of albumen in the urine and the quantity of granular matter in the renal substance.

Another hypothesis, still more untenable, is that the albumen either supplies the place of urea, or is a transposition of its elements, or tends to a similar effect. This idea falls at once to the ground as urea is known to be excreted up to the very last stage, and when death follows suppression of urine it is found in the blood and dropsical effusions: indeed its non-elimination seems incompatible with life. The quantity of it discharged from the system in the advanced stages of the disease is said to be less than in health; but when speaking of the causes of the low specific gravity of the urine a reason for this occurrence will be suggested which is simple, and perhaps nearly adequate to its explanation.

Since studying this subject and arriving at the conclusions which I am about to relate, I find that the same hypothesis, as to the cause of albuminous urine, has been thrown out by others; but as it has not yet to my knowledge been supported by a close examination of all the cases in which albuminous urine has occurred, and has been advanced in a vague and undefined form, I trust

that I may still be allowed to claim a share in whatever credit the fact of having first established a fixed and general rule for the explanation of the presence of albumen in the renal secretion may be considered to deserve.

Dr. Williamson, in the last number of the Edinburgh Medical and Surgical Journal, mentions this hypothesis, *viz.* that albuminous urine is produced by congestion of the kidney, but he seems to consider it as occurring from a state of the lining membrane of the pelvis, analogous to that of the serous membranes in dropsy—or in other words to a disturbance of the balance between exhalation and absorption. As there is so much difference in the structure and function of mucous and serous membranes, the comparison, if I have understood it correctly, does not seem a good one. The same gentleman also mentions a diseased condition of the blood, such as that existing in scurvy, as likely to cause albuminous or bloody urine; and the probability of such an occurrence should be borne in mind in investigating the cause of albuminuria in any particular case.

Having now stated all the theories that I know to have been advanced for the purpose of explaining the production of this peculiarity, I will next proceed to sketch the train of reasoning by which I was led to arrive at the discovery of a very simple rule for its explanation.

The first step to be taken is to have as clear a view as possible of the nature of the mechanism by which healthy secretion is performed. There are certain difficulties and mysteries attending this vital process which have not yet, and perhaps never will be fully understood; but there are some facts now pretty universally admitted with respect to secretion in general, and that of the kidneys in particular, which I may be allowed briefly to enumerate.

1. All secreted fluids escape through the porous coats of the capillaries into the excretory ducts, or recipient cavities, where a free surface exists, and not from the open mouths of exhalent vessels as was formerly imagined.

2. The principles of which some, if not all, secretions are composed, exist previously in the mass of the circulating fluid; this is especially the case with the secretion of the kidneys, and hence their function would seem to be limited to the task of eliminating or selecting from the blood, during its passage through their capillaries, those substances, by the union of which healthy urine is constituted.

Some eminent physiologists, whilst they admit the truth of this latter rule in the case of the excretions, amongst which they class the urine, deny that the secretions are formed in a similar manner; they are therefore compelled to invest the membranous parietes of the capillaries and ducts with an absolute formative power, by which they are enabled at their pleasure to decompose or combine the principles existing in the blood, and thus to form new substances. Of these two views of secretion, the first expressed seems to me the most simple and rational. The blood, circulating through the body, from its temperature and constant motion, and from the various changes produced in its composition by the generation and discharge of certain gases and the absorption of others by the skin and lungs, and from the constant flow of fresh fluids into it by the lacteals, lymphatics, and veins, forms a mass which may not only be supposed to contain the elements of which all the various secretions are composed, but also to have the power of so combining these elements as to produce those principles which are peculiar to each.

As our knowledge of physiology has advanced, this chemical or formative power of the coats of the vessels,

which seems formerly to have been bestowed on nearly all the organs of the body, has been shown not to exist in some cases. In the lining membrane of the lungs, for instance, the free carbon of the blood was supposed to combine with the oxygen of the air, and give rise to carbonic acid and animal heat; but since carbonic acid has been found to exist already combined in the blood, the case is reduced to one of simple exosmosis, and the absorption of oxygen to endosmosis; as these processes occur in living tissue however, they are of course under the control of the vital power. The discovery of urea in the blood, after extirpation of the kidneys, has also in a great measure destroyed the chemical power with which the coats of their capillaries and ducts were endowed; and these facts, with the difficulty experienced in bringing forward any *positive* arguments in support of the other view of secretion, seem to render it highly probable that the explanation given of that process in the case of the kidneys may be extended to all other glands. That the peculiar principles of certain secretions have not yet been discovered in the blood of the system does not seem to be a sufficient argument for their non-existence in that fluid, and the circumstance may be attributed to the minute proportion these substances must bear to the mass in which they are suspended, to the compound and heterogeneous nature of that menstruum, and to the imperfection of our tests for their detection.

Of the means used by nature to regulate the separation of the proper principles by the vessels of each particular gland we know little or nothing; perhaps the secretion is determined to the interior of ducts or cavities by the free surface existing in that situation, whilst the coats of the capillaries are compressed and supported in all other directions.

