SYMPTOMS
AND
SIGNS
BY
DOCTOR MALCOLM.

INTRODUCTION TO CLINICAL STUDY.

AN INTRODUCTION

TO

CLINICAL STUDY,

OR,

AN INTERPRETATION

OF

SYMPTOMS AND SIGNS.

A MANUAL,

ADAPTED TO THE USE OF THE HOSPITAL STUDENT.

BY THE LATE

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PREFACE.

THE following pages had well-nigh passed through the press, when
the unexpected and lamented death of their author occurred. They
embrace the substance of a Course of Lectures delivered to the Clini-
cal Class of the Belfast General Hospital, during a previous Session ;
and the author's notes supply conclusive evidence, not only of his
intention of adding more "Parts" to the present, but also that his
projects had been partially effected. It may be stated that among
his papers was found the following sketch of what his intentions were
in the further prosecution of the work of which this was intended to
form Part I. :—

"To be followed by—

PART II.

The Clinical Indications of the Blood, and other Constitutional Diseases ;
with Index.

PART III.

A Series of One Hundred Clinical Lessons, illustrating the application of
Semeiology in actual practice, and including the differential Diagnosis of
resembling Diseases ; with Index.

PART IV. (concluding.)

A Series of Examples of Unusual Interpretation of Symptoms, with other
difficulties in Diagnosis ; with Index."

"Man proposes, but Providence disposes ;" and his premature death
has unhappily extinguished the hope that this and other intended
undertakings should be further proceeded with. His friends, how-
ever, have thought that it was due his memory, and might not be

altogether unacceptable to the profession, and the medical student, for whom he had so long and unintermittingly laboured, that the present volume, with its unavoidable defects and imperfections, should be given to the public. In thus attempting what they regard as an almost sacred duty, they have only to remind the professional brethren of its late author, that as the work consists of the subject matter of lectures delivered to students, so the following pages were intended, if not exclusively, certainly chiefly, for their use. Indulgence, also, is claimed for the too frequent, though obvious, typographical errors of the first two-thirds of the work, in consideration of the peculiar circumstances under which they were printed ; errors, however, which it is hoped will not detract from its usefulness and value.

J. C. FERGUSON.

J. M. PIRRIE.

Belfast, October 20, 1856.

INDEX.

AN INTRODUCTION

TO

CLINICAL STUDY, &c.

THE INTERPRETATION OF SYMPTOMS.

A KNOWLEDGE of the true value of Symptoms is of the utmost importance in practice, as in many cases no other clue exists to guide us to a proper diagnosis. In some instances, it is true, the "history" or the "examination" may indicate the nature of the case without appeal to them, but these are rare; and even these can receive no complete elucidation without taking the symptoms into account. What are symptoms? Briefly and technically they are the expression of disordered functions; as for example, cough, pain, &c., and these have received various qualifications, according to the indications they give, or their nature. Thus some symptoms are "pathognomonic," *i.e.*, at once and of themselves indicating the disease; others are diagnostic, distinguishing the disease from others. Again, some are prognostic, indicating the termination; and others are therapeutic, and point out the treatment to be adopted. Symptoms must not be confounded with actual disease, or with signs. Disease is a pathological process indicated frequently by symptoms, but not always; though at the same time, we must remember that many diseases are so obscure pathologically—indeed have no morbid anatomy visible—that we are forced to describe such by a *group of symptoms*, instead of the pathological process. *Signs* again are true indications; any symptom that distinctly indicates the disease, or any part of the process called disease, or any part of a structural lesion, becomes *a sign*; and it should be our great object to make all the symptoms, *signs* in practice. Sometimes the term is applied merely to *physical* indications—such as the results of percussion, exploration, auscultation—but though these are indisputable *signs*, yet they are not more so than many symptom-signs. In short, any sign which is an object of sense may be deemed *physical*, but only such.

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Were the same symptoms always to arise and assume the same prominence in the same cases, Semeiology would be an easy study ; but in practice it is often far otherwise, and the greatest difficulty arises from the varying states of the same symptoms, both in number and intensity ; and what may seem the most striking symptom may not really be the one which it is of most importance to interpret.

Symptoms, as being disordered functions, must be viewed in two lights—1st, as mere physiological deviations ; and 2nd, as indicative of lesion.   In other words, they must be treated physiologically and pathologically ; and the one will reflect light upon the other.   By the former view, we arrive at a knowledge of the *organ* affected ; and by the other, the *lesion*, or abnormal state capable of producing the disorder of the function.   The former can be always ascertained ; the latter by no means uniformly.

 Every one can recognise a symptom when he knows the nature of the function which is disordered ; but the physician alone can interpret it.   This is the great desideratum with every learner— and you must see how vital such a knowledge must be to you, who are in a few months or years to enter upon that practice which is based upon your knowledge of this very interpretation.   Now, how is this known ?   Can any one ascertain it for himself ?   Three things are necessary.   1st. You must know physiology, or the nature of the function in health.   2nd. You must know pathology and morbid anatomy, or the processes of disease, and the physical evidence of their existence.   And 3rd. You must acquire that clinical experience which has witnessed the connection of the symptoms during life with the morbid states.   These form the ground-work ; and it is plain that practice must tend to improve this knowledge indefinitely ; and, in proportion to the perfection of the previous knowledge on these points, so will that practice become valuable ' experience,' sooner or later.

We shall commence our examination of symptoms with the most prominent and general, as observed on the first view.   I prefer this order, for it premises the symptoms most likely to attract our attention first, and to give us the first idea of the case.

I.—THE GENERAL APPEARANCE.

The general appearance of a patient is the first thing that strikes us upon observing him or her for the first time.   By this single glance we notice several important points.   We become immediately acquainted with his probable stature, size, weight, age.   We

notice his healthy or unhealthy appearance; whether he suffers from recent or slight, chronic or severe, illness; whether he is correctly proportioned in conformation, or deformed; and his very countenance, or, perhaps, it were more correct to say his whole bearing and mien, will frequently at once suggest the disease.

Thus, many of the constitutional states are stamped so clearly that mistake is nearly impossible. *Plethora, obesity, anemia, maras-mus, scurvy, syphilis, scrofula, cancer, gout, hysteria, insanity,* are frequently indicated by a single attentive look. Also the febrile state. Further, many local diseases may be safely diagnosed from a mere general inspection, and the distinction of these into cere-bral, pulmonary, and abdominal, not unfrequently at once made. But as this knowledge chiefly depends upon the interpretation of minute symptoms, which must be very gradually learnt, I shall merely refer in this place to some points of importance attainable by *primâ facie* observation of the patient. Thus it is of consequence to find out, from the appearance, whether the disease is of brief or long duration—whether it has deeply impressed the constitution, whether the constitution is sound or decayed, whether there is any consti-tutional disease present, or whether it is merely local. These points can be generally ascertained by one inspection. The general appearance will also show whether the patient has been seized with illness whilst in the midst of good health, or whilst under the in-fluence of previous disease, whether his strength has much declined, and whether the general state present has any connection with the occupation in which he had been engaged. All nervous diseases are readily marked on a first inspection, during the paroxysm—hœmorrhagic also, and cutaneous, of course. Again, should the patient be in the unconscious state, the general appearance may in-dicate *delirium, coma, syncope,* or *convulsion.*

Among the most prominent symptoms in the general appearance, we have—

The Complexion.—This may be divided pathologically into three classes of cases. 1st, The anemic; 2nd, the hyperemic; and 3rd, the discolourations. The anemic comprise all the complexions characterised by excessive paleness, and indicate the state of anemia. The second are distinguished by an abnormal amount of *redness,* either in unusual situations or general. In healthy and sanguine temperaments, there is a natural redness of the cheeks, and a natural glow in general all over the face. This must not be confounded with the red circumscribed flush of hectic disease; or again, the vinous redness observed in the face of the habitual tippler. Under other

circumstances, redness may be a cutaneous efflorescence, as occurs in the broad diffusive patch of *erysipelas*, or the small but numerous stainings of *rubeola, scarlatina, roseola*, the outbreak of *small-pox*, of *urticaria*, and various erythematous affections. Again, the redness may indicate cerebral congestion—the acute febrile stage—threatening of *apoplexy*, of *epistaxis*; and if of a venous tint, you must look to obstruction or disease in the lungs or heart. Partial redness has its special indication; as redness in the eyelids, indicating *epiphora*; redness of the nose, indicating *gastric disorder*; redness of the lips, in *phthisis*, and *chronic diarrhœa*, and *hectic* generally; redness of the ears and neck implying *congestive* states of the head; redness of the cheeks, of a dark venous tint, indicating *pneumonia*; if crimson, and extending to the nose, *phthisis*; if like a fine venous net-work, *scurvy*, or *nævus*.

Among the discolourations, we have the dirty grey, or earthy hue, the yellow and fawn tints, and the violet or blueish skin. All the constitutional degenerations exhibit the first form; all bilious disorders, the second; and the blue and violet hues will be noticed in pulmonary obstruction, *hydrothorax, capillary bronchitis, laryngitis, pericardial effusion, hepatization*, on the one hand; and in *cholera, ague*, during the cold fit, and in *spasms* and *scurvy*, on the other. This tint, when observed in the fold between the nose and the cheek, is of special diagnostic value, as then indicating *pulmonary congestion*.[*]

The Expression of the face lies chiefly in the play of the different muscles. It is, therefore, under the influence of the nervous system, and may be the result of original diathesis, of long habit, of reflex action, or of nervous disease. Generally speaking, a steady, calm, and hopeful expression is of good import; a natural expression is invariably favourable, even under disease. An expressionless face is indicative of serious cerebral mischief, or of idiocy. A peevish expression, especially in children, is generally the accompaniment of abdominal disease. A wild expression denotes high excitement, delirium, or mania. A heavy expression is seen in *fever, pneumonia*, and all acute inflammations in the typhoid state. An anxious countenance denotes a painful disease, as *dyspeptic* affections with headache, and abdominal inflammations, and is especially marked in some cardiac affections. A decidedly painful expression we notice in *rheumatic* and *gouty*, and *neuralgic* affections, in *colic* and *cramps*; and in short, in all cases of prominent pain. A com-

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[*] An old writer had the idea that by the three wrinkles seen in well-marked featured faces an index-map of disease may be traced on the countenance.

bined painful and despairing look meets us in *Asiatic cholera, ileus,* and acute *peritonitis;* in cholera the peculiar sharpening of the Facies *Hippocr.* is well observed. A frowning look is generally indi-cative of pain. I have noticed it permanently in children affected with *tabes* and *worms.* A lively excitable expression is seen in nervous and hysteric individuals. The Sardonic grin, or a drawing of the mouth, may arise from cerebral disease, or mere gastric irritation and worms, as in children ; or it may occur in nervous or other affections, without cerebral origin, as *hysteria, cholera,* &c. In like manner a constant winking may arise from serious or merely secondary causes ; or it may spring from a local affection of the eye, or even from habit. A sleepy and dull ex-pression is seen in incipient cerebral effusions, in *ramollissement,* in *idiocy,* in *narcotic poisoning,* in *typhus.*

The Manner and Position.—A good deal may be learnt from the manner and position of a patient. Thus a fretful manner, save in the nervous temperament, is indicative of serious disease. A hurried anxious manner is likewise important. An earnest serious manner betokens a grave case. But much depends, in these cases, upon the prevailing temper and disposition of mind. In some cases, for want of this knowledge, a peculiar manner may lead greatly astray—this especially in the case of hysteric females. The attitude, position, and gait, also, frequently give much information. Thus the supine position indicates debility—the prone, pain, especially in *colic.* Inability to keep the head up, denotes *debility, vertigo,* or *paralysis,* which last is more surely indicated by inability to move the limbs, or stand. Complete stillness denotes general *paralysis,* or *syncope, apoplexy, trance, collapse.* Immobility of one limb, or one set of muscles, indicates *paralysis, rheumatism,* or *injury.* The head inclined to one side indicates *spasm,* or inflammation of the neck, tumour in the neck, cervical disease, or injury. A crooked spine indicates partial muscular inaction, *spasm, spinal disease,* or may be due to the effects of *pleuritic effusion,* original defor-mity, or the tendencies of a particular trade. The head is inclined forward in *asthma,* and frequently in *emphysema, bronchitis,* and *tubercles.* The head drawn back denotes *spasm,* or *spinal* disease, or injury, reflex irritation in children, or cervical *tumours;* and *orthopnœa,* and inability to lie down, are observed in *pulmonary* and *cardiac* disease, and *ascites.* Decubitus on *one* side indicates pleuritic pain in the other, or effusion in the same side. A state of restlessness is serious, and indicates fever, acute painful diseases, and tendency to delirium. A hurried gait and excited manner, are noticed in incipient

delirium tremens, and *hysteria.* A slow difficult gait in *chronic rheumatism,* in *gout,* in partial *paralysis,* in *colic,* in pains generally, in cerebral and spinal diseases, incipient fevers, and general debility. An unsteady gait, with dragging of the leg, is seen in *paralysis;* without dragging, in *vertigo.* A stiff gait is noticed in inflammation or tumours of the groin and abdomen. A bent gait is seen in old age, in spinal and abdominal disease, and in general debility. A tremulous gait may arise from *cold, rigors, spasms,* chronic *dyspepsia,* with nervousness, or cerebral or spinal irritation. A cautious gait generally indicates some acute affection, involving one or more joints, injury of the framework, abdominal pain, or *vertigo.* The recumbent posture, with the legs bent, indicates abdominal inflammation, more especially if the weight of the clothes is complained of; if, on the contrary, the pressure of a band is desired, the case is *spasm* or mere irritation. Prostration is seen in all moribund cases, in *low fevers,* in *gangrene,* and extreme debility.

The Voice and Speech are taken notice of at once, and any deviation therefrom easily marked. It is of importance to remember that alterations in the position of the teeth, in the state of the tongue and mouth, the palate, the nose, and the larynx, will affect the voice and articulation, for which, therefore, allowance must always be made. The sex and age must also be considered. A weak voice occurs in debility generally; especially in *cholera,* in excessive nervousness; while *aphonia* is noticed in *hysteria* and cerebral disease, as also thoracic and cervical tumours, as *aneurism.* Hoarseness occurs in *catarrhs,* in *phthisis,* in *syphilis,* and in the case of tumours pressing upon the larnyngeal nerves. A high voice is noted in the deaf, and in cerebral cases, especially the active delirium. The speech may be slow, rapid, and imperfectly articulate. Thus in cerebral excitement, early *congestion, mania, delirium tremens,* the speech is impetuous. Slow speech, in cerebral effusions, *fevers* with cerebral oppression, and in *narcotism.* Total loss of speech is observed in *brain disease, hysteria,* and occasionally *fevers.* Imperfect articulation is of serious import, denoting *paralysis, ramollissement,* extreme pain, *spasms;* at the same time, it may be a habit, as in cases of stammering, or the expression of fear.