It is evident that the structure of glands must exert some influence on the nature of the secreted products, otherwise the differences observed with regard to the length, situation, and minute arrangement of their constituent vessels and ducts would not have existed, for we never find nature to employ a complicated form of apparatus when a more simple one would answer the same end. The coats of the capillaries being porous, and all secreted fluids having to pass through them, it follows that any causes which tend to alter the condition of these coats by relaxing or constringing the contractile tissue of which they are composed, must at the same time enlarge or diminish the calibre of the pores surrounded by that tissue; and by watching the operation of these causes some facts may be collected which will perhaps serve to elucidate in some measure the connection existing between the nature of the secretion and the size of the pores by which it escapes.

In health, there is probably a discriminative or selective power possessed by the capillaries of different organs under the guidance of the organic nervous system, by which the tissue of their coats contracts or dilates according to the nature of the substances applied to each part of it, and thus diminishes and closes, or enlarges, the calibre of the pores. We know that instinct, or the vital power, causes animals to reject noxious matters, and remove them by vomiting when taken into the stomach, and that the roots of plants exhibit to a certain extent the power of selecting from the soil such inorganic substances as are necessary for their nutrition and development. In the higher animals, the lacteals absorb only the chylous or nutritious part of the food, rejecting the excrementitious portion; and, in experiments, their orifices or pores have been even observed

to contract and close on the application of acrid matters, thus manifesting a sensibility to unnatural stimuli, and a disposition to absorb chiefly such fluids as were necessary for the purposes of health. The lymphatics, during their natural healthy action, show a similar discrimination in removing only the effete particles of organs, or such as have served the ends required by their deposition, and whose longer continuance in that part or in the system would prove injurious; and also in absorbing, during disease, those tissues which are least essential to life — as the adipose, the muscles of volition, &c.; not affecting those of involuntary motion — the nervous, glandular, or osseous tissue. And may we not complete the analogy by supposing that in health the pores situated in the contractile tissue of the capillaries of each gland only admit the passage through them of such principles as compose the particular secretion, and contract on the application of any of those other matters, which by their elimination at another point are destined to serve important ends in the animal economy?

From the frequent communications occurring between the filaments of the organic and cerebo-spinal nervous systems we can explain the influence of mental emotions and other impressions acting on the latter system, in changing the quantity or altering the quality of various secretions. They will act either by determining an increased power of contraction in the arteries leading to the gland, or by inducing direct relaxation of their capillaries and enlargement of the pores. Grief, shame, fear, and other depressing passions, probably produce increase of the lachrymal and renal secretions, and the phenomenon of blushing in the latter manner; whilst the profuse flow of saliva at the sight or smell of a savoury dish, and the

increased activity of the spermatic vessels during the excitement of amativeness, seem to be connected with the development of the former cause. But this increased arterial action, as before stated when speaking of inflammation, cannot exist long without diminishing the contractile power of the capillaries, and thus producing a condition favourable to rapid transudation. We also observe the power of the cerebo-spinal nerves over the coats of the capillaries in certain diseases in which irritation of parts adjacent to the trunk of a nerve produces, in the tissues supplied by the terminations of the latter, those sensations which are called sympathetic pains. Thus, in disease of the hip-joint, pain is felt in the integuments of the inner part of the thigh and knee; and not only is there pain, but redness and heat, indicating a relaxation of the capillaries, frequently coexist, and thus by their union constitute a state of the part approaching very closely to inflammation. In the same manner may be explained a fact, noticed by most experienced men, that irritation of any part or organ, if long continued, will terminate in inflammation.

I would next direct attention to some circumstances connected with *albuminous* effusion, as a product of inflammation, and more particularly to the accompanying physical condition of the vessels through which it exudes.

When congestion is set up in the vessels of the cellular tissue of the body, which in health allow the escape of only a very fine vapour through their pores, we find an increased exudation of this vapour, causing watery effusion or œdema, to occur as the speedy consequence of the application of a slight obstructing cause to the circulation through them. If the congestion be greater, so as to be attended with the ordinary signs of inflammation, then albuminous effusion is observed to take

place; and thus Muller says, "If a part, the subject of inflammation, has a free surface, whether there be a wound or not, an exudation of a coagulable fluid (the liquor sanguinis) takes place." The effect of a free surface in favouring effusion we see illustrated in the rapidity with which serous and albuminous infiltration of the loose cellular tissue of the scrotum follows inflammation, and the same remark will apply to the chemosis attending conjunctivitis.

When a ligature is tied round a limb so as slightly to obstruct the return of venous blood from it, at the end of a period, varying with circumstances, serous effusion into the cellular tissue or œdema is found to have taken place. In old and debilitated persons, from insufficient arterial impulse, and also from diminished contractile power of the capillaries, the same circumstance occurs spontaneously.

In the disease called phlegmasia dolens, or that in which there is a pale inelastic swelling of the leg supposed to arise from the obstruction of the femoral vein by phlebitis — if that view of its nature be correct — it may be assumed that the congestion of the capillaries has been sufficient to cause albuminous effusion into the cellular tissue.