The Eye is considered as the most expressive feature in health; in short, the window of the mind. So in disease it is not less indicative. The eye may be prominent or sunken, large or small. It may vary in colour, in lucidity, in capacity for motion, and in power of vision. Thus a prominent eye may denote disease of the

eye-ball, or parts behind it—as tumours of the orbit, or it may be congenital—or it may *seem* prominent from retraction of the eyelids, or from atrophy of the bedding of the socket. If the prominence be gradually increasing, the case is organic; if of rapid growth, it may be merely from congestion of lungs, brain, or heart, or it may be purely hysteric. A sinking in of the eye is seen in cases of *marasmus*, in atrophy of the orbital fat and tissues at the rear. It is generally serious. When these apparent states affect only one organ, cerebral disease, in the absence of a local cause, must be expected.

A blood-shot congested eye may denote ophthalmic inflammation, cerebral inflammation, injury, diseased heart in the advanced stage, *purpura*, all acute and especially the eruptive fevers. A suffused eye, when not purely of ophthalmic origin, is indicative of fever and cerebral congestions. A yellow conjunctiva is noticed in *jaundice*, in some cases of *chlorosis*, in recovery from a blood-shot state, or extravasation; and a dirty brown, or fawn colour, indicates a putrid state of the blood, observed in low and dangerous forms of fever.

A very white and clear sclerotic indicates debility, and is well seen in *phthisis*, in which it is likewise glistening. A dull cornea is seen in old age, and in cases of low vitality. The " arcus senilis," is evidence of *fatty degeneration*. A narrow pupil is seen in opiate and alcoholic poisoning, or in cerebral inflammations, in the first stage.

A dilated pupil indicates cerebral pressure, *apoplexy*, effusion, belladonna or hyoscyamus poisoning. It is seen also in worms, in aggravated *hysteria*, and in *epilepsy*. The eye is generally bright in early cerebral inflammations and *phthisis*, and dull in all other cases of debility, especially in *cholera*, when a film covers the cornea at the close.

Immobility of the eye occurs in sleep, in coma; partial immobility is a *paralysis*; excessive contraction is a *spasm*, and may be either tonic or clonic, the former of more serious import. Squint is occasionally a symptom of cerebral disease or worms. In general it is a mere habit, arising from imperfect equilibrium in the muscles under the will, or it may be congenital.

An immoveable iris is seen in *iritis*, with lymphy effusion, in *amaurosis*, and cerebral disease. The eye is sometimes very sensitive to light, as in early cerebral congestion, in convalescence, in *hysteria*, and, of course, in *ophthalmia* generally. Sight is deficient in chronic cerebral or optic diseases, in *amaurosis*, and in abdominal irritation, as *dyspepsia*, *worms*, besides ophthalmic causes. It is a curious observation, that frequently to patients suffering from cerebral

inflammation all objects appear *red*. Mistaking the colour of ob-
jects, or " Colour-blindness" indicates retina disease. Seeing spots
and nebulæ is a frequent sign of gastro-intestinal irritation. A dark
hue of the lower eyelid is observed in *dyspeptic* attacks, in supra-
orbital and facial *tic*, in *chlorosis*, in *menstrual* irregularities, and ex-
treme general debility.

The Respiration, considered as a general sign, may be indicative of
general states, or of disease in one of the three great cavities. Thus
the respiration may be too slow, too quick, irregular, difficult,
thoracic or abdominal, stertorous, paroxysmal, sighing, or panting.
In a healthy adult, the respiration numbers about sixteen or seven-
teen per minute. If above this standard the respiration is accounted
rapid ; if under, slow.   When too much blood is accumulated in the
lungs, as in fevers, or there is obstruction to the capillary circulation,
then the respirations are increased, hence we find the respiration quick
in fevers and inflammatory diseases, especially of the lungs. Respira-
tion is slow in *apoplexy*, and other cerebral effusions, in *syncope*, in
debility.   It is irregular—*i.e.*, at one time quick and again slow—
in *hydrocephalus*, in cerebral fever, in *hysteria*, in diseases of the
heart, in *asthma*.   It is difficult, *e.g.*, *dyspnœa* and *orthopnœa*, as pro-
duced in thorax effusions, in *pleurisy*, *pneumonia*, and all painful
affections, thoracic *tumours*, and *tubercle*.   Respiration is thoracic
in abdominal inflammations, *tympanitis* and *ascites* ; abdominal, in
fractured ribs, *pleuritis*, and (normally) in children.   When this
difficulty is attended by great *anxiety*, the pericardium may be looked
to.   The respiration is paroxysmal in *hooping-cough*, *asthma*, diseases
of the heart, and frequently in *phthisis*.   It is stertorous in *apoplexy*,
coma and in moribund cases from thoracic disease. Sighing respira-
tion is met with repeatedly in *hydrocephalus*, fatty degeneration of the
heart, in *hysteria*, in chronic abdominal affections and debility.   The
panting respiration is only an exaggerated form of the *dyspnœa*.   In
judging of the respiration, it is necessary to bear in mind that there
is a marked difference normally in the sexes and in the child.   Men
generally breathe by the inferior costals, females by the superior
costals, and infants mainly by the diaphragm.

The Pulse is perhaps the most important sign to the experienced
practitioner.   In considering its indications, we must remember
the normal differences arising from difference of age.   Thus in the
first year it is as high as 120, in the second year, 100, in the third
year, 90, and at adult life it varies from 72 to 78 ; and in advanced
age, it falls as low frequently as 60.   The erect posture also raises

the pulse a few beats; and any exercise or emotion, or even a meal, will have the same effect. The temperaments, also, possess an influence. Thus the nervous temperament has a higher pulse ordinarily than the sanguine or lymphatic, and these again than the melancholic. The pulse, arising as it does from the action of the heart, is influenced mainly by states of the nervous system. Hence it is full, strong, and frequent in *plethora*, and inflammatory affections, *hypertrophy* of the heart, *synocha*, and active congestion. It is frequent, but small and feeble, in *hæmorrhages*, in debility, in *atrophy*, or dilatation of the heart, and moribund cases. It is slow in cerebral conpression and effusion, one stage of *hydrocephalus*, *bilious dyspepsia, hydrothorax* (occasionally,) *apoplexy, syncope,* and *cyanosis.* The irregular pulse denotes diseased valves or walls of the heart, pulmonary engorgement, *aneurism,* or tumours pressing upon the great vessels, pericardial or pleural effusion, cerebral disease, *dyspepsia, worms,* fatty degeneration, *ossification* of the cardiac and other arteries, debility; it is also sometimes observed immediately before the crisis in fevers. It is, occasionally, the normal state, and then becomes regular under disease. The jerking pulse denotes disease of the valves or aorta. The hard pulse may be very small; nevertheless it is a sign of inflammatory irritation, especially in abdominal and synovial affections. When hardness and irregularity combine, either *spasm* is present, or *ossification* of the arteries, or diseased heart. A soft pulse may be rapid, as in fevers in an advanced stage, in *influenza,* acute *dyspeptic* attacks, and *mucous* irritation generally; if slow, it denotes debility, or impending sickness of the stomach. A quick, as distinguished from a frequent pulse, is usually felt in confirmed *phthisis.*

Generally, a frequent pulse denotes some form of the febrile states; and it does not unfrequently happen that this single symptom is the earliest clue to the existence of an obscure and lurking malady, as, *e.g.,* in the cases of *phthisis* and diseases of the heart. It is nearly impossible to give an accurate idea, from mere description, of the minuter shades of difference in pulses; nevertheless the knowledge is of vast import, frequently telling us when to bleed, when to refrain, and when to stimulate. Hence the necessity of taking every opportunity you possess, of *feeling* the character of the pulse in a *variety* of diseases, and especially observing its relation to the varieties of general states, and the stages of local diseases.

The Tongue.—Though the state of the tongue is dependent in an especial degree upon the condition of the digestive organs, yet it frequently gives indication regarding diseases of the head and

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thorax, and hence may be deemed a general sign. In interpreting its different conditions, it is necessary to know, in each individual case, its habitual appearance, and as influenced by various kinds of ingesta.

The tongue may enlarge from local disease, *ptyalism*, *syphilis*, or affections of the digestive organs, or abuse of spirituous liquors. It is observed small in *marasmus*, in low *fevers*, and *cholera*. The papillæ of the tongue are prominent in acute *dyspepsia* and the *eruptive fevers*, especially *scarlatina*. A dry tongue is seen in *fevers*, and inflammatory affections generally, when prolonged or unrelieved. If exceedingly parched, and yet without thirst, the sign is of dangerous import. A pale tongue is well marked in all the states of *anemia*, and generally in excessive debility. A very red tongue is found almost constantly associated with chronic *diarrhœa*, or *dysentery*, or in the *eruptive fevers*, or in convalescence in *typhus*. A livid hue is seen in all pulmonary parenchymatous inflammations, heart disease, in *cyanosis*, *cholera*, in *purpuric fevers*, in *gangrene*, and *moribund phthisis*. The tongue is cold in *cholera*, and in cases of impending dissolution. The opposite condition exists in early inflammatory and febrile affections. A clean tongue may be unhealthy—it is seen in *phthisis* and *hectic*; and if dry, in *fevers*, especially before the crisis, it is most unfavourable.

The tongue may be variously *coated*, from the slightest fur to the deepest deposit.

A slight white fur denotes irritation, either gastric or general. A white moist coating portends deeper disease, either cerebral, or inflammatory, or febrile. When thick in inflammatory affections, it is very serious, especially if continuous. A yellow coating is frequent in fevers, in bilious derangements, and in the typhoid inflammations. A brown hue indicates a more advanced stage, denoting protracted irritation or fever; and the black tint is still more alarming. Generally, an extensive coating, especially if equal, is more favourable than any partial deposit, which indicates a more obstinate case. Aphthæ are indicative of either pulmonary, gastric, hepatic, or intestinal irritation, more especially the latter. The tongue is tremulous in *hysteria*, *delirium tremens*, and low fevers, and with difficulty protruded in these last cases. Ulceration of the tongue is seen in secondary *syphilis*, and in gastric disorders. The lateral protrusion of the tongue, when not from local causes, indicates *paralysis*; and in febrile states, its movements, constitute a good test of the strength of the system.

The State of the Blood.—The blood may be examined in various

ways :—1st, as it appears within its vessels ; 2nd, as withdrawn from the system; and 3rd, as viewed through the microscope. Without resorting to any form of depletion, we can examine it by the first and third modes. Thus by mere inspection of a patient, we can ascertain its colour, its probable amount, the relative quantity of the red globules and watery parts, its distribution, its temperature, and the rapidity of its circulation, all of which give important hints. By inspecting the prolabia, the palpebral lining, or interior of the mouth, you can readily see if the blood be deficient in red globules, or if it be unoxygenated, or obstructed. The former state occurs in *anemia* from whatever cause ; the latter from pulmonary and cardiac obstructions and disease, also cerebral congestions, hæmorrhage, the purpuric state, or *cyanosis.* Yellow blood is seen in *jaundice* ; and a whitish blood in diseases of the spleen, and in certain obese cases. The probable amount of blood of course can only be guessed at, and this only relatively. Thus the skin will be observed hyperemic and distended in plethora, and the inflammatory and poison fevers ; shrunken or colourless in *marasmus,* hæmorrhage, *anemia,* and *dropsy.* The state of *anemia* may be further diagnosed by the stethoscopic examination of the arterial and venous circulation in the neck. The distribution of the blood may be made out by observing the indications of local congestion, such as increased heat, pain, redness, and swelling, and especially the increase of the circulation in the vessels leading thereto. Its temperature will be recognised by the feelings of the patient ; and, still better, by examination with the hand or a thermometer. If in excess, it denotes inflammation, or one of the poison or constitutional fevers ; if diminished, it denotes obstruction to the circulation, or some form of debility, or the rigor state.

The rapidity of the-blood current is partially indicated by the pulse, already alluded to. Supposing that we draw a little blood for examination, we notice several points. Thus the serum may be much tinged with blood, as in *purpura,* low *fevers,* and states of general debility—it may be of a high orange hue, as in *jaundice;* it may be whitish, as in fatty states of the system. The clot may be large and firm, as in *plethora* and inflammations, *rheumatism,* and the pregnant state ; small, as in *chlorosis;* loose and soft, as in mere irritation, with little power. It is tarry in *cholera.* When venesection is attended by early faintness, the case is generally one of nervous irritation. If, on the contrary, long tolerated, *inflammation* may be safely predicated. This, however, only as a rule.

Examination by the Microscope sometimes discloses states of the system otherwise undetected. The globules are adherent, and con-

fluent in *inflammation*. Pus granules show that the suppurative process has been established somewhere. Superabundance of the white globules point to splenic disease; and ill-formed globules prove a deteriorated state of the vital powers and general want of tonicity. The microscopic examination of the blood in disease is, however, as yet in its infancy, but I have little doubt that ere long we shall witness the application of this diagnostic aid to the discovery of many forms of disease at a stage when their presence is only suspected by the subsequent grosser symptoms, accessible to unaided sense. Sugar has been detected in the blood of diabetic patients; urea in *albuminaria;* caseine in cases of inordinate lactation; bile, in *jaundice;* besides various medicinal substances when under administration.

The State of the Skin frequently presents highly important indications. This may vary in degree of fulness, in temperature, in colour, and in sensibility. A certain degree of plumpness is quite natural and compatible with perfect health; but excess or diminution denotes a past or present morbid state. Swelling of the integuments may arise from congestion, from obesity, from accumulation of air, or serous fluid, and partially from tumours, or from suppurations. A general congested appearance is observed in exanthema or eruptive fevers, especially in *erysipelas.* Obesity may be a mere nutritious excess, and not at all incompatible with health, yet it tends to cardiac or cerebral diseases. Emphysema of the integuments is easily recognised by the crackling feeling on palpation, and arises from injury or other means, producing a communication between the cellular tissue and the external air, as, for example, a wound of the lung; or from decomposition. Anasarca may occur after *measles, scarlatina,* or *small-pox;* may arise from cold; may be dependent on general debility, or may be the indication of diseased heart, pleura, lungs, liver, or kidneys; and rarely, from tumours pressing upon the large venous trunks. We meet with anasarca also after protracted discharges, *diarrhœa,* and *hæmorrhagies,* and in *chlorosis,* and similar blood states. Induration of the integuments is seen in children. The state is popularly named " hide-bound," and is the result of lymphy infiltration.

The opposite state, or diminution of fulness, is exemplified in all cases of *marasmus,* in advanced stages of fevers and inflammations, in *phthisis,* in *diabetes,* in diseases attended by chronic discharges, in *cholera,* in the cold stages of intermittents and remittents, in hectic, in chronic *paralysis* and *rheumatism,* and in cachectic diseases, when at all chronic. The most marked specimens are seen in *phthisis,* last stage, and in *Asiatic cholera.*

The skin may be too hot, too cold, or alternate too rapidly and frequently. Thus a high temperature is observed in fevers of all kinds prior to the crisis, more especially in *pneumonia, scarlatina*, and infantile *enteritis*, and the hectic of *phthisis*. It is to be remembered that the parts diseased in acute inflammation, are *cæteris paribus*, of a much higher temperature than elsewhere.

The skin is cold in the rigors of fevers, inflammation, and hectic, in *syncope, paralysis*, and *cholera*, state of sinking or moribund cases, in chronic *dropsy, chlorosis*, and many fluxual diseases, and in cases of *cyanosis*, and *gangrene*, and obstructed circulation generally.

The skin may be high-coloured, or pale, or discoloured. Thus, a red skin denotes *erysipelas*, intense cutaneous congestion generally, or some of the exanthemata. If of a venous tint, it is a case of *cyanosis*, or *apoplexy, intoxication*, or *asphyxia*, or some other form of venous obstruction. A skin too pale is seen in all forms of *anemia*, in *syncope*, in *anasarca*, fluxes, chronic constitutional diseases, in strong emotional states, and debility. Large portions of the skin may be morbidly pale, as in *leucopathia*.

Discolourations comprise various shades of black, of yellow, of grey, of brown, of green, and of blue. A perfectly blackening of the skin of the European is only seen in the staining by the administration of the nitrate of silver; and a darkening to a less extent, in old age, in the various mental states, occasionally in females during pregnancy or at the change of life, and in children of fine skins during the dog-days. A livid hue, approaching the dark, is seen in *purpuric fevers*, and some cases of *typhus*, and when of a blue, leaden colour, is well exemplified in the collapse cases of *Asiatic cholera*.

The skin is yellow in *jaundice*, and to a less degree in incipient bilious disorders and mature hepatic disease. It is seen also in the course of *gastric fevers*, and even *typhus*, and the *synochus*; and, partially, after contusions, or in the decline of *purpura* spots. A greenish complexion is frequently noticed in *chlorosis*.

A brown tint, when general, is observed in persons who have been long exposed to a tropical sun; when partial, it is one of the maculæ of *syphilis, chloasma*, or *melasma*. An earthy grey hue, when chronic, is of serious import, denoting a constitutional *cachexia*, either *scrofulous, cancerous*, or *syphilitic*, or the impression of protracted fevers, or suppurative diseases.

The functions of the skin may be deficient or in excess, as regards perspiration and sebaceous secretion, which may also be vitiated. When deficient, the skin is dry and harsh, as is well seen in *diabetes*, and the first stage of all fevers, and generally in cases of excessive discharge elsewhere. An excessive perspiration occurs in acute *rheumatism*, fevers after crisis, especially relapsing *synocha*, also *hectic*,

phthisis, cardiac and abdominal inflammations, and the remittents and intermittents. It occurs also in pain, syncope, hæmorrhagic reaction, and in extreme mental emotion, as fear ; local sweats, as of the feet, hands, axilla, &c., are connected generally with abdominal disease. Generally warm sweats are of favourable import. On the other hand, the cold sweats, when not the result of mental impressions, or *hysteria*, are serious, especially if clammy, and are best observed in moribund cases. The sweat, besides differing in diminution or excess, may vary in consistence, odour, and colour ; all of which give some indications. Thus a viscid perspiration is observed in states of great debility, as in the lowest fevers, advanced *phthisis*, and abdominal cases; while a watery perspiration is best seen in cases of acute *rheumatism*, and the inflammatory fevers. The sweat may be tinged with colouring matter of various shades ; thus we meet with bloody sweats, yellow, blue, white, and black. The red sweats are hæmorrhagic, vicarious or purpuric. The yellow occur in hepatic derangements. The blue and black are most probably examples of altered sebaceous secretion, and are observed connected with ovarian or protracted digestive affections. The white has been rarely seen in suckling women, and owes its appearance to the admixture of milk globules.

The odour of sweat is sometimes diagnostic. It generally depends upon the presence of ammonia, lactic acid, acetic acid, ozmazom in variable proportion. An acid smell is noticed in rheumatic and gouty cases. Hydrosulphurets, in the sweat, are observed in *fevers, phthisis*, and diseases of the bladder, kidneys, and spinal cord. The odour is mostly sweetish in *syphilis*, mouldy in chronic *psoriasis*, and extremely offensive in *favus* and *impetigo* of the scalp.

The skin may be numb, or even devoid of feeling ; or again, it may be extremely sensitive. Numbness is observed in cerebral and spinal diseases, and in *hysteria ;* and anæsthesia, in *apoplexy, syncope, narcotism,* and *epileptic paroxysms.*

The various degrees of neuralgia or irritation may be noticed in all inflammatory affections, especially of the skin, from the merest itching to the most intolerable torture, in rheumatic and gouty affections, in cerebral and spinal disease, and *hysteria,* and reflex nervous irritation. Irritation at the orifices of the mucous canals generally gives warning of disease within.

The Strength.—In treatment, especially during the progress of diseases, it is of the utmost importance to ascertain at once the degree of strength of the patient. This is known partly by observing the position, partly by the general appearance, espe-

cially the muscular development, and partly by the use of the limbs. Of course, in all debilitating diseases, the strength is below *par*, and especially in fevers, even before emaciation has set in, all severe inflammations, and all *cachectic* constitutional cases. When the debility is excessive, the decubitus is supine, and the countenance sharp and sunken. In chronic cases, the members are shrunken, wasted, and soft, and in all, there is great difficulty in movements of any kind. When the evacuations are parted with involuntarily, the debility is at its height. This condition must be distinguished, however, from *paralysis*, which may exist in states of the system otherwise far from weak ; and from painful diseases, as *rheumatism*, which prevents mobility, merely from the induction of suffering thereby produced. Debility may also be more apparent than real, as in acute inflammations, *hysteria, hypochondriasis*. A marked *feeling* of loss of strength is noticed in the lassitude of incipient fever, the purpuric states, and in bilious derangements. When debility and increased strength alternate, cerebral disease must be looked for ; or, if debility occur suddenly in habits otherwise unaffected by weakening agencies, the same organic affection must be expected. Sometimes the patient feels the loss of strength in a greater or less degree than is real. If the former, it is usually inflammatory, and argues mere vascular disturbance ; if the latter, the nervous system is more deeply engaged.

The General Feeling.—It is of much importance to know *how* the patient feels. Sometimes the kind of answer denotes the nature of the malady. Thus, in a certain stage of disease, especially cerebral, the reply that he feels quite well is of grave importance, while in the same conditions, the answer, that he feels miserable, is most favourable. A patient may feel well, or uneasy, or " sick all over," or " all pained," or feverish, or anxious, or chilly, or may complain of fixed or local pain. When he feels well, it is generally a sign of returning health ; but under cerebral excitement, or in chronic diseases, it is not to be depended on, as the phantom, hope, ever plays about the sick couch even in the midst of visible dissolution. Uneasiness, or a feeling of discomfort, is frequently noticed in the beginning of fevers and acute inflammations, and though apparently an unimportant indication, is not to be despised. It may presage the gravest cases. " I don't feel well," is frequently expressed at the outset of the most fatal maladies, and in many cases this feeling of *malaise* may be the only ostensible one for a long time ere the malady exhibits its unmistakeable characters. In cases of *hysteria* and *hypochondriasis*, however, it is almost natural to

the disease, and is of little weight.   When this uneasiness is accom-
panied by mental anxiety, the case is more alarming, more espe-
cially in quiet and well disciplined dispositions.   Many are the cases
in which death has been accurately foreboded in the intensity of
this feeling.   It is one, therefore, under such circumstances, not
to be overlooked.   It is well marked in the incipient attacks of
cholera, during an epidemic of the same.   Great distress of the
countenance is noticed often in cardiac affections, in *tic doloreux*,
and in the rigors of the poison-fevers.

Feverish feelings are complained of in the formation of the hot
stage of all fevers, in hectic at times, in certain hysteric states,
in acute inflammations, and in acute dyspeptic conditions de-
pendent on undigested substances or erythematic irritation.   Chilli-
ness is natural in a cold atmosphere, but is morbid in the rigor
of fevers and inflammations, *cholera*, and other abdominal maladies,
hæmorrhages and *syncope*.   It is felt also in *hysteria*, the commence-
ment of *epilepsy* and other nervous states, and, frequently, in the
chronic tubercular affections, (especially *mesenteric* disease,) the
supervention of *gangrene*, and suppurations generally.

General pains are met with in fevers, both in the beginning and
convalescence, in *rheumatism*, in *scurvy*, and in the *neuralgia* of *hysteria*,
or cerebral, or spinal disease ; and when localised, the organ in the
site complained of, or that organ whose irritation might cause a
reflex pain there, must be examined as the originating cause.

The Sleep of the patient gives us frequently material aid in deter-
mining the nature of the case.   The following observations will
render this point clear.   We may have *insomnia* in various degrees,
and too profound sleep, and irregular sleep.   The want of sleep
is observed in cases of *delirium tremens*, or *fevers*, in *rheumatism*,
and all painful affections, and especially in cerebral irritation,
nervous states, and chronic affections of the thoracic organs.   It
is not unnatural in the beginning or acme of acute diseases, but
becomes of serious import if continued.   Somnolency may occur
in cerebral disease, after the period of excitement, and in apoplectic
threatenings; also after nervous exhaustion.   Various states of
somnolency have received different designations.   Thus *sopor* is the
name given to a state of somnolency which is characterized by in-
difference to things passing around when the patient is roused;
lethargy, when he cannot collect his senses; *coma*, when he in-
stantly lapses into a deep sleep; and *carus*, when it is nearly im-
possible to arouse him.   These states are most frequent in profound
cerebral oppression from any cause, and occasionally in cerebral irri-

tation from *worms*, *hysteria*, and other nervous states. Restlessness, or uneasy sleep, is observed most usually in inflammatory and acute febrile affections, nervousness, cardiac and aneurismal diseases in the thorax, and dyspeptic states. Sudden startings from sleep are noticed in *hydrocephalus*, diseases of the heart, and asthmatic cases generally. Dreaming is not necessarily morbid, but when constant and unpleasant, generally denotes disorder of the digestive organs. Nightmare is of similar import. Slight convulsions during sleep, are frequently noticed in children, and portend worms, or other intestinal irritation. Unrefreshing sleep argues some inflammatory or nervous state ; and any alteration of the respiration during sleep betokens similar causes.

II.—THE INTERPRETATION OF DERANGEMENTS OF THE NERVOUS SYSTEM.

The symptoms, whose interpretation we have just completed, I have named *General*, because they are signs of very various affections in different organs and tissues. Those upon whose consideration we are now about to enter, are more of *a Special* character, and their indication will be, therefore, proportionally limited. Yet we shall find here, too, many instances of an extended application.

We commence with the symptoms more distinctly referable to the NERVOUS SYSTEM.

The Nervous System comprises the Brain, the Cerebellum, Medulla Oblongata, Spinal Cord, the Cerebro-spinal and the Ganglionic Nerves. The BRAIN may be considered as the seat of INTELLIGENCE, sensation, will—in fact, of power. It consists of gray matter, forming the bulk of the convolutions, and acting as a cap (so to speak) to the white and fibrous-looking portion, which is principally composed of the great nervous tracts, extending to the nerves and other parts of this system. Whilst intelligence is supposed to take up its abode chiefly in the convolutions, or the gray matter, the white substance may be deemed merely the *transmission fibres* between the nerves and the gray. Besides being functionally distinct, these are especially *anatomically* different. Thus, the gray substance is composed of "nucleated cells," of varying size and shape, whilst the white is an assemblage of minute tubes, which are of smaller dimensions towards the gray matter, than towards the nerves. They are also of various shapes ; cylindrical, varicose, or regular throughout, besides many of a flat or riband-like appearance.

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We learn from the experiments of physiologists that the CERE-
BELLUM possesses the power of *co-ordinating the voluntary movements,*
which otherwise originate. This is partly a mental process, yet
acquiring strength, as in the growth of the infant, exactly in pro-
portion to the development of this organ.

THE MEDULLA OBLONGATA (parts of which extend through the
nervous tracts into the *corpora striata, and optic thalami*), has for its
peculiar superintendence, the functions of RESPIRATION, DEGLUTI-
TION, and all acts of volition and sensation. It is perhaps the most
important section of the nervous centres. It is thus not only a
centre in itself, but also a channel for the transmission of the com-
mands of volition, and the calls of sensation. The corpora striata
organs are centres of MOTION ; while the optic thalami are centres of
SENSATION. The *corpora quadrigemina* may be deemed the special
ganglia of VISION : the *olfactory processes,* those of SMELL : the
olivary bodies, or small lobules connected with the crura cerebelli,
those of HEARING : the *ganglia* of the glosso-pharyngeal, and the
fifth, those of TASTE : and those of the spinal nerves, and the fifth,
those of TOUCH.

THE SPINAL CORD has functions which are dependent on its per-
fect union with the brain, and others independent. Thus, in union
with the brain, it is the instrument of sensation and voluntary mo-
tion to the trunk and extremities; and secondly, independently, either
by direct central or peripheral irritation, it may be the medium for
the excitation of movements, as, *e.g.,* in *all reflex* motions. So much
for the cord in general, or as one mass ; but we know it has two
columns, an *anterior* and a *posterior,* whose functions were first clearly
demonstrated by the late Sir Charles Bell. Of his view a very im-
portant modification has been lately made by Messrs. Todd and
Bowman. Their idea (to which, however, they give no higher
title than hypothesis) is that the antero-lateral columns, with the
gray matter, are the *recipients* of sensitive impressions and volitional
impulses, and that they are the centres of the independent or phy-
sical nervous actions of the cord ; and that the posterior columns
propagate the influence of that part of the encephalon which com-
bines with the nerves of volition to regulate the locomotive powers,
and serve as *commissures* in harmonising the action of the several
segments of the cord. However this may be, certain it is that the
roots of the spinal nerves have separate and distinct functions ; the
anterior, motor ; and the posterior, sensory ; and all nerves are
either destined to transmit common sensation, special sensation,
motive power, both sensation and motion, or are ganglionic ; and,
if we agree with the views of Dr. M. Hall, we must suppose another

set of nerves, or at least, fibres, independent of the former, comprising a train of afferent, or incidental, and another of efferent, or reflex nerves—the former " *excitor*," and the latter " *motor*."

The nerves of the GANGLIONIC SYSTEM, as far as is known, possess functions adapted to convey, transmit, and store the vital power necessary for the conservancy and integrity of the operations of the organs of organic life.

Thus, then, every part of the Nervous System has its peculiar office, and hence the importance of this knowledge to *explain* any of its derangements. Yet, it would be out of place, here, to enter more fully into this interesting inquiry. I must be content with pointing out the seat and part of the system affected, in interpreting each symptom of disordered nervous system.

The chief symptoms referable to the nervous system may be ranged under the heads of altered intelligence, sense, common sensation, and motor power.

ALTERED INTELLIGENCE may be of various kinds. The mind may be too active, too bright and precocious: it may be sluggish, impaired, or wholly deadened ; or it may be perverted. The moderate effects of alcohol give an idea of too great excitation ; as also strong emotions, especially of a pleasurable kind. In diseased states, we meet with instances of the brightest intelligence in children suffering from *tabes mesenterica*, *rachitis*, and *scrofulous* diseases generally, but occasionally in any protracted disease of other organs than the brain ; and in adults labouring under *phthisis*, incipient *delirium tremens*, or *hysteria*.