In certain organs of the body, which are liable to sudden and great increase in the quantity of blood sent to them, nature seems to have taken precautions and made arrangements in their structure to prevent this effect of congestion from resulting.

Thus, in the erectile tissue of the penis, the veins are large and numerous, and form either plexuses or cells, into which the excess of blood is received, and from which, when the inordinate action of the arteries has ceased, it gradually flows out — albuminous effusion being

also prevented in this case by the dense fibrous tissue surrounding the vessels. In the spleen, a somewhat similar disposition occurs probably for the same reason.

The differences observed in their natural and morbid secretions between the serous and mucous membranes are also worthy of consideration, as bearing in some measure on this point.

The structure of the former membranes is very dense, their vessels are so minute as not to admit the entrance of the red particles of the blood, and a fine vapour is the only transudation through their coats. When, from increased arterial action, a state of acute congestion is produced, it is evident that each vessel, being surrounded on all sides but one by the firm unyielding tissue of the membrane, can only relieve itself by effusion in that one direction, and on that point therefore the whole force of the distending pressure will act. The contractility of the capillaries is soon exhausted, and the impulse still continuing albuminous effusion takes place. In some instances the fluid thus poured out, though in considerable quantity, has contained so much albumen or fibrine, and retained so much of the vital property of the blood, as to coagulate spontaneously when removed from the body after death: in ordinary cases it is capable of organization, and forms adhesions. When the inflammation is chronic, or the congestion less intense, the effusion proceeds more slowly, contains less albumen, and more nearly resembles the products of inflammation of the mucous membranes. These latter are looser in their texture, their vessels comparatively large and numerous, and the porous coats of the capillaries more lax, so that transudation takes place more readily through them. When an increased quantity of blood is determined to the vessels of a mucous tract, which had been

previously in a healthy state, the immediate effect is a suppression of their secretion from the capillaries contracting at first on the application of their stimulus; but as they soon begin to yield to the distending force, and become relaxed, the thinner portion of the contained blood escapes in the form of a copious watery discharge. In ordinary inflammation this discharge gradually diminishes in quantity and increases in its consistence, probably from its slower secretion and the evaporation or absorption of its more aqueous particles. We find this progress to convalescence to be hastened by the use of local and general stimulants of such moderate power as is best calculated to restore the tone of the capillaries. When the congestion is very intense, or when that part of the membrane affected is closely attached to bone or cartilage, so as more nearly to resemble the structure of serous membrane, then a more albuminous matter exudes and forms false membranes, as in inflammation of the larynx, trachea, or pharynx; but these are rarely organized, and the reason of this is not very obvious. Probably several circumstances unite in preventing its occurrence in mucous membranes; thus the effusion will be disturbed by the passage of various matters along the canal, its temperature will be thus affected, the secretion of mucus from any healthy part will also become mixed with it and prevent its close adaptation to the inflamed membrane, and the impulse of distention, or the compressing force applied to the vessels of the latter, may not be sufficient to cause organization of the deposit, whilst all the opposite conditions to these, supposing them to be of importance in facilitating that end, may be shown to occur in inflamed serous membranes.

In procuring the direct union of divided parts, a certain amount of increased action is known to be necessary

for the effusion of an organizable albumen, and in surgical practice these views as to the nature of the agency by which that effusion is effected have been long acted upon. In weak and debilitated subjects the surgeon endeavours to induce the adhesive process by giving stimulants so as to increase the force and frequency of the circulation, and thus cause the necessary degree of congestion in the adjacent vessels from which the effusion takes place: if the arteries of the part do not take on increased action, then no lymph is effused and union does not take place, and if that action is not continued a certain length of time, organization of the effusion is arrested and suppuration results.

In chronic inflammation or passive congestion, as in indolent ulcers, in which the capillaries are relaxed and the arterial action is below the healthy standard, the secretion is thin and watery, but the flow of blood being increased, and an additional impulse given to that contained in the part by general and local stimulants, the effusion becomes more albuminous, healthy pus and granulations are formed, whilst the capillaries gradually begin to recover their tone on the application of their natural stimulus.

Many more facts might be brought forward in support of this view, but perhaps those I have mentioned are sufficiently numerous to justify me in saying, that *albuminous effusion* is always the consequence of a congested or distended state of the capillaries of the part, and that in a healthy condition of the blood the *proportion* of albumen in the effused fluid may be considered as commensurate with the *degree* of that congestion.