Intellectual impairments are more common, and more important symptoms. They may involve the mind generally, or some of its faculties only. Thus the perception, the memory, the reasoning faculty, may be severally affected, and will have separate indications. Deficient perception of objects, is noticed in inflammation and all structural diseases of the brain, and in threatened *apoplexy*, and prior to nervous paroxysms. Deficient memory in like manner. Mental incapacity and stupidity have various degrees. *Stupor*, or *coma*, indicates some degree of pressure, whether from congestion, hæmorrhage, as in apoplexy, inflammation, tumors, effusion ; also from irritation elsewhere, as sometimes observed in gastro-intestinal disorders. It is also noticed in a diseased state of the blood, as in fevers, opiate or other form of narcotic poisoning, *hysteria*, and idiocy. A perversion of the intellect is observed in all the forms of delirium, from the merest incoherence to the most frightful mania.

Delirium represents some *irritation* of the convolutions, either by

means of the cerebral circulation, by alteration of the blood, by reflex action, or by nervous states. We meet with it in congestion and inflammation of the membranes and substance, and again in hysteria and cerebral irritation, from inflammatory disease elsewhere, as in *pneumonia*; in "*Bright's disease,*" from retention of excretions; in hæmorrhages, from deficient stimulus; in *delirium tremens*, from direct nervous irritation. Though delirium by itself will not positively indicate the nature of a malady, its form may give an idea of the strength of the patient. Thus a furious, or simply active, delirium generally denotes more power than the subdued, and especially the muttering delirium. This last is observed in typhoid fevers; the former in acute inflammations, cerebral fevers, and *delirium tremens*. Many patients become readily delirious in consequence of their peculiar dispositions, as in the case of children and nervous individuals. Others on the contrary, seldom lose consciousness under the severest forms of disease. Delirium may assume the form of mental distress, or exceeding nervous anxiety and dread. This is well marked in cases of *delirium tremens*, and indeed may be deemed diagnostic; but it is also observed, though in a less degree, in some cases of *hysteria* and *hypochondriasis*, and in the beginning of fevers. It is necessary to remember that delirium may be simulated by other states not necessarily morbid, as dreaming, disturbed sleep, delusions, and even mental imbecility, as noticed in dotage. Permanent delirium, of course, indicates insanity.

DERANGEMENT OF THE SENSES must be studied under the following heads:—Exaltation of their functions, Impairment, and Perversion.

The senses may be generally *excited*, or stimulated, in the beginning of fevers (especially cerebral), in *hysteria*, in *hypochondriasis*; *deficient* in all instances of cerebral purpura, in matured fevers, in disease caused by vitiated blood, in insanity; and *perverted* in the instances of delirium. But it is necessary to individualise these indications according to the special sense engaged.

When the power of *vision* is increased, the sensibility of the organ is also augmented. Hence *photophobia*, which is present in cerebral congestion, and local inflammation and irritation of the organ, and *hysteria*. Defect of vision, or *amaurosis*, is noticed in disease of the retina, or the optic nerves, or of the eyeball, involving pressure upon the nerve, or of the brain *in any part of the optic tracts* as far as the corpora quadrigemina; and generally in any disease of the brain, which directly or indirectly obstructs the transmission of optic impressions. Besides these, *amaurosis* may arise from disease or irritation elsewhere. Thus in *vermes*, *hysteria*, diseased states of

the blood, *syncope*, or *hæmorrhage*, diseased liver or spleen, or, indeed, any abdominal irritation. In interpreting *amaurosis*, you must remember that many young persons are naturally subject to *myopia*, or short-sightedness, and the old, to *presbyopia*, or long-sight, in consequence of alterations of the convexity of the cornea peculiar to certain ages.

Perverted vision is of various kinds. Thus, vision of real objects may be incorrect, or there may he apparent vision of objects not present. In the former case there may be half vision, or interrupted vision, in which case, it may arise from corneal opacity, or other obstruction within the eye itself, or it may be a premonition of *amaurosis*, and arise from its various causes. Then again, there may be double vision, which is a much more important sign, especially when limited to a single eye, or when it occurs in cases of spinal disease. Otherwise, there may be present the usual extern causes of *amaurosis*. Vision may be so perverted as to represent objects altogether different from the real outline. In this case serious cerebral mischief must exist, in an otherwise natural state of the eye. Turbid, or clouded vision, when the structures of the eye are safe, implies diseased retina, or altered and discoloured blood. Red vision is an occasional symptom in cerebral inflammations, and yellow, in deep jaundice. Seeing objects as with a brighter hue than natural, indicates incipient cerebral inflammation; and if obscured, or of a darker hue, incipient *amaurosis*. " Scintillation," or the seeing of sparks and other bright lights, is complained of in inflammation, or irritation of the retina, cerebral congestions, or inflammation. The seeing of dark objects (or midge-seeing as it is termed), when not locally accounted for, may arise from gastro-intestinal affections, nervous states, and more rarely, cerebral disease. Mistaking the colours of objects, when not a congenital defect, indicates retina or cerebral disease, and the seeing of objects not corporeally present, may be remarked in delirium, or the forms of insanity.

The Sense of Hearing may be too acute, or dull, or perverted. In fever, incipient inflammation of the ear or the brain, the hearing becomes so acute, that the slightest sound is heard. It is often associated with *delirium* and *hysteria*, or other nervous states. The opposite state, or deafness, may arise from local disease—disease involving the auditory nerve, disease of the brain, directly or indirectly interfering with the functions of the nerve, or abdominal disease. It must be remembered also that great debility, old age, fevers, *syphilis*, may cause deafness, while it may also be likewise congenital. Sometimes, as in the analogous case of the sense of

vision, the patient may seem to hear sounds which really do not exist as atmospheric impressions. Thus "*tinnitus aurium*" is a common symptom in *anemia*, disturbed cerebral circulation, in cerebral congestion, inflammation, in all obstructions to the return of cerebral blood; also, in *hysteria* and *dyspepsia*. It is frequent also after fevers with cerebral complication, and in plethoric cases, precedes *apoplexy* or *epistaxis*.

The *Olfactory Sense* is remarked to be particularly acute in incipient nasal *catarrh*, and cerebral irritation. Its absence or defect is to be traced either to local states, or *coryza*, or disease of the nerve or brain, disease engaging it in its course, or in abdominal affections. When the sense is perverted, it must, in the absence of any local cause, be ascribed to some nervous state, as *hysteria*, or cerebral affection.

The *Sense of Taste* is acutely exercised in many cases of *hysteria* and *hypochondriasis*, and in cerebral disorders; when the sense is dulled, in the absence of local causes, you must look to gastric affections, to fevers, to cerebral disease, or insanity. This sense is, however, more frequently altered. Thus in *hysteria* the most disagreeable food may be deemed pleasant, and *vice versa*. The latter condition occurs in all gastric and hepatic derangements. The insipid taste is especially the characteristic of gastro-intestinal affections. The bitter taste is felt in hepatic and duodenal disorders. The sweet and salt taste occurs in *phthisis*, or in imminent *hæmoptysis*. When acid, you will almost always have present some form of the irritative *dyspepsia*. The taste becomes metallic on the approach of *ptyalism*, but this may occur also in nervous disorders; while a foul taste is merely indicative of a morbid state of the secretions in the digestive tract.

COMMON SENSATION is a property of the sensory ganglia of the nervous system. When these, or the periphery of a sensory nerve is touched or irritated, *pain*, in some form, is felt. When the tract of such a nerve is obstructed, the sensation is dulled or lost; and the same will occur if that part of the brain or spinal cord be injured or diseased which communicates with the nerves so affected. When the sensations are exalted, "*hyperæsthesia*," or a state of extreme sensitiveness, exists, and this must either be local, spinal, cerebral, or hysteric. When diminished, a degree of "*anæsthesia*" is present, which may arise from cerebral oppression, spinal effusions, or pressure from disease, and is the chief symptom of the comatose state, high

delirium, and *syncope.* When the common sensations of a patient are greatly aggravated, *neuralgia,* or various forms of *pain,* exist, which may either be local (in the skin, or nearest tissues or organs), reflected, or of central origin; or imply a constitutional state, as already mentioned above.

Pain is either nervous, inflammatory or irritative. It is of various degrees. Wandering pains are observed in *neuralgia* from *hysteria,* or cerebro-spinal disease, or in rheumatic, gouty, syphilitic, and scorbutic states.

Fixed pain is felt in local inflammation: when periodic, in *neuralgia,* and occasionally in reflected sensation. When in several parts at once, it indicates one of the constitutional affections. Pain may be dull and deep-seated, as in diseases of parenchymatous organs ; sharp, tensive, lancinatory, acute, as in serus and fibrous inflammation ; pulsating as in suppurative inflammations, burning as in cutaneous irritation ; stinging, as in *erysipelas;* prickling, itching, as in pruritic erruptions, and cerebro-spinal disease and *hysteria.* When pain is diminished by pressure, it is *colic* or *neuralgia,* or some form of simple irritation ; and when increased, it is inflammatory. Pains of brief duration are either rheumatic or neuralgic, and seldom inflammatory. Chronic pains indicate inflammation or *cancer.* Remittent pains are rheumatic, syphilitic, or gastric. Intermittent, are neuralgic, or gouty. If localized pain ccntinue long and abate, but does not cease, suppuration must be looked for. A local pain should always be viewed in reference to the nerve or nerves which supply the part, as any sense of irritation along the tract may be more readily detected. The subsidence of pain, when sudden, is sometimes indicative of *gangrene* or of *paralysis.* When gradually abating, it is a sign of returning health.

Great sensitiveness of touch is indicative of local inflammation or *hysteria,* or of cerebral disease. When absent, it argues either a state of total unconsciousness, or *hysteria,* or *paralysis.* When the sense of touch is perverted, it is either the result of *hysteria,* or of serious cerebral lesion.

MOTOR POWER is either voluntary or involuntary. Its states tell of the degree of strength and the integrity of the nervous system. Voluntary motions may be in excess or defect. Involuntary motions constitute the various forms of *spasm.* When there is great excitement of the voluntary muscles, we have a case of *delirium,* as in fevers or cerebral irritation and inflammation, or in *hysteria* and *insanity.* It is well illustrated in *delirium tremens.* When the will can no longer command the usual motions, *paralysis,* more

or less complete, is likely present.   We meet with this state, how-
ever, also in excessive debility, fatigue, rheumatism, and all painful
diseases. Debility is only of bad omen when it is persistent, or occurs
in acute cases.   In combination with *paralysis* of sensation, it is most
generally of cerebral or spinal origin.   Yet we meet with this *motor
paralysis* in such cases as *scurvy*, uterine irritation, *hysteria*, where
there is little danger.   When the debility is general, it is usually
more favourable than when local.   Besides the cases mentioned,
palsy may occur in poisoning, as from lead or mercury.

The limitation of the *paralysis* affords the most important data
for determining the seat of the disease ; as a knowledge of the dis-
tribution of the nerves, enables us to detect, with much certainty,
the particular nerve, or set of nerves, engaged in any given case.
Thus, " *strabismus*," or squint, is often caused by palsy of one or
more muscles, supplied by the *third pair*.   " *Ptosis*" is caused by
palsy of the levator palpebrarum, supplied by the third pair, or from
a spasmodic action of the orbicularis.   It is frequently the pre-
cursor of *hemiplegia* ; but it may be caused by a tumour.   Palsy of
the orbicularis causes a gaping of the eye-lid or " *lagophthalmia*,"
owing to disease of the *seventh pair*.   Palsy of the muscles of the face
is due to the same cause, or engagement of the motor branches of the
fifth pair.   If the former be alone engaged, nothing may be remarked
until the patient speaks, smiles, coughs, &c.   The affected cheek or
side remains motionless, and swells out in expiration.   The labial
consonants are imperfectly sounded ; saliva runs out, and the patient
cannot spit, or blow with the mouth, or snuff with the affected
nostril.   The eye also appears more prominent.   Palsy of the *fifth
pair* impedes mastication, but does not disfigure the countenance.

Palsy of the tongue, and indistinctness of articulation, must be
referred to pressure in connection with the *lingual* and *glosso-pharyn-
geal nerves*.   Want of articulation depends upon palsy of the tongue,
cheeks, and lips, which state, however, does not prevent sound being
made. Palsy of the larnyx is the cause of *aphonia*. Palsy of the bladder
is frequent from over distension, from *hysteria*, from *paraplegia*. Palsy
of the sphincter ani depends upon central nervous pressure or
debility.   *Hemiplegia* may occur gradually or quickly after chronic or
after acute cerebral symptoms, or after attacks of convulsions ; or
suddenly, without previous indication, or after *apoplexy*.   The cause
will be found to be pressure in the opposite hemisphere, most usually
upon the optic thalami or the corpora striata.   *Paraplegia* may arise
from concussion, laceration, extravasation of blood, or fluid effusion,
displaced bone, congestion, inflammation and softening of the cord,
diseased bone, tumours in the spinal canal.   Spasmodic contractions

are in these cases frequent, with or without pain. The urinary symptoms are, first retention or incontinence, then alkaline urine, and the voiding of mucus. The evacuations are slow and dark; sensibility is variable; *priapism* attends; the temperature is higher after injury; and gangrenous sores of the surface common.

General palsy may arise from concussion or *apoplexy*, effusion at the base, chronic cerebral, or cervical disease. Here *neuralgia* is frequent, the bowels are torpid, the urinary organs, as in *paraplegia*, and the skin dry and scurfy, and disposed to ulcerate.

Infantile paralysis may be congenital, may arise from accidents during birth; from dentition or other eccentric irritation, toxœmia, or central disease; and is frequently partial, affecting only a leg or arm.

It is important to notice the conditions of motor power, whether it is in a statef o irritation, or defective. If the former, observe if there be tremors or subsultus, partial spasms or regular convulsions.

Convulsion. The involuntary motions or convulsions, commonly called "*fits*" or "*contractions*," may be tonic or clonic. They may be partial or general, and may attack the voluntary or involuntary muscles; *e.g.*, the *involuntary* are excited in the spasms, gastric and intestinal, palpitations, hiccup, and *angina pectoris*; and the *voluntary* muscles, in nictitation, or the winking habit, arising from irritation of the orbicularis nerves—rolling of the eyeballs, from reflex irritation of the *third pair*, as during dentition—*strabismus*—also twitching of the muscles of the face, causing the "*risus Sardonicus*," due to cerebral disease, affections of the abdominal viscera, or nervousness—grinding of the teeth from *worms*,—*Trismus* from peripheral nervous irritation, &c. Convulsions of the throat are observed in *hysteria* and *hydrophobia*; of the larnyx, in spasmodic *croup*; of the diaphragm, as in combined paroxysms of cough, vomiting, and hiccup. The muscles of the abdomen may be convulsed in *hysteria*, *colic*, and *worms*: the muscles of the spine during spinal disease, in *hysteria*, passage of renal calculi; and those of the upper extremities from disease of the spinal cord or medulla oblongata, or reflex irritation of the lower extremities. When the mental faculties are at the same time obscured, the attack is named "*eclampsia*." This form generally depends upon acute and sudden cerebral congestion. Convulsions may occur on the invasion and at the crisis of acute diseases, especially fevers, in children during dentition, with females at puberty and after child-birth. Very young infants, and generally children of a nervous habit, delicate frame, large head, soft fibre with *plethora*, and all general states inducing nervous debility, or irritation, are prone to *convulsions*.

D

A *Rigor* is a feeling of cold, attended with shivering of the frame, and combined with a certain degree of stiffening and spasm of the muscles. It is decidedly a nervous impression, and indicates various states characterised by nervous irritation. At the beginning of all fevers, especially intermittents, of acute inflammations, and in the hectic stage, it is especially marked. It frequently indicates the moment of suppuration in protracted inflammation, and when repeated, is noticed in *phlebitis*, or purulent absorption. At the same time it bears occasionally a less serious import. It may be excited readily in *hysteria*, by even mental impressions; and in certain constitutions by such a simple act as the introduction of a catheter. In other cases, the passage of calculi, the precursory state of convulsions, and the supervention of gangrene may induce this symptom.

Subsultus Tendinum, or the starting of the tendons, arises from remor of particular muscles, and is most usually observed in those of the forearm. It is a frequent symptom in fevers of the typhoid type, and is indicative of nervous debility; at the same time, it may occur without serious import in cases of *hysteria*, and the nervous temperament. Where these twitchings, in the course of a disease, are noticed in the muscles of the face, the danger is greater.

Jactitation is a more general spasmodic trembling, engaging the muscles generally, and occurring in the lowest states of debility, especially after great losses of blood, or copious evacuations. It is observed most usually with a moist, cool skin, and is always a symptom of serious moment.

Cramp is a violent irregular and tonic contraction of muscles, and is attended by extreme pain. You are aware, that, though purely motor nerves supply the muscles, sensory nerves also reach the myolemma, or binding tissue; and hence, in any irregular contrac tion, or zig-zag shortening, these last will be more or less irritated. Ordinary muscular contraction is attended only by a knowledge of the fact—an impression of the " muscular sense "—but without any pain; on the contrary, in robust health, by a feeling of pleasure, which in the lower animals of the active class, constitutes perhaps the greatest happiness of their lives. In cramp, a muscle is held, as it were, violently, and, for a time, spasmodically rigid; and for some time even after relaxation, the whole part aches—feels sore and bruised, and occasionally, even extravasations of blood eventuate. The most usual sites for this cramp are the muscles of the calf of the

leg (the gastrocnemii), supplied by the *sacral plexus ;* the anterior muscles of the thigh, supplied by the *lumbar plexus ;* the thoracic, abdominal, and lumbar muscles, supplied by the *dorsal* and *lumbar* nerves ; and the muscles of the neck, by the *cervical* branches : and of the involuntary muscles, those of the pharynx, œsophagus, stomach, and intestines, larynx and lungs. Cramp in the calf is usually connected with gastro-intestinal or hepatic irritation— though it may be also *direct* from affection of the spinal cord ; cramp of the bowels is well noticed in spasmodic *cholera.* Other forms may arise from spinal irritation, or other central affections, from *hysteria,* or from reflex irritation from inflamed or irritated organs. Beside these, poisoned or contaminated blood, nervous exhaustion, excessive exercise of the muscles, and injuries, especially punctured wounds of tendinous parts, will induce the painful spasm.

Swoon, fainting, or *syncope,* is characterised by symptoms re-sembling those of deep sleep. There is total absence of con-sciousness, complete relaxation of all the muscles; respiration and circulation are extremely slow and feeble. The countenance is placid and pale, and the surface cold. Its causes are very various, but all may be traced to those acting directly on the brain, and those acting first on other parts, and ultimately on the brain. Thus, it may arise from great fatigue, long-fasting, sudden copious dis charges, as hæmorrhage, excessive pain, operations, great injuries, especially of joints, the irritation of worms, the passage of cal-culi, sudden and profoundly interesting emotions; and from the retrocession of some acute diseases, as *gout,* and the exanthems ; and obstructions to the cerebral circulation, as pressure on the great veins by tumors, &c., strong odours, miasmatic poisons, and ad-vanced fever. Another set of cases have their origin in *cardiac* affections, direct or indirect. Thus, organic *valvular,* or structural *parietal* disease will sometimes induce it. Also the fatty heart, peri-cardial effusion, *hydrothorax,* the pressure of a flatulent stomach and intestines, the pregnant state, and excessive *ascites.*

Headache, also named *Cephalalgia,* is of very general occurrence in disease. Pain of the head is either external or internal, central or reflex, and varies according to the region affected, and the character of the pain.

External pain of the head is known by examination by the hand. Tenderness is felt on pressure, and frequently there is some degree of swelling, extra heat, and even redness. It is felt in all cutaneous affections at their origin, especially *erysipelas,* in *neuralgia* of the

fifth, at its acme ; in *rheumatism* of the temporal, or occipito-frontalis expansion, or muscles ; in *syphilis,* in inflammation of the periosteum, or bone.

The internal headache is either the result of cerebral congestion, incipient or chronic inflammation, or is a nervous symptom, or the reflex of some distant irritation, especially abdominal. When the whole head feels sore and full, a hyperemic state is present, tending to inflammation or *apoplexy.* Frontal headache, if local, is connected with nasal or bronchial *catarrh,* or affections of the frontal sinuses. When supra-orbital, it is *neuralgia* of the ophthalmic nerve, or sympathetic of gastro-intestinal or hepatic derangements. When orbital, it is either local or cerebral.

Temporal headache is felt in *rheumatism, gout;* less frequently neuralgic and cerebral. Coronal headache is either nervous or cerebral ; if permanent, the latter. Occipital headache is felt in fevers at the beginning, in inflammation of the cerebellum, and arachnoid at base, or simply obstruction to the cerebral circulation. I have also noticed this form in renal congestion. The headache may be confined to a small spot, perhaps not larger than the area of a sixpenny coin. This, if periodical, is neuralgic, if persistent, is syphilitic, or more usually cerebral. The pain varies in kind and degree. When deep-seated and boring, it indicates cerebral organic disease ; when merely acute, it is local, meningeal, or reflex ; when pulsating, it is, when not local, nervous, reflex, or the index of disordered circulation. A heavy, constant, dull pain is met with in chronic cerebral disease, as *ramollissement.* A heavy, oppressive pain, in cerebral congestion, or effusion ; or it may simply attend *bronchitis.* When the pain is diffused, remittent, increased by muscular exertion and pressure, and is accompanied by pains elsewhere, it is a sign of muscular *rheumatism.* When a localised pain is deep-seated, boring or gnawing, remittent, and attended by swelling, you must examine for *periostitis*; when the pain is intermittent, recurs at one and the same period of the day, without tenderness or swelling, it is neuralgic.

The congestive, or cerebral headache, may be more accurately determined by observing (in addition to the existence of the pain), the full, plethoric countenance, the injected eye, the dull, heavy expression, the scintillations, the throbbing of the cephalic vessels, the great sensibility to bright lights and noises, and the full, bounding, quick pulse.

The dyspeptic headache is usually local, especially supra-orbital, and is attended by nausea, foul taste, and *anorexia.* Inability for exertion, especially mental exercise, *Tinnitus aurium,* confused per-

ceptions and conceptions, likewise attend. It remits, but frequently returns, until the cause—viz., gastric acidity, indigestion, or other irritation, or disordered secretions, be removed.

The "nervous headache" occurs in persons of the nervous temperament, and especially in females, and males engaged in sedentary employments or occupations taxing too severely the mental power. It is generally very distressing, and accompanied by vertigo, and the symptoms of nervous agitation. The pulse is small, the head cool, and the face pale. *Insomnia* and *anorexia* are also usually present.

The clue to the headache of *hypochondriacs* must be gathered from the indications of the general state, and especially by comparing the account of the malady as given by the patient, with the result of a careful examination of the state of the different organs, when the peculiar incongruity will soon be discovered. Headache sometimes attacks exactly one-half of the head, and is hence termed "*hemicrania*" or *megrim*. It is generally either neuralgic or rheumatic. But it does not seem to be limited or peculiar to any one form.

The "stupid headache" of the ancients is mostly caused by disturbances of the circulation, and defect of sensorial stimulus. It is met with after copious evacuations, great fatigue, and frequently succeeds disease elsewhere, which has depressed the system. The "chronic headache" is generally limited, and arises either from *rheumatism, cranial periostitis,* or *caries,* or chronic cerebral disease.

The study of headache at different ages, is replete with interest; and gives considerable indications for diagnosis. The headache of the infant is recognised by frequent moans, fretting, and crying without apparent cause, and especially by the hand being repeatedly raised to the seat of pain. It is indicative of the irritation of difficult dentition, or digestive derangement. In the child, worms, or disordered gastro-intestinal secretions, are frequent causes; and also, it is not unfrequently the precursor of cerebral congestion and *hydrocephalus.* In the boy or girl, it is mostly the sick or dyspeptic headache that is complained of. In the adolescent female, it is the *amenorrhœal, dysmenorrhœal,* or *chlorotic* headache, or the purely nervous; and in the male of the same age, attention must be directed to the state of the lungs, as pulmonic headaches are not uncommon, and especially in *phthisis* at the early stage. In maturity, look for *rheumatism, dyspepsia,* and *hysteria* in the female, and cerebral *plethora, gout,* and dilated heart in the male; and in old age, *apoplexy,* and softening, *aneurism, cancer,* must not be forgotten.

Headache, then, you will perceive, is a symptom of very varying import, and, therefore, one well-deserving of attention, and deep

clinical consideration. It may be present—indeed, is present—at some stage of almost all diseases ; and, according to the time and circumstances of its occurrence, it acquires a peculiar value, which is, therefore, always relative. It were impossible to state these in this place, as all diseases would require to be reviewed. So, in concluding this section, I would just impress upon you the importance of having in your memory, ready for any emergency, the probable causes of the symptom, and the probable states of the system, or a distant organ, that may be present. In any case of *cephalalgia*, then, let us always endeavour to find out whether it be merely functional, sympathetic, or mechanical ; an illustration of a general state, as *hysteria, scrofula*, &c. ; an inflammatory affection, local or cerebral ; the result of *hæmorrhage* or *anemia* ; of a poison in the circulation ; or the index of a deep-seated and chronic cerebral disease.

Vertigo is a state of mental confusion, or dizziness, with a fear of falling. There is generally a swimming sensation, with illusory sounds, defective vision, feeling of rapid motion, or whirling movements, and tendency to *syncope*. It is dependent on various causes ; all, however, more or less disturbing the balance of the cerebral circulation. Thus, it is common after accummulation of undigested food, in states of debility from fatigue, or exhaustion from disease or *hæmorrhage*, in sickness from sailing, swinging, or rapid motion through the air. It is met with in cerebral affections, especially apoplectic, associated with headache, in cardiac and pleuritic diseases, in fevers of a low character, in *pregnancy*, in *vermes*, and most frequently in *hysteria*. Repeated and chronic *vertigo* is a pretty sure sign of a chronic cerebral disease, even when *cephalalgia* is absent. When objects become dark before the eyes, and the system plethoric, *apoplexy*, or a paralytic seizure may be anticipated.

The State of the Ears should not be overlooked, as it may occasionally give you indications of some value. Discharge of blood or serum from the external meatus may spring from injury or disease of the membrane merely, or from the same of the internal ear ; or from injury of the petrosal sinus, and, of course, fracture or *caries* of the petrous bone. It is possible, nevertheless, that this symptom might arise from the general state, *purpura*, without any local lesion. A flow of pus from the ear, or *otorrhœa*, is common in children, and is mostly a local *catarrh*, or inflammation of the follicles of the mucous membrane. It may be connected, however, with suppuration in the mastoid cells, the internal ear, and of the dura mater

and cranium. In this latter case, facial *paralysis* is not uncommon, soon followed by *hemiplegia* of the opposite side. This discharge from the ear may also be vicarious of other fluxes, which may have been suppressed. It is frequently seen in cases of *scrofula* and *syphilis*.

Pain in the ear is either local (from inflammation or rheumatism) cerebral, or nervous. When it occurs in the course of fevers, it is indicative of suppuration being at hand; and after cerebral ijnury, or inflammation, it is a most serious prognostic. Recurrent swelling of the ear is a sign of gastric or hepatic derangement, but is also observed in scrofulous children.

The State of the Nostrils may be known by examining the discharge, if any, and the condition of the schneiderian membrane, in addition to considering the feelings of the patient. A thin serous fluid runs copiously from the nostrils in nasal *catarrh*. A thicker discharge is observed late in the disease. When pus is seen passing down, in a chronic case, you must look out for syphilitic or scrofulous disease, which will make themselves known by the existence of their peculiar ulcerations. The poison of glanders should, also, be remembered.

Bleeding from the nose, or *epistaxis*, is a very important sign. It indicates a congested membrane, injury, or a purpuric state. When congestion, it is active in *plethora*, especially cerebral, passive from venous obstructions in the lungs, heart, kidneys, or liver. It is noticed in the beginning of acute fevers, especially with cerebral engagement, and at the crisis. Pain in the nose denotes some local inflammation, while itching frequently arises from the irritation due to worms, especially in children; and in the old, it is better to be looked on as a cerebral symptom.

When one of the alæ is observed to lie motionless close to the septum, and nearly closes up one nostril, see if facial *paralysis* be not present; but if the alæ move very rapidly, examine the state of the lungs, for this argues pulmonary obstruction, and is a very useful indication in the case of children. When one nostril is observed dry, there must be some obstruction to the passage of the tears through the lachrymal duct; and if this occur in both, the secretions are stopped from disease of the membrane.

The Temperature of the Scalp is dependent on the quantity of blood circulating therein, and the general state present. In fever at the beginning, in all scalp erruptions, (in *erysipelas* especially), in cerebral congestion, the temperature is greatly increased. In

hæmorrhagic cases, fainting, debility, mere nervous irritation, the scalp becomes cool. This symptom is frequently an important guide in many cases of *delirium*, in diagnosing its pathological cause.

Cranial Measurements are not of any very extensive application in practice. It is important, however, to have some general idea of the normal standard, whereby you may be able to appreciate the value of any deviation. It is a general truth, that the greater the amount of nervous substance, especially of the gray matter, *cæteris paribus*, the greater is the intellectual capacity. Of an average head of adult age, the circumference, horizontally, is from twenty-one to twenty-two inches; over the head, from twelve to fourteen inches; and the long diameter, usually six and three-fourths to seven and one-fourth inches, in this country. Any *great* diminution of these figures in any given case is indicative of mental imbecility, if not idiocy, and any excess, argues either enlarged intellectual endowments, or the supervention of external *hydrocephalus*. A difference in the sides of the cranium—one being atrophied —denotes usually insanity of the "*dementia*" type; it is also noticed that epileptics have frequently peculiarly-shaped skulls. In children, the examination of the skull will inform you of the presence of external *hydrocephalus;* and of the condition of the cerebral circulation, so long as the anterior fontanelle remains open. Delay in this process, or a softened state of the cranium, must be referred to the debility of disease, the irritation and nervous exhaustion due to dentition, or to *scrofulous rachitis*.

The Effect of the Position of the Body, as an index in nervous states, is occasionally highly important. Thus, when headache is relieved by the horizontal position of the body, you may be certain that the cause is either nervous, or a mechanical disturbance of the cerebral circulation. If, on the contrary, it be increased, cerebral congestion is, in all probability, present. Again, if the irritation cease by raising the head, then it is either a plethoric disorder of the circulation, cerebral disease, or injury. If the pulse rise rapidly on setting the patient up, beware of cerebral pressure.