There are some circumstances which render it highly probable that the nutrition and growth of the different parts of the body are effected, in the first instance, by

the effusion of albumen in a similar manner. Wherever active nutrition is going on, the arteries of the part are observed to carry more blood, probably to contract more vigorously on it, and to become tortuous in their course. This inordinate action of the arteries will cause some distension and relaxation of the capillaries, as they cannot at once accommodate their calibre and contractility to the greater quantity of blood forced into them; effusion of a more or less albuminous nature will follow, and by its organization the mass of the particular organ will be increased. In childhood, where growth and nutrition go on so rapidly, the size of the arteries is relatively greater than at any other period of life; and wherever the formative action proceeds with the greatest activity, there a disposition of the vessels favourable to congestion, and consequently to albuminous effusion, may be observed to exist. In the brain, which is composed in a great measure of albumen, the arteries are long and tortuous, and the impulse given by the heart's action to the lowest portion of blood contained in them having to overcome the weight of the column above, perhaps more or less of the weight of the brain itself, and also the obstacles to its free passage occasioned by the existence of so many angles and curves, it seems not improbable that an accumulation in the minute vessels of the cerebral substance sufficient to cause the requisite quantity of albuminous effusion may occur. Possibly the peculiar arrangement of the veins and sinuses of the brain may exert some influence over the deposition and adaptation of the effused albuminous matter.

In the impregnated uterus we have a still more striking example of the connection which exists between a congested state of the vessels and the process of growth or nutrition. The spermatic and uterine arteries soon

become enlarged and very tortuous, the corresponding veins accompanying them in their curves, *albuminous effusion* quickly takes place from the vessels lining the uterine cavity, it becomes organized, and the decidual membranes are formed. In the meantime a similar state of congestion has been produced in the capillaries of its muscular and cellular coats, albumen is there also effused, and when organized assumes the nature of these textures, and thus the whole organ is increased in size. The same arrangement of the vessels so essential to the growth of the uterus and to the nutrition of the fœtus continues during gestation, till parturition having taken place the necessity for it ceases, and the arteries remitting their abnormal action the newly organized tissues become gradually absorbed. According to this view of the process inflammation can only be considered as the extreme degree or improper application of a natural and healthy action; and hence the term as usually meant to signify a disease is not perhaps applicable to the processes of reparation or adhesion, and should only be used when speaking of those cases in which the congestion is either very acute, or occurs in parts where, or under circumstances when, its continuance is likely to disturb the nervous system and thus affect the health of the individual, or to prove injurious or inconvenient from the effects to which it may give rise.

Having now spoken of albuminous effusion as the consequence of a morbid or unusual action of the vessels of any part, I would next direct attention to the arrangement which is found naturally to prevail whenever any particular secretion contains much albumen.

The testis is a gland considered by physiologists to be very analogous in its structure to that of the kidneys, its chief peculiarity consisting in the extraordinary length

of its vessels, and in the obstacles which their disposition presents to the easy return of blood from it. This seems the more inexplicable as we find that nature generally tries to facilitate the circulation through an organ, and as I believe that no adequate reasons for the existence of this deviation from the general rule have as yet been assigned, I would submit the following explanation:—

As the testis has not necessarily a constant unremitting function to perform, but secretes most copiously whilst there is an increased determination of blood to it, at such times there must result a certain degree of congestion of its capillaries. This congestion, if sufficiently great, will according to the principles before-mentioned tend to cause the exudation of an albuminous fluid; the proportion of albumen in, or in other words the tenuity of, the secretion varying according to the intensity of the congestion, and consequently according to the vigour and strength of the individual. This theory will explain the presence of albumen in the semen, which consists chiefly of that principle. The origin of the animalculæ I do not pretend to explain, unless it may be supposed that they owe their development to the steady and favourable temperature and moisture, which are circumstances known to be best adapted to fulfil that end in the case of other ova; and perhaps this view is strengthened by the fact, that the retention of the seminal fluid for a certain length of time seems to be necessary for their existence in a perfect form. Probably the great length of the excretory duct, besides serving to support the capillary vessels, is also subservient to the inspissation of the secretion by favouring the absorption of its aqueous portion.

The synovia present in the cavities of joints is another albuminous secretion: its use being to lubricate the op-

posing surfaces of bones, &c., and thus diminish the friction of motion, it is poured out most plentifully, and *probably* contains more albumen during exercise; the secreting membrane and the vascular folds formed by it are also then found redder and more congested than usual. If the exercise and the accompanying determination of blood be too severe or long-continued, the congestion may amount to inflammation; whilst in joints which admit of but little motion, or have not been used for a length of time, the membrane is pale and bloodless, and in all probability, although I am not aware of the experiment having been tried, the fluid contained in it then will be less albuminous and approach more nearly to the composition of the secretion of serous membranes.

If this view be correct the synovial will form an intermediate class between the serous and mucous membranes. When placed in situations where the motion and friction are slight, they resemble the former membranes in structure and in their secretion, as in anthrodial joints, such as those of the carpal and tarsal bones; whilst in the ball and socket and ginglymoid joints the synovial membranes are more vascular, their tissue looser like that of mucous membrane, and their healthy secretion more albuminous and viscid.

But there are two instances of the appearance of albumen in secretions naturally not containing that principle, which bear still more directly on the subject under consideration.