THE GENERAL SYMPTOMS that indicate cerebral disease, require your careful attention, inasmuch as it is from them, in many cases, rather than the more special derangements, that you may be led to diagnose the case, or are necessitated to do so.

The General Appearance of a cerebral case will denote some

departure from the normal state of the nervous system. You may see him in one of two states—with consciousness perfect, and in a state of delirium. In the former, you will notice some alteration or disorder of the special senses, or of the faculty of sensation or motion; while the latter state will at once betray itself in the manner, conversation, and bearing of the patient.

The Complexion may be pale, as in chronic cerebral cases, or flushed, as in the acute. *The Expression* is either exceedingly lively and excited, or dull and imbecile, and heavy; or it may be distorted.

The Manner is always unnatural—too slow, yet immethodic, indicative of absence of mind; or too flurried, denoting cerebral irritation. *The Position* is either too varied, convulsive, or too still. *The Voice*, if atall affected, is altered or lost; and articulation is imperfect. *The Eye* is red, suffused, bright, sensitive, in incipient cerebral congestions; dull and amaurotic in the advanced stages. In the chronic diseases, it loses its wonted expression. *The Respiration* is either quick, or slow, or irregular, noisy or stertorous. *The Pulse* is slow and full, unsteady, too quick, or feeble. *The Tongue* is coated, and inclined to dryness, and eventually becomes brownish. *The Skin* is usually dry and scurfy, inactive, shrivelled; but in cases of extreme excitement, a flushed or perspiring state may attend. *The Bowels* are most frequently constipated, and the evacuations of a dark hue. *The Appetite* is either indifferent or precarious. *The Sleep* is imperfect in the acute; deep, comatose, in the advanced disease. *The Strength* is increased in the congestive and irritative forms, and diminished ultimately in all the paralytic states. *The general feelings* are merely different from those of health, but not peculiar; while the state of *the Blood* may be either plethoric, or inflammatory, or purpuric, or carbonaceous, or even healthy, so far, at least, as present observations lead us to state.

The Reflex Symptoms are a study of themselves. You must make yourselves practically acquainted with Hall's theory, and his own development of it, ere you can properly understand it. But in the term "*reflex*," I would also include all the varieties of sympathetic phenomena. A few examples will perhaps assist your comprehension of this matter. Itching of the *glans penis* is felt in disease of the kidneys. This is an instance of pain reflected from the sentient nerves of the spinal cord. Convulsions may arise from intestinal irritation, as in children. Here the same irritation is conveyed to the spinal cord by means of the sympathetic, and *reflected* on nerves of motion. *Syncope* may arise from impressions on sentient nerves; hence the sensations of cerebro-spinal nerves are reflected from the spinal cord,

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on parts supplied by sympathetic nerves. The well-known occur-
rence of inflammatory *metastases*—as when *orchitis* is replaced by
parotitis—shows that there may be reflected action of the sympathetic
nerves without engagement of the cerebro-spinal system. A similar
law accounts for the vicarious phenomena in pathology. Again it
is well-known that different parts of the same tissue sympathize.
Also similar, though different tissues, and adjacent, though dis-
similar, tissues likewise sympathise. This law also extends to
symmetric organs of similar structure and function; of organs,
though different, of the same system; and the more vital organs
with the nervous system. Then, again, nerves, though different, if of
the same or merely corresponding functions, sympathise—as when
a strong light falling upon the retina produces tickling in the nose.
The following are instances of the application of Hall's theory :—
Dental irritation, *i.e.,* irritation of the fifth, or sensory nerve, may
produce spasm of the laryngeal muscles, of the third pair, of the
fingers and toes, *strangury, tenesmus, convulsions,* and *paralysis.*
Gastric irritation may, in like manner, produce *asthma,* vomiting,
hiccup, and *epilepsy.* A punctured wound may produce *tetanus.* A
poisoned wound may produce the spasms of *hydrophobia.* You will
thus observe that reflex symptoms may be either sensory or motor,
and occur in any part of the body, near or distant from the original
seat of irritation ; always remembering that some parts and organs
are more particularly prone to the result of distant irritation.

III.—THE INTERPRETATION OF DERANGEMENTS OF THE RESPIRATORY SYSTEM.

In order to understand the value of the different Respiratory
Symptoms, it will be necessary to allude, for a little, to the structure
and physiology of the apparatus whose derangements we are about
to consider.

The main use of the respiratory system is, to effect such an
interchange of gases between the blood of the body, and the atmos-
pheric air, as is conducive to the purification of the former. This
is effected by a certain apparatus, THE LUNGS, and frame-work
connected therewith.

The Lungs are compound bodies—parenchymatous organs—
adapted to contain the greatest amount of surface within the
smallest possible compass ; thus resembling the disposition of the
gray matter of the brain, which, by its arrangement of convolutions,
presents an immense amount of vital structure in a very small
space. The lungs are composed of *tubes,* intercellular passages,

air-cells, vessels, nerves, lymphatics, and areolar tissue, all covered by, and intimately connected with a serous sac called the *pleura*.

The bronchial tubes are compound in structure, comprising in their composition, mucous membrane, with ciliated epithelium; circular and longtitudinal muscular fibres of organic life; cartilaginous rings, more or less perfect; and areolar connecting tissues, submucous and submuscular. These tubes terminate abruptly within one-eighth of an inch of the pleural surface—their diameter being, at this point, one-fiftieth to one-thirtieth of an inch. The smaller tubes are destitute of cartilaginous rings, and even the mucous membrane diminishes in thickness with the diameter. These tubes end in the *intercellular passages*, which are distinguished by being simply membranous connecting media for the vast clusters of air-cells, all of which open into them by circular and defined openings. The *air-cells* are of an irregular shape—not by any means globular —smaller in the central parts. Their walls are formed by an exceedingly delicate transparent membrane, totally distinct from the mucous tissue of the bronchial tubes, and resembling, perhaps, the basement membrane of the papillæ of the skin. Immediately in connection with this membrane—the parietes of the air-cells—may be seen the vascular net-work of the termination of the pulmonary artery and veins. The blood is thus brought into all but immediate contact with the air of two cells, and thus is effected the interchange of gases. This plexus of vessels must not be confounded with the distribution of the bronchial arteries, which are essentially the nutrient vessels of the mucous membrane and the parenchyma of the lung. These bronchial arteries are branches of the aorta, and supply the pericardium, bronchial glands, and œsophagus. They follow the divisions of the bronchial tubes, ramify upon them, and ultimately anastomose with the vessels of the cells, but do not enter that structure. The most recent views show that these " two systems of vessels are almost entirely distinct in distribution, termination, and function, and that while the bronchial arteries discharge almost the whole of the blood into the bronchial veins, into the vena azygos, the entire contents of the pulmonary artery pass on to the left heart, through the four pulmonary veins." When we come to explain the signs of *bronchitis, pneumonia,* and *hæmoptysis,* these observations will be more fully appreciated.

In order to judge of the vast extent of the respiratory membrane it is sufficient to bring to your recollection the fact, that it comprises four hundred and forty square feet, or is about thirty times greater than the external surface of the body, that the diameter of each air-cell does not exceed the one-seventieth of an inch—

that the number clustering round each bronchial tube (is by calcula-
tion) not less than eighteen thousand, and that the total number in
the lungs is not less than six hundred millions !

It is ascertained that at least fifteen cubic inches of atmospheric air
are changed by every respiratory movement, which would amount to
two hundred and fifty cubic feet every twenty-four hours ; but even
after expiration, a large quantity remains in the lungs—one hundred
and eight cubic inches. Air once respired is thrown back with a pro-
portion of from four to six per cent. of carbonic acid, and a quantity
of watery exhalation, which in twenty-four hours amounts to several
thousand grains. The absorption of oxygen from the air, and the
elimination of carbonic acid and water, constitute the chief inter-
changes which are the end and aim of bringing the blood and the
atmospheric air in such close proximity. Now, how is the renewal
of fresh air secured ? It is by the mechanism which regulates the
respiratory movements. These movements allow of very consider-
able expansion of the lungs ; so that in many instances as much as
three hundred and sixty cubic inches may be expired by one forcible
effort—a figure which is more than double the ordinary contents
of the lung after ordinary expirations. This mechanism consists of
certain adaptations in the framework, whereby the elevation of the
ribs and the contraction of the diaphragm will allow the ordinary
pressure of the atmosphere to fill the collapsed cells ; and again the
falling of the ribs, the contraction of the abdominal muscles, and
the contraction of the bronchial fibres, will cause such a pressure
upon the lungs as to reduce them to a very small compass indeed.
It is impossible, of course, by any effort, even after death, to express
all the air out of the lungs—a residual portion always remains.

These respiratory movements are partly voluntary and partly
involuntary. They go on during sleep, and in all states of uncon-
sciousness, so long as the cervical cord and medulla oblongata remain
uninjured. The expiratory effort is greater always than the in-
spiratory, the ratio being as three and a-half to two and a-half.
When we consider the elasticity of the lungs, and the parietes of the
chest, this result will not seem surprising, for by the experiments
of Dr. Hutchinson, of London, it is found that the opposing elastic
power of one square inch of the walls of the chest at the end of a
full inspiration, is equal to the weight of a column of mercury whose
base is one square inch and height four and a-half inches. Hence,
in the case of a chest, whose superficies (exclusive of the diaphragm)
is two hundred square inches, the total elastic form will be equal to
a pressure of four hundred and fifty pounds, or two and a-quarter
pounds on every square inch. This interesting fact explains satis-

factorily the difference of duration of the inspiratory and expiratory "respiratory murmurs;" also the quick and frequent respirations in debility, as is well-marked in the infant, and the peculiarity of the breathing sounds at this age, first observed by Trousseau. The lungs and apparatus are supplied by the eighth pair, the phrenic, sympathetic, intercostals, the long thoracic, and the inferior dorsal nerves. Hence the sympathy of the respiratory movements with the stomach, the heart, the larynx, the pharynx, the liver; and externally, the muscles of the neck and trunk; and, through the seventh pair, with those of the face.

These preliminary observations may have been unnecessary, but my desire is to impress upon you the great advantage of applying, on all occasions, and in all your studies, the elementary, but essential, knowledge of anatomy and physiology. As we proceed, you will be more and more convinced of the utility of this practice.

COUGH is, perhaps, of all the symptoms of derangement of the respiratory organs, the most common in pulmonary disease : at the same time, we shall find, that it may exist in the case of perfectly healthy lungs. *Cough* is a violent, rapid, expiratory effort, and may be voluntarily produced. It arises from irritation, either direct or indirect, of the sensory nerves of some part of the respiratory structures. The least irritation of the larynx, or glottis, instantly brings on a fit. The membrane of the trachea is less sensitive; while in health, the deeper-seated parts of the tube seem but ill-supplied with sensory nerves, yet under disease, even these parts acquire an unusual degree of sensibility. Cough, then, may be excited by direct irritation of the sensory nerves of the mucous membrane in health, and to a greater extent and degree, in disease. But it may have other sources. Thus, irritation of neighbouring parts, as the parenchyma (by deposits), the pleura, diaphragm, the stomach, the liver, and tumours pressing upon the lungs. These, however, are not by any means constantly so irritated as to induce cough; hence absence of this symptom would not argue the absence of disease in any of these organs or parts, even the pulmonary parenchyma, or pleura.

Cough varies in many ways. Thus, it may be various from differences in,—1, The source of irritation; 2. The degree of sensibility in the part irritated; 3. The character of the cough itself, *i.e.*, the degree and state of the muscular contractions; 4. The state of the bronchial membrane.

Cough of a constant *hacking* kind (almost without expectoration) may arise from elongated uvula: if produced only on attempting

to swallow, from disease of the œsophagus or pharynx : if suddenly suffocative, and for a time, in rapid succession, it is irritation of the larynx. If acutely *painful*, we must look to the pleura, or for a fractured rib, or other injury. If *convulsive*, it is usually a form of nervousness, or some sympathetic irritation. If it shakes the entire frame, is anticipated with great dread, shrieking and rapidly successive, it is hooping-cough. *Dry* cough is usually nervous, or pleuritic, or noticed in the first stage of *pneumonia*, *phthisis*, and *bronchitis*, besides diseases of the neighbouring organs, as the stomach, liver, gall-bladder ; and all cases of reflex pulmonary irritation, as from worms. The *humid* cough is a symptom in catarrh, and other forms of *bronchitis*, especially the winter cough of old people, the softening of tubercles, and pneumonic suppuration. A *difficult* cough is one which is painful, and unrelieved by any expectoration. It is noticed in acute stages of *bronchitis* and *phthisis*, and *pneumonia*. A long continued cough is either chronic inflammatory, or tubercular. The cough is wheezing in *bronchitis*, and hooping in *pertussis*, *croup*, and *laryngitis*, and arises from narrowing of the pulmonary tube. It is barking or hollow in chronic *bronchitis* and *hysteria*. The paroxysmal cough is heard in cases of *asthma*, softening, and cavities in tubercular disease ; hooping-cough, in which the intermissions are nearly perfect; and in chronic *bronchitis*. A chronic hoarse cough denotes ulceration of the larynx ; a croupy cough, congestive or plastic inflammation, when not nervous.

Cough has various indications according to the age. Thus, in the infant, if short, caught, distinctly obstructed, it probably marks *pneumonia;* if constant, but free, *bronchitis*. In the child, it is usually bronchitic, pleuritic, or sympathetic, from abdominal irritation. In the adolescent female, it may be bronchitic, hysteric, or from uterine irritation. In the adolescent male, *phthisis* should be looked for. In mid-age, *pneumonia*, *pleurisy*, and *bronchitis* generally ; and in females the state of the digestive organs may be inquired after. In the old, (if chronic,) *bronchitis*, *emphysema*, *asthma*, and heart diseases are the most common causes.

When cough is short, painful, and attended with livid lips, and a brown congestion of the cheeks, look out for *pneumonia*. When hacking, frequently paroxysmal, frequently dry, with flushing and perspirations, *phthisis* should be suspected. When there co-exists frontal headache, aggravated by the cough which is wheezing and constant, but increased by accummulation of phlegm, by atmospheric changes, and on retiring to, or leaving the bed, some form of *bronchitis* is present. Cough induced *only* in certain positions, is

of some diagnostic value. Thus cough brought on by turning on one side is noticed in lesions of the pleura, or parenchyma of the inferior lung. Cough induced by keeping the head low is noticed in *hydrothorax, pericarditis,* and other diseases of the heart, and in *ascites.* Cough induced in suddenly rising up, or on any sudden movement, is observed in *bronchitis* and *phthisis,* and arises in great measure, from displacement of accumulated mucus. Cough that induces pain of the head is usually bronchitic; pain of the abdomen, peritonitic; pain of the side, pleuritic, pneumonic, hepatic, or splenic. Cough that completely intermits is either *pertussis,* hysteric, or reflex, seldom bronchitic, save in the very advanced stages.

EXPECTORATION may be considered under two points of view— either as the *act* of expectorating, or as the *matter* expectorated 1. In the first sense, expectoration is the act of expelling anything from the bronchi. In health, the natural watery exhalation passes off as vapour; but even in disease the arrangement of the tubes, as to their contractile fibres, is such as to act with the greatest advantage in expelling any foreign body from their premises; besides, the motions of the ciliæ of the epithelia tend to carry objects of irritation right on towards the larynx. These natural and in- voluntary means are, however, greatly enhanced by the voluntary expulsive efforts of hawking and coughing. These efforts are greatly increased likewise by repeated closing of the glottis; and in cases where this cannot be done, or is useless (as after the operation of tracheotomy), there is great danger of suffocation from inability to expectorate. The same result is also produced when debility prevents such inspiratory efforts as will permit of a sufficient quantity of air behind the object of irritation and obstruction, to act with sufficient momentum towards expulsion.

Difficult expectoration is usual at the beginning of acute inflam- matory affections of the lungs; but when persistent, it denotes either engagement of the parenchyma, or a great degree of debility. Hawking as frequently denotes irritation at the fauces and pharynx, as at the lungs, and even the pressure of a tumor (as *aneurism*), will induce it.

2. *The Matter of Expectoration* is usually a most compound mass, including, as it does, not merely the usual mucus (altered, or other- wise,) of the bronchial tubes; but that of the mouth, the saliva, portions of ingesta, entangled in its passage through the fauces; the secretion of the tonsils and numerous glands of the mouth, and further, various heterogeneous substances, as tubercle, coagulable lymph, calculi, melanotic matter, hydatids, and other matters

developed occasionally in the lung; and lastly, purulent fluid from the pleura, mediastinum, and even the liver, which has reached the bronchi by perforated communication.

The following kinds have been noticed in practice:—

1. The *mucous expectoration* is chiefly composed of mucous cells floating in a thin viscid fluid. This kind varies in consistence. When the watery fluid predominates, and the mucous cells are few, we notice such in incipient *catarrh*, in old *bronchitis*, and occasionally in chronic *pleuritis*. When the true mucous element prevails, the catarrhal *bronchitis* is more advanced, and we meet with it besides in resolving *pneumonia*, and chronic cases of *bronchitis*, and phthisical *bronchitis*.

2. The *purulent expectoration* is met with either pure—*i.e.*, a mixture of pus cells floating in an albuminous fluid, or mixed—*i.e.*, combined with the former variety. This expectoration is opaque and of a creamy colour and consistence. It is met with in *bronchitis* (advanced stages) especially in the vesicular form, in the suppurative stage of *pneumonia*, in *phthisis* at the softening and ulcerative stages; and in cases of perforated communication with purulent collections in the pleural cavity, liver, or mediastinum. It is a nice point sometimes to decide if pus be present in a given specimen of expectoration. Many tests have been proposed, *e.g.*, pus sinks—mucus floats; pus is not viscid, and is easily diffused in water—mucus is stringy, and cannot be diffused; epithelium cells abound in mucus— seldom in pus; mucus is not coagulated by heat, though it is by acetic acid—pus is, for the pus cells float in an albuminous fluid. Microscopically examined, pus cells are more distinct, and occupy uniformly the entire field, giving the impression of a number of miniature white marbles lying in one plane; while mucous cells are of a gray hue, with shadowy outline, many elongated, and lying loosely on a stringy, tenacious, ropy-looking fluid, which is not albuminous. Pus, mixed with potass or ammonia water, becomes instantly transparent, and so thickly gelatinous as sometimes to allow of the inversion of the vessel containing it, without any falling out. Pus always contains some oily matter—mucus seldom. This is ascertained by the ether test. Pus may be taken upon the point of a glass rod in drops—mucus cannot. If a minute drop of pus be placed between two portions of plate glass, and if we look through it, placed near the eye, at a distant candle, we observe the most distinct and interesting phenomena of circles coloured like the rainbow—with mucus, no such effect is produced. (This last test of distinction is mentioned by Dr. M. Hall.) Notwithstanding these differences, some have distinctly stated, that they are identical.

Certain it is, that pus may be secreted after mucus from an unbroken mucous membrane, and the cells are so very similar under a high power that they may be considered as being secreted in a similar manner. The presence of pus, however, always denotes an advanced stage, and a more serious lesion, whether it originate in an ulcerated, or an entire surface.

The state of *viscidity* of the sputa gives indications of value. Thus almost exactly in proportion to the degree of tenacity, so is the degree of inflammatory action present. This gives a clue to the progress of cases of *bronchitis* and *pneumonia*. The colour, also, should not be overlooked, and even the shape of the sputa. When transparent, it is purely mucous, or watery; when greenish and opaque, it is still mucus, thickened, and marks a favourable change— generally a crisis of *catarrh;* when yellow or creamy, pus is most commonly present; when gray or bluish, it is most usually pharyn- geal or buccal mucus. When nummular, and, as the old authors call it, *concocted*, it indicates advanced *catarrh;* and when polypoid, *i.e.*, presenting a branching appearance, it denotes that lymph has been thrown out, which coagulating, has assumed the form of casts of the bronchial ramifications.

3. *Bloody expectoration* is, perhaps, the most important and in- teresting. It varies indefinitely in appearance and amount. It may appear of a mere buff, yellowish, or brownish tinge —as a streak of blood—as a rust-like mixture of blood and mucus, or pus—or as regular hæmorrhage. The buff tinge, if tenacious, is just as in- dicative of *pneumonia* as the more decided rusty form; but as it ap- pears early or late, it has different values; in the former case, being indicative of incipient *pneumonia*, and in the latter, of the resolving, or chronic stage. The pure streak of blood, is a simple *hæmoptoë*, and is found in the expectoration of *phthisis, hooping-cough, bronchitis*, and sudden congestions; and, occasionally, proceeds from the gums and throat—parts which you must carefully examine in all cases of bloody expectoration.

Expectoration of the damson shade is seen in the gray hepatiza- tion of *pneumonia*, and is rather rare. The black shade must be accounted for by the presence of *melanosis*, or as indicating a case of the miner or coalheaver's *phthisis*, or, accidentally, from the presence of gallate of iron in patients under the influence of gallic acid. *Hæmoptysis*, or a flow of pure blood from the lungs, is generally of serious import. It has various sources; the bronchial membrane, by exudation, rupture of small vessels, tubercular cavities, or softening, pneumonic or gangrenous cavities, the bursting of an aneurism; and occasionally a sudden pulmonary congestion from

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over-exertion or after disease, states of purpura, and vicarious causes. Hence the difficulty of at once defining the source of *hæmoptysis* in many cases. It is also very important to distinguish *hæmoptysis* from *epistaxis*, *hæmatemesis*, and *hæmorrhage* from the pharynx or neighbouring parts. Let us always remember that pulmonary blood is florid and *frothy*, when not excessive in quantity ; gastric, on the contrary, is dark purple, and destitute of air-bubbles ; pharyngeal hæmorrhage will at once disclose itself by visual examination, while epistaxis-blood is always hawked up with frequent attempts at swallowing, in consequence of the irritation of the trickling fluid at the posterior fauces.

4. The presence of *oil-globules* in the sputa, is owing either to an admixture of some oleaginous ingesta, or the co-existence of purulent or tubercular matter.

5. *Tubercular* matter has been detected, mixed with pulmonary (elastic) tissue. · It is found in the form of whitish gray friable particles, and occasionally as calcareous concretions, indicating a more advanced, yet quiescent stage.

6. *Coagulable lymph* may be expectorated, as in *croup* and plastic *bronchitis*.

7 and 8. *Cartilaginous concretions* are generally portions of the bronchial rings, or the walls of the larynx ; while *hydatids* may originate either in the parenchyma of the lung, or spring by perforated communication from the liver, which is a more favourite seat.

The *odour* of expectoration is occasionally characteristic, especially when cadaverous—as then old suppurating or gangrenous cavities are indicated. There is a faint, sickly odour always arising from the expectoration of advanced phthisical cases, and pneumonic abscesses ; and that of old bronchitic cases, when purulent, becomes likewise very mawkish, so that merely entering the patient's apartment, may truly suggest the nature of the case.

The *taste* of the expectoration is sweet, salt, bitter, or insipid. It is sweet in incipient tubercle, especially if *hæmoptysis* occur ; saltish in advanced *phthisis* and incipient *bronchitis* ; bitter in hepatic complications ; and nauseous in all suppurative states of the lung.

The absence of expectoration would point out *pleuritis*, *phthisis* at the outset, occasionally *pneumonia*, nervous cough, and pulmonary irritation—from hepatic, gastric, or peritoneal disease, or thoracic tumours.

Trifling expectoration, if purely mucous, has nearly the same signification. Very copious expectoration, or *bronchorrhœa*, is observed for the most part in chronic *bronchitis*, and suppurative states of the lung, or parts communicating therewith.

THORACIC PAINS are very common phenomena in disorders of the pulmonary organs. They may be considered according to their intensity, persistence, seat, and the degree of tenderness on pressure of the region complained of. Very *acute* pain in the chest is observed in *pleurisy*, and *pleurodynia*, or intercostal *neuralgia*, in *hysteria*, from spinal irritation, from pressure of a tumour, spinal disease or injury, from fractured ribs, and from *rheumatism* or *syphilis*. *Dull* pain indicates *bronchitis*, *pneumonia*, hepatic disease, intra-thoracic tumours, cardiac disease, chronic *pleuritis*, and pulmonary congestion.

Transient pain is either neuralgic, hysteric, or rheumatic, or proceeds from straining of the muscles. *Constant* and persistent pain has the same indications as the dull pain.

Pain of the sternum is bronchitic chiefly—periosteal, or osteal, and occasionally an index of *aneurism*. Pain of the side is either pneumonic—especially if felt under one nipple—or pleuritic, pericardial, neuralgic, hysteric, or rheumatic; or simply a displacement of the latissimus dorsi.

Pain in the cardiac region denotes either heart disease, *hysteria*, *angina pectoris*, or *pleuritis*, or gastric flatulence. Pain of the spine indicates either *bronchitis*, spinal disease, *aneurism*, or *hysteria*. Pain of the shoulder denotes (if the right) hepatic disease, *rheumatism*, injury, or a local inflammation. Tenderness on pressure, with increased temperature, generally indicates real inflammation, *rheumatism*, or *periostitis*. Relief on pressure is noticed in hysteric and neuralgic affections.

In considering the value of thoracic pains, let us always bear in mind the physical cause. It must either arise from affections of the parietal sensory nerves ; or from irritation of such nerves as will induce sympathetic pain (as spinal irritation), irritation of any filament of the respiratory nerves, or a general nervous state. So that even these physiological data will, in many obscure cases, suffice to enable you to detect the proper cause.

The Vital Capacity.—A novel means of making our diagnosis more accurate, has been lately introduced to the profession under the term "*Spirometry.*" It is a method first scientifically employed by Dr. Hutchinson, to ascertain the permeability of the lungs. By means of this plan, we are enabled, *a priori*, to determine the number of cubic inches of air a healthy man should inspire or expire, provided the individual selected be in perfect health, and his exact height known. These interesting results are based upon the data afforded by three thousand experiments carefully conducted. Dr.

Hutchinson has arranged the varying quantity of air contained in the lungs as follows :—

1. The residual air, or quantity remaining after the most complete expiration.

2. The reserve air, or the quantity left after an ordinary expiration, *minus* the residual air.

3. The breathing air, or the difference between the air of ordinary inspiration and ordinary expiration.

4. The complemental air, or the *extra* quantity inspired by a forced effort.

5. The " vital capacity," or the aggregate of the reserve, the breathing, and the complemental air, or the whole amount of air taken into the chest by the greatest inspiration.

The instrument adapted to make the experiment is constructed on the principle of an ordinary gasometer, and is patented by Dr. Hutchinson himself. In these experiments, a most curious principle was ascertained—indeed the only one I may say which gives value to this means of diagnosis. " On carefully examining a great variety of chests, and observing their circumference, breadth, depth, and even measuring the absolute capacity of several individuals after death, by taking casts of their thoracic cavities, Dr. H. found that the size of the chest bore no necessary relation to the height, and that while many tall men had very small chests, and many short men very large chests, *their vital capacities always remained proportionate to their heights.*" The explanation of this is as yet unknown. Position also makes a material difference. Thus standing is the most favourable, sitting next, reclining next ; supine and prone lying the least. The proportion of vital capacity to height is readily ascertained, by remembering the vital capacity for five feet stature, and that eight cubic inches must be added for every inch of height between five and six feet. Thus if a man be five feet eight inches, he should have a vital capacity of two hundred and thirty-eight cubic inches ; another, five feet nine inches, should have two hundred and forty-six cubic inches instead.

Besides height, weight possesses some, but only a limited influence. If a man weigh ten stone and measure five feet six inches in height, he may increase to one hundred and fifty pounds without any loss in his vital capacity, but for every additional pound, you must deduct one cubic inch.

This vital capacity attains the maximum between the ages of thirty and thirty-five years, and afterwards falls at the rate of one and a-half cubic inches for every year.

Now let us see the application of this method in determining

disease. It is plain that a deficiency in " vital capacity" cannot de-
termine the precise cause of the loss ; but it will, if great, determine
a congenital condition ; or, that disease must be present, or have left
its traces on the lung; and in cases especially of pulmonary consump-
tion in the early stage, when few or no diagnostic symptoms are
present, it gives a probable and (if comparative examinations are
made) in the absence of congenital deficiency, an unerring clue to
the existence of *tubercle.* Dr. Davies, a recent author, says (and I
can, for the most part, corroborate it from my own experience)—
" My own observation readily brings to my recollection nume-
rous instances where the ordinary means of investigation have
failed to satisfy my mind, and where the difficulty has been greatly
removed by an examination by the *spirometer* of the respiratory
powers of the patient." Besides, there are many cases constantly
applying, of what might be called *phthisis-phobia,* whose fears a
single trial of the instrument will enable you completely to dissipate.
In the formation of a medical opinion of a life proposed for in-
surance, it is of the utmost value, not merely in satisfying the
mind, but in suggesting a careful examination of the thoracic
organs, in cases ordinarily by the other usual tests and personal
appearance, unexceptionable.

Inspection.—The indications derived from a mere visual inspec-
tion are occasionally of great value, suggesting sometimes the actual
disease, or at least the most probable lesion. This inspection can
only be properly made when the thorax is bared. You will notice
almost instantaneously the rounded barrel-shape, characteristic of
emphysema; the inequality of the bulging of the sides, due to
pleuritic effusion, or *pneumo-thorax* in one, or *contraction* in the other
from absorption of a previous empyema; the subclavicular flattening,
and the characteristic emaciation due to *phthisis*; the inequality in
the intercostal contractions of the sides, arising from pneumonic
consolidation, partial emphysema, pneumo-thorax, and pleuritic
effusion ; the character of the respiration, any displacement of the
heart or liver, any parietal tumour, and lastly, any deformity from
injury, or original disease, or congenital formation.