In cows (and probably in all other females of the mammalia) it is a well known fact that when the mammary vessels become distended from the increased determination of blood to them about the time of parturition, the fluid first secreted, termed colostrum, is scanty and bloody, and that it afterwards flows in greater quantity

and not discoloured from blood, and is then so *highly albuminous* as to be used in domestic economy as a substitute for eggs, becoming a solid mass on boiling. Here the same explanation is available: the arteries acting with unusual power force a great quantity of blood into the minute capillaries of the gland, these become swollen and distended, and till they have time to accommodate themselves to their contents a variable degree of congestion, causing various kinds of effusion, is necessarily produced. At first it is so intense as to rupture some of the smaller vessels, and thus cause the presence of blood in the secretion; as these enlarge, it diminishes so much in degree as to be attended with only an albuminous exudation, the relative proportion of albumen present in the effused fluid gradually decreasing as the congestion is removed, till it finally ceases to be recognizable on the application of the same test (heat) for its detection.

Again, the saliva in health does not contain albumen, at least its quantity is not sufficient to affect the ordinary tests for its presence, but in that secreted during the congested state of the salivary glands, which attends mercurial action, it has been found always to exist; and here also, if the point were investigated, the proportion of albumen would doubtless be found to vary with the degree of that congestion.

From the consideration of all these circumstances, I would venture to propose the adoption of the following rule as adequate to the explanation of the cause of albuminous urine in nearly every case in which it may be observed to occur, *viz.*—

That the presence of albumen in the urine is produced by, and its proportional quantity is in a direct ratio to, the degree of congestion of the capillaries of the kidney, from whatsoever cause that congestion may arise.

Having now, I trust, satisfactorily proved that the only condition necessary for the exudation of albumen, and its subsequent appearance in any secretion, is a certain degree of congestion of the secreting gland, it only remains for me to show that such a state of the kidneys may exist in all those diseases which are attended with albuminous urine.

I need not again recapitulate any of the facts and arguments before advanced, to show that in acute nephritis a very high degree of congestion must naturally be present in the inflamed organ; but taking this fact for granted would next direct attention to the bloody and highly albuminous urine secreted in this disease, and to the corroboration which this fact, and the corresponding result obtained in the experiment before mentioned, furnish in support of the correctness of the above rule, and more especially of that part of it which assumes the existence of a relation between the proportion of albumen in the urine and the degree of congestion in the kidney. It would seem that the intense degree of congestion accompanying acute glandular inflammation may also explain another effect of the latter, *viz.* the diminution or suppression of the secretion; for independent of its action in exhausting the nervous energy of the part and the healthy sensibility of the capillaries, it is evident from the anatomical structure of glands, and from the manner in which the capillaries surround the minute divisions of the excretory ducts, that when the former become much swollen from distension the pressure of their expansion must necessarily tend to compress and approximate the walls of, and hence obliterate the cavity naturally existing in, the latter, so that the free surface essential for secretion no longer occurs; whence, in the case of the kidneys,

retention of urea in the blood and the not unfrequent consequence of death as the termination of one of the forms of coma described by Dr. Addison.

In chronic nephritis a minor degree of congestion exists, for the blood does not enter the renal arteries with so powerful an impulse or in such large quantity as in acute inflammation; and hence in the former the relative quantity of albumen in the urine is less. Other causes probably tend also to the same end; for, in addition to the heart participating in the general debility, as shown by the decreased power and activity of the circulation, the blood as the disease advances contains less albumen than in health, and holding a considerable quantity of water the tenuity favours transudation, and its more aqueous portion escapes in the form of urine of a low specific gravity. When from the operation of any accidental cause there is an unusual determination to the kidneys, the congestion will naturally be for the time increased, and as an immediate consequence, more albumen will be effused into the urine; but, on the other hand, if no unnatural excitement, causing increased action of the renal vessels, take place for a length of time, the latter will become accommodated to their contents, and the albumen thus lost to the system may be reduced to a very minute quantity or altogether cease, but will be immediately reproduced on the recurrence of any increase of vascularity and congestion. Both of these alternations have been observed in the progress of disease and afford additional proofs of the truth of the above theory.

In the two experiments to which I have before alluded, where, by removing or destroying the function of one kidney, increased determination to, and consequent congestion of, the remaining one were produced, the urine

was also found albuminous, and this fact shows that excessive healthy action may induce disordered function; and had these animals lived long enough I doubt not but the remaining kidneys would have exhibited more or less of the appearances of chronic inflammation.

When chronic inflammation causes the deposit of a solid matter in the vascular tissue of the organ, a state of more or less congestion must evidently be produced in the remainder, for this deposit occupying the place of vessels compressing those contiguous to it, and ultimately causing their absorption, whilst the renal arteries bring on as much blood as when all the vessels of the gland existed, it follows that more than usual must be distributed to the remaining ones; and as the number of those still pervious is gradually reduced by the obliteration of fresh vessels, a degree of engorgement of them must occur to some extent. It is from the slow and gradual manner in which the deposition generally takes place that the quantity of albumen effused is so small in proportion to the extent of vascular tissue destroyed, as the remaining vessels have had time to enlarge; but when the morbid action goes on most rapidly, the proportion of albumen in the urine will be greater, and in the most insidious it will be very minute.

Applying this reasoning not only to the more regular form of chronic inflammation, or that in which the kidneys are granular or mottled, but to all kinds of morbid deposit in these organs, we shall see how far they admit of a similar explanation. Cases of albuminous urine from other causes have been met with—by Solon in dropsy and obliteration of the certical portion by cysts: by Rayer in three cases, one of hœmaturia with cancer and calculus in the kidney, another of true tubercular disease of it, and the third of

inflammation of that organ and the bladder; by Christison in cerebriform disease; and by Syme in strumous disease. These cases are mentioned in Dr. Christison's work as well authenticated, and it seems to me that they are all explicable by the above rule, for each morbid deposit, supposing it to act simply as foreign matter in occupying so much space, is adequate to the production of albuminous urine; but when, in addition to this, it is remembered that by its irritating action more or less inflammation of the contiguous portion or of the whole organ must be consequent on its continued presence, these two causes of obstruction to the renal circulation seem to me quite sufficient to account for that effect.

There is another class of cases in which, from various causes, the circulation through the abdominal and renal veins becomes more or less obstructed, and thus sometimes spontaneously, perhaps more frequently from the conjoined effect of accidental determination to the kidneys, a sufficient degree of congestion of these organs is produced to cause the temporary appearance of albumen in the urine. Thus it has been observed in cases of peretonitis (probably affecting chiefly that portion adjacent to the kidneys) by Nystel and others; in pregnancy by Rayer; during the crisis of fever, certain cutaneous affections, and some inflammatory diseases (particularly pneumonia), by Solon; in hypertrophy of the heart, with valvular obstruction by M. Forget; in chronic inflammation of the liver by Graves; in pthisis, sometimes slightly in diabetic urine, and in a few other cases, in all of which, either from suspension of the cutaneous function and consequent increased action of the kidneys, or from a direct obstruction to the venous circulation

in which the renal veins participated, some degree of congestion in these organs may naturally be supposed to have existed.

It is now necessary for me to state the exceptions to the above rule, which are chiefly of importance from their interfering with, and in some measure diminishing, the value which might otherwise be attached to albuminous urine as a test of the presence, and even of the degree of renal congestion. They may be briefly stated to be comprised in those cases in which pus or other albuminous matter is suspended in the urine from inflammation of some part of the geneto-urinary mucous membrane. Thus it has been found more or less albuminous in cases of old and severe stricture, in a bladder inflamed and irritated by a calculus, during the passage of a calculus down the ureter, and would probably present the same character if examined in the acute stage of gonorrhea; but it must also be remembered that these affections will each ultimately tend to produce renal congestion and irritation, so that in old cases it will sometimes be a doubtful point to determine whether the albumen is derived from the inflamed mucous membrane or from the kidney.

As the pelvis of the kidney may be considered to form a part of that organ, as we can hardly suppose its lining membrane to be inflamed without affecting that of the tubuli uriniferi, and thus involving the contiguous vessels, and as the definition of this as a distinct disease must be very difficult, and would serve no practical end even if it were possible, the recognition of its existence as a separate affection under the name of pyelitis, as proposed by M. Rayer, does not seem required.

A diseased condition or unnatural fluidity or tenuity of the blood, as in scurvy, or that peculiar condition of

the vessels which induces excessive hœmorrhage from slight causes, and which has been found hereditary in some instances, may each cause the presence of albumen or blood in the urine.

Considerable importance has been attached to the low specific gravity of the urine, as characteristic of granular disease: in the acute form its density is at least equal to that of health, and it is only in the advanced stages of the chronic form that the proportion of solids contained in it is materially reduced. Some relative deficiency may be referable to the fact of the quantity of water in which they are suspended being increased, but it would appear established that there is a decided falling off in the gross amount of solids discharged from the system, and this I shall attempt to explain in the following manner. Urea is found in the blood: it would seem to be the product of a species of decomposition of animal matter going on during the circulation of that fluid, the quantity of it excreted from the system being greatest after the consumption of azotised food, and commensurate with the proportion of animal principles existing in the blood. Now, during the progress of chronic nephritis it has been shown that the blood becomes impoverished, the albumen escaping from it in the urine being replaced by water, and the debility being still further increased from the impediment to nutrition occasioned by the frequent complication of vomiting and diarrhœa.

The substitution of water for the important principle, albumen, must necessarily diminish the quantity of those azotised matters formed in the blood by the decomposition or deterioration of its more animalised portion, and hence the deficiency of urea and the lithates in this disease. Viewed in this light, the low specific gravity

of the urine cannot be considered as indicating more than an impoverished condition of the blood, which state we know may also occur in many other diseases, and hence any value which might otherwise attach to this symptom as diagnostic of this particular affection must be rendered doubtful till future experiments shall decide as to whether a similar state of the urine does not accompany the same condition of the blood in every disease in which the latter is present, as after long continued suppurative or other albuminous discharges.

CHAPTER VI.

General conclusion from the foregoing facts and arguments — objection to it answered — the influence of this opinion, if correct, on the diagnosis, prognosis, and treatment of the disease.

I HAVE now mentioned and discussed the symptoms, morbid appearances, causes, and conditions of the urine, described by authors as peculiar to granular disease of the kidney, and have endeavoured to show that they may all be reconciled with the supposition of the different forms of that disease being identical with so many various degrees of inflammation of the organ. The only objection to this view, that I am aware of, arises from the fact that suppuration is the chief or sole product of chronic nephritis that has been yet observed; but as the cases in which proofs of the previous existence of the latter were looked for, have been generally those in which it followed stricture or calculus, or other disorders, which by their continuance cause a great deal of constitutional disturbance and lessen the vital powers very much, any arguments drawn from this negative evidence must be materially diminished in force.

In conclusion it may be desirable to examine how far these theories, if they ultimately prove to be correct, will affect the diagnosis and prognosis of the disease, and whether, and to what extent, they will strengthen the propriety of, or diminish our confidence in the present plan of treatment.

The diagnosis of no visceral disease can be considered complete without such an examination of the urine as shall enable the practitioner to say whether it contains

albumen or not. The application of a little nitric acid and heat cannot cause much trouble or loss of time, and as the information thus gained is of greater importance than would at first sight appear, every precaution should be taken to avoid fallacy. The urine having been found to contain a certain quantity of albumen, the next point will be to determine the source from which it is derived. If there is a copious muco-purulent sediment, the probability will be that at least a portion of the albumen has been secreted by the inflamed mucous membrane, and inquiries must therefore be instituted as to the precise seat of the congestion. The existence of a discharge, obstruction to the flow of urine, or pain and difficulty in or after its passage, will each indicate some particular disease, and a sound should be passed to gain more precise information as to its locality and nature. In one case, after an attack of scarlatina, I have known inflammation of the mucous membrane of the urethra, presenting most of the characters of gonorrhœa, to occur as an idiopathic affection, and were the urine examined at such a time, it would in all probability be found albuminous. The possibility of the albumen suspended in the urine being derived from this source should therefore be borne in mind. The absence of any adequate cause in the urethra or bladder being established, we may conclude that the albumen present in the urine arises from, and consequently indicates the existence of, a certain degree of congestion in one or both kidneys. By frequently examining the proportion of albumen in the urine, any increase or diminution in the intensity of the renal congestion can be at once detected, and the efficacy of any remedies tested. This simple examination of the urine will conduct the inquiry so far, and if any considerable decrease in the amount of solids contained in it be found

to continue permanently, then the probability will be that from some cause or other the blood is in an impoverished condition; and here any assistance to be gained from ascertaining the constitution of the urine would seem to stop.

The evidence thus afforded as to the degree of congestion existing in the kidney will be corroborated by the character of the febrile symptoms, the nature and extent of the complications, and the intensity of the local signs. Where the constitutional disturbance is great, where the secondary inflammations are acute, and the pain in the loins and other local symptoms well marked in addition to the existence of highly albuminous or bloody urine, the case will pretty certainly be one of acute nephritis; and of course between such a case and the most insidious forms of the disease innumerable shades of intensity will exist.

In determining its causes considerable assistance may be derived from studying its complications; thus, wherever anasarca is found to coexist, the possibility of the disease having been primarily induced by an impaired state of the skin will naturally suggest itself; and inquiries will be made with the view of learning whether from occupation or accident, or from the pre-existence of some exanthematous or other disease, such a disorder of the cutaneous circulation as would arrest its healthy function had not been produced. If the patient has been for a length of time affected with diseased heart or liver, or is in the advanced stage of pthisis, or if a tumour is situated near the course of the large venous trunks of the abdomen, and if the urine indicates only a slight degree of congestion in the kidneys, the inference will be that the latter affection is the consequence of obstruction to the return of blood through the renal veins from

the existence of one of the former diseases. The age and appearance of the patient, and the simultaneous affection of the lung or other organs, will enable us to form an opinion as to the possibility of the renal congestion being kept up by scrofulous or tuberculous deposit in the organ; and if calculous matter has been passed with the urine at any former period, or if the present composition of that fluid is such as to strengthen the idea, we may, in the absence of any other adequate appreciable cause, attribute the albuminous urine and other signs of nephritis to the lodgement of one or more calculi in the kidney.

The general symptoms of nephritis and the manifestation of some of the sympathetic and secondary derangements consequent on its existence, will ordinarily suffice to clear up any doubts as to the *situation* of the disease: the *nature* of the particular morbid action going on in the kidney in any individual case can, of course, only be determined by a close examination of each symptom, and a comprehensive inquiry into the general state of the system.

The prognosis would probably be more favourable if the views here advanced as to the pathology of the disease become recognized and adopted, for we know that inflammation of an important organ, though always dangerous, is nevertheless considerably under the control of our remedies if actively treated at an early period of its development.

Hence, in a case of acute nephritis, affecting only one kidney, and produced by the action of a direct stimulus, as a blow, &c., in a patient otherwise healthy, we may hope, if called in early, to have a fair prospect of subduing the increased arterial action, and ultimately of curing the disease. Where the contrary conditions occur, of course the prognosis must be materially modified.

In chronic nephritis, though the immediate danger is not so great, yet the rapidity of improvement and the chance of ultimate recovery will be less than in acute cases, for the very fact of the existence of chronic inflammation as a primary disorder indicates a debilitated and unhealthy state of the constitution, and till this is removed by proper measures the local disorder is always obstinate and difficult of cure. In the kidneys, however, as in other vital organs (the lungs for example), after the destruction of nearly the whole healthy tissue of both glands, the minute secreting portion that remains is, by an admirable provision of nature, rendered sufficient for the purposes of life, if carefully preserved and only sparingly exercised. Hence in the advanced stages of nephritis, when only two or three masses of tubuli are left of both kidneys, life may be prolonged to a considerable period by carefully avoiding all sources of renal congestion in the shape of diuretics, whether medicinal or dietetic, and by making use of the skin as a secreting organ promoting the circulation through the cutaneous vessels by the use of warm or vapour baths, moderate exercise, friction, and flannel.

It is in the treatment of this disease that the usual opinion as to its pathology, if fully carried out and acted on, would tend to exercise the most prejudicial effect; for the practitioner might naturally hesitate to adopt active depletory measures in a disorder which he considered to arise from constitutional infirmity. Experience, however, in this case would seem to have contradicted and conquered theory; for all physicians who have had extensive opportunities of treating the disease unanimously concur in recommending the employment of an antiphlogistic plan of treatment. Thus in the acute form repeated bleeding, general and local, active cathar-

tics, diaphoretics the most direct and powerful, such as Dover's powder, antimonials, and the warm or vapour bath, and afterwards counter-irritants, have been found most effectually to relieve the symptoms and diminish the intensity and danger of the attack. In chronic nephritis a less vigorous course of treatment, modified according to circumstances, but based on the same principles, is recognised as the only one from which beneficial results can be expected.

There are, moreover, two or three remedies, concerning the propriety of administering which some difference of opinion exists, and which on that account require separate mention. Thus Dr. Christison is disposed to recommend diuretics, whilst Drs. Bright and Osborne consider them as rather injurious than otherwise.

If the explanation which I have ventured to suggest, as to the immediate cause of the albuminous deposit in the kidney and also of albuminous urine, be correct, then all stimulating diuretics are decidedly contra-indicated so long as the continued existence of that cause is manifested. It even seems to me quite possible that large doses of diuretics given in the advanced stages of the disease, when the function of both kidneys has to be performed by a minute remaining portion of secreting tissue, may materially hasten the fatal termination by increasing the degree of renal congestion. Any arguments derived from an apparent increase of the solids discharged from the system in the urine under the use of diuretics must be more or less subject to fallacy, as it has been observed by Woehler, that all substances acting as diuretics contain principles which are themselves excreted by the kidneys.

When, therefore, diuretics are given at all, the condition of the kidney should be previously ascertained by

examining the proportion of albumen in the urine, and if it is found in such minute quantity as to indicate a very slight degree of distention of the renal vessels, then the stimulus of very small doses of diuretics might perhaps cause the relaxed capillaries to recover their tone or contractility more quickly, and thus facilitate the progress of cure. If, however, diuretics are found to increase the proportion of albumen in the urine much, they should either be given in smaller doses and less frequently, or their use may be suspended for a time; and probably they should never be employed till after depletory measures have been resorted to for the purpose of reducing that increased arterial action on which the active congestion of the kidneys depends.

In using counter-irritants, preparations of cantharides, as blistering agents or rubefacients, are of course to be used with caution for fear of absorption.

From the utility of mercurial preparations in inflammation of other important organs, benefit might *à priori* be expected from their employment in nephritis, but experience has hitherto served rather to forbid their use than to recommend their adoption. It has been found, especially in London, that the mouth is very quickly affected, and that a state of constitution on which mercury exerts a very prejudicial influence is induced by the continuance of the disease. But probably in many cases this condition is not strictly a result of the renal disease alone, but of its conjoined action with those depressing causes, such as the use of raw spirits and imperfect nutrition, which we know to have been long in operation in a majority of the cases met with in large towns. Hence, when the acute form occurs in a strong healthy person, in addition to other depletory means, it would seem consonant with reason to employ mercury in some

form with the view of keeping down the activity of the circulation and favouring the absorption of any albumen that may have been effused into the substance of the kidney.

Thus it will be seen that the application of these views of its pathology tends in some measure to facilitate and simplify the diagnosis, to render the prognosis more favourable, and to explain the rationale of the treatment of the disease.

In conclusion, to prevent the possibility of misconception, I would expressly state that nothing in these remarks, even if they prove correct, can at all detract from the acknowledged merits of Dr. Bright as the discoverer of these diseases. To him the honour of having first established the fact of their frequent existence, and of the connection between albuminous urine with dropsy and the diseased condition of the kidneys, and also of having first pointed out the morbid appearances presented by the latter, must ever be ascribed. The inquiries, which the stimulus of his example has already caused to be instituted into the subject, have tended considerably to elucidate many important points in organic chemistry, and may possibly ultimately lead to the acquisition of some more extended knowledge of the process of secretion in general.

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