In making this inspection, it must be borne in mind, that com-
parative differences of the sides are of the most importance, and, of
course, of the corresponding regions ; and care must be taken, that
tumours in the abdomen,. which may press upon the diaphragm,
may not lead to a simulation of thoracic disease. At the same
time, it must be recollected, that there may be certain natural or
acquired bulgings, which may be mistaken for the effects of disease;

e.g., the bulging of the right scapula, left anterior and inferior regions, upper sternum, second costal cartilage, and left sterno-mammary region. Spinal curvature, in any degree, also alters entirely the symmetrical proportions, especially in the course of the ribs, and a slight deviation of the spine to the right side is frequently natural. In marking the rythm of respiration, you must remember the relative duration of inspiration and expiration. Thus, if the entire time from one inspiration to another be known by the figure ten, then inspiration will occupy five, or one-half, of this time ; expiration four, or two-fifths, and the pause one. This, according to the observations of Walshe, from numerous experiments. The motions of the chest can be readily observed during inspiration. If diminished in any case, it must be from the existence of pain, from injury, from organic changes in the lung or pleura ; or if permanent, from *paralysis*. Instances are readily recalled, by mentioning the cases of *pleuritis*, *neuralgia*, central *paralysis*, *pneumonia*, pleuritic effusion, *emphysema*, *pneumo-thorax*, and *tubercle*. But the movements may be in excess—then, we must have either obstruction or irritation in the lung or chest, a nervous state, or some interference with the diaphragmatic action. Hence *croup*, laryngitic affections generally, the presence of foreign bodies in the bronchial passage, faucial and pharyngeal irritation, *bronchitis*, especially the vesicular variety, and *pericarditis* are amongst the chief lesions noticed to greatly accelerate these motions.

Palpation.—The next mode of examining the chest, is by manual application. This is for the purpose of ascertaining the degree of the partial movements, the vibration, and the extent of tenderness. Thus, when the open palm of the hand is opposed accurately to any part of the chest, each inspiratory movement will be felt to fill the hand, and each expiratory to recede ; and to examine the movements of any intercostal muscle, you have only to place a finger between the ribs, and observe if the divergence and convergence of the fibres are regular and sufficient. In using this test, you must recollect, that the divergence is greatest in the inferior spaces, and make allowance accordingly. When the hand is applied to a healthy chest, you will notice a slight tremor or fremitus during speech. Naturally, this is more marked in adults and males, and occasionally it may be absent in children and females. It is more distinct in thin persons, in long chests, in the recumbent posture, and when particular (consonating) sounds are made. These facts will guide you in employing this method as a test for disease. Besides, remember that the regions of natural excess of this fremitus are the

right side, the larynx and trachea, the infra-clavicular, the infra-scapular and inter-scapular. In the cardiac region, where the heart is almost immediately under the hand, it is absent, and so at the inferior lateral regions generally.

In disease, the fremitus is increased or diminished—increased in tubercular deposit, *pneumonia*, in short, in any moderate increase of density of the parenchyma ; also in dilatation of the bronchi. It is absent, or greatly reduced in pleuritic effusion, pneumo-thorax, *very* dense consolidation of the lung or a part ; but even here much depends upon the state of the larger bronchi. In cases of pleuritic lymphy effusion, or drying and thickening of the membrane, it sometimes happens that palpation alone will detect it, and even the patient himself has pointed out the seat of the disease. Palpation may also detect empyema by fluctuation, or by succussion ; and rarely, a kind of pulsating movement of the spaces is observed synchronous with the heart's systole, in certain cases of *pneumonia* and intra-thoracic *cancer.*

Mensuration of the Chest is made use of in two ways—during rest and during the respiratory movements; and may be generally or partially applicable. In the healthy adult, the right side measures in circumference usually half-an-inch more than the left ; one exception is in the instance of left-handed persons. The difference between the measurements after extreme inspiration and expiration is calculated at two inches, though it may reach as high as six inches ; but the greatest value of measurements is to ascertain differences in the comparative examination of the two sides. If the inequality should be great, it argues the retraction or bulging of one of the sides; and by frequent measurements, we can accurately ascertain the progress of absorption of any effusion. The best plan to measure the circular bulgings is at the level of the sixth cartilage ; and, again, midway between the nipples and the clavicles. The transverse measurements are, across the acromions, the axillæ, and the base ; the antero-posterior, under the clavicles, and at the base ; and the vertical, from the clavicle to most dependent point of the ribs. In addition, you may frequently ascertain, with advantage, the partial measurement of the distance from each nipple to the mid-sternum. In this way, you may arrive at data of great importance. In all cases where the visual inspection suggests measurement, it should be done, and even in others, where you think a difference may exist, from the sole consideration of the history, even where visual inspection and palpation gave no hint.

Instruments have been lately made to measure the differences of

the intercostal movements, and thoracic ones generally.   One by Dr. Sibson, called " *The Chest-measurer*," and another by Dr. Quain, called " *The Stethometer.*"   Dr. Sibson's is a species of callipers, with one moveable branch, which terminates in an index-wheel, to give the very smallest deviations.   The most that can be said of this instrument is that it certainly gives more precise information than the hand; but its use, I need not conceal from you, is beset with sources of error, arising from the very delicacy of the instrument.   In its present form, I do not think it will ever become a standard guide.   Dr. Quain's is more readily applicable, and with moderate care, gives sufficiently definite results.   In applying it, care must be taken to have the dial most accurately fixed and steady during the time of stretching the cord, as the least strain or deviation is indicated by the index-hand.   A simple means of measuring the inspiratory expansion, and expiratory retraction, is the common tape, which, in the hands of careful observers, will give, occasionally, valuable information.

The Displacement of Organs may be detected by careful visual inspection.   The organs most likely to be so altered in position are the heart, the liver, the spleen, with the stomach, duodenum, the colon, with the diaphragm.   Thus, the heart may be pushed to one side, elevated, or depressed.   It is *laterally* displaced by pleuritic effusions—serous or purulent—by *emphysema*, by *hydro-pneumo-thorax*, and various thoracic tumours, as *aneurism*, or *cancer*.   When the heart is pushed *forwards*, it is by reason of *emphysema*, or a tumour posteriorly situated.   The *elevation* of the heart is, of course, necessarily the case in *ascites*, *tympanites*, and abdominal tumours of great size ; but it may arise from atrophy of the organ, or cirrhosis of the lung.   *Depression* of the apex is noticed in emphysema and hypertrophy of the heart, and tumours situated inferiorly.   The liver may be displaced either by pleural effusions and similar causes of bulging of the right thorax on the one hand, and by abdominal tumours on the other, as well as by its own organic changes.   The spleen, in like manner; and the other organs above mentioned. One thing is mainly to be kept in view, that the displacement of an organ must have its source either in the organ itself, or in those in direct contact ; and the condition of these parts must be carefully made out in all cases.   Permanent displacement, when not congenital, is always morbid.   On this subject you should particularly study the *clinical topography* of cases as met with in the wards, and especially in the inspection and dissection rooms.   A constantly exercised habit of observing can alone impart that nicety of dis-

tinction which the experienced practitioner eventually acquires, and which it should be your aim to master.   You will find very valuable aid from studying the writings of Dr. Sibson, who has most elaborately considered all the bearings of thoracic changes in the position of organs in health and disease.   This knowledge is especially necessary in using aright the next means of diagnosis which I shall bring under your notice, namely—

PERCUSSION.—The student must have a thorough knowledge of the geography—so to speak —of the thoracic, and superior abdominal organs, ere he can apply this aid with safety ; and besides, and as a preliminary step, he must become acquainted with the various sounds which different parts and regions of the chest elicit.   By these means, attained beforehand, you will enter upon the study under great advantages.   It is not absolutely necessary to understand the theory of acoustics, yet this knowledge facilitates further progress, and explains phenomena otherwise unaccountable.   Upon this point, I shall only have time to give you the most useful ideas, and must refer you to your works on Physiology and Natural Philosophy for elaborate information.   Sound is the element of percussion.   Now, sound is a sensation produced by the air, or other medium, agitated in vibrations, impinging upon the tympanal membrane, and through this and the ossicula auris, upon the auditory nerve.   These vibrations may take place in various media, the only requisite being that they must be more than thirty-two, and less than eight thousand two hundred per second.   A change in the medium alters the vibrations, which may be even destroyed or nullified by cross or interfering vibrations.   The character of these vibrations depends on the force by which the molecules of the vibrating body have been impressed.   Hence, differences in the loudness and intensity of sound, in the number of equal vibrations in a given time—hence the differences in the *pitch*, in the number of repetitions of vibrations—hence the duration ; and on the nature of the body vibrating—hence the quality of the tone.   The vibrating medium varies, in actual percussion practice, according to the state of the skin and muscle, the bone and cartilage, the pulmonary parenchyma, and the quantity of pulmonary air present.   We may accordingly, conclude that the percussion-note depends much upon the force of the stroke, the quantity of air, and the nature of the solid media interposed.   The varieties of sound elicited by percussion may be all included under the different degrees of *dulness* and *clearness*.   The percussion of the thigh, or the liver, gives an example of distinct dulness, while that of the flatulent stomach or

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intestines, one of distinct clearness. Between these extremes, there are innumerable variations.

The *Act* of percussion may be performed in various ways—1. We have Avenbrugger's plan, or that of immediate percussion ; the percussion of the chest with the fingers alone.   2. Piorry's system, or mediate percussion.   Piorry uses a medium which he applies to the chest, and strikes.   This medium is a small piece of ivory about two inches by one in dimensions.   Others (the most numerous class) use the mid-finger of the left hand ; and others again, as Louis and Walshe, use a piece of india-rubber as the medium ; while the percussing instrument is either the bulb of the first two fingers of the right hand, a small hammer adapted for the purpose—which is the kind used by Dr. Hughes Bennett, of Edinburgh—or the ear-piece of the stethoscope, bound with a ring of india-rubber.   It is, perhaps, not very important which of these plans you adopt, as any, with *a good ear* (which is of far more consequence) may suffice.   At the same time, for general purposes, and when you wish to elicit sounds very distinctly, the latter is to be preferred.   Now, before reasoning upon the results of a percussion examination, it is important to have a clear conception of the healthy or natural percussion-note of the different regions of the chest.   The consideration of this point will, at the same time, make you familiar with these different regions and the boundaries.   We must premise that *deep* percussion is to be distinguished from *superficial*, which modes may elicit very different sounds in the same region.

1. *Supra-clavicular regions.*—The note is moderately clear.

2. *The clavicles.*—Very resonant at the sternal end, but diminishing towards the acromions.

3. *Infra-clavicular regions.*—The note here is clear, and may be considered as a type of the pulmonary quality ; also diminishing towards the shoulders.

4. *Right mammary region.*—Note less clear, and perceptibly diminishing below the fourth rib, especially on deep percussion, and at the sternal edge.

5. *Left mammary region.*—Note less clear, diminishing inferiorly and towards the sternum below the third rib, but increasing slightly inferiorly, if stomach be empty.

6. *The sternal region.*—*Supra*, very clear and resonant ; *upper*, less clear, partially osteal ; *middle*, less resonant ; *inferior*, dull, but modified by the osteal and gastric resonance.

7. *Right infra-mammary regions.*—Slightly dull, becoming more marked inferiorly.

8. *Left infra-mammary region.*—*Inner part*, dull, except when stomach is distended ; *outer inferior*, dull on deep percussion ; *rest*, amphoric.

LATERAL REGIONS.

9. *Right axillary region.*—Clear, especially superiorly, diminishing below the fourth rib.

10. *Left axillary region.*—Clear also, but inferiorly modified by proximity to the stomach.

11. *Right inferior lateral region.*—Distinct dulness, from sixth rib downwards; moderate resonance above.

12. *Left inferior lateral* are, anteriorly, clear ; tympanic, if stomach be distended ; inferiorly, dull.

POSTERIOR REGIONS.

13. *Scapular—supra-spinal region.*—Dull, with some resonance ; *infra-spinal region*, dull, with scarce a trace of resonance.

14. *Inter-scapular region.*—Wooden and osteal resonance, slightly pulmonary.

15. *Right infra-scapular region.*—Moderately clear, decreasing below eighth rib.

16. *Left infra-scapular region.*—Note clear, but modified by the presence of the spleen and stomach.

Besides these normal differences, (which are all-important to remember,) you must also recollect, that when a dense substance lies deeper than the lung, it will not be indicated unless you percuss forcibly—deeply—as when you detect the existence of the liver beneath a portion of lung. Remember also, that percussion of the ribs gives a more resonant sound than that of the intercostals; and that the greater development of the right pectorals, and the irregular distribution of fat—even states of normal induration—will modify and deaden the sounds. It may also happen, though not a rule, that a slight degree of dulness may be heard on percussing the *right* infra-clavicular region, in cases of perfectly healthy lung. Then again, we must remember, that the expansion of the lung in inspiration very much modifies the sound. The vertical extent of the lungs is greater in deep inspiration, extending as low as the sixth rib anteriorly, and the eighth or tenth posteriorly; they meet also under the mid-sternum and above, and overlap the heart to a greater extent. The percussion-note generally is more distinct in inspiration, when there is more or less falling of the abdominal organs, which, therefore, will not be so well indicated in the usual regions.

The percussion-note is rendered generally clearer by emaciation—in females—and especially in young children.   In the latter, indeed, pneumonic consolidation or pleuritic effusion may exist, unindicated by percussion. The effect of old age again has a contrary effect ; to which we may add, deformities and fractured ribs.   And, at the same time, we meet with cases of chests perfectly healthy, which yet elicit but little sound.   This occurs in frames possessing little tonicity or tension.

We shall now be prepared to consider percussion as a means of diagnosis in disease.

The clear sounds, or sounds clearer than natural, are heard when there is more air in a given space under the part percussed, or a diminution of the usual solids or fluids, whether in the lung or pleura.   Sounds duller than natural, indicate a diminished quantity of air, or an addition to the solids or fluids.   When the clearness prevails generally over a lung-space, we must look for *emphysema* or *pneumo-thorax*, *atrophy*, and *anemia*.   Besides this difference, which is a mere *increase* of the clearness, there are variations of quality, of utility in practical diagnosis.   Thus, we have the *wooden*, or *table* sound—similar to the percussion-note of a table —which is produced by dry thickening of the pleura, a superficial cavity with thin walls, and chronic consolidation of moderate extent.

The Tubular or tracheal sound is heard in the cases of dilated bronchi—or when solid bodies are in close contact with the bronchi—as enlargement of the bronchial glands, consolidation between a large bronchial tube and the surface, small empty cavities, especially with solid walls, as in *tubercle*.

The amphoric, or empty bottle sound, is heard in large cavities with thin walls, and also in the upper part of the lung in cases of *pleuro-pneumonia* of the inferior portions.

The cracked-metal sound is generally produced by striking over large cavities, having free communication with the bronchi.   It is heard, therefore, in phthisical excavations.   But it may be heard in simple *bronchitis* of children (though in this case the sound is more diffused), and occasionally even in health.

The tympanitic, or drum sound, is heard chiefly in *pneumo-thorax* of great extent.   This character has been noticed by Dr. Graves, as also produced by vibrations in the hepatization of *pneumonia*.

Dulness on percussion, greater than natural, is noticed in pulmonary congestions, active or passive, deposits of lymph or tubercle in the parenchyma, *œdema* of lungs, deposition of *cancer*, accumulation of

blood or mucus, or purulent matter; effusions of fluid into the pleura, tumours, dilated or otherwise enlarged heart, and displaced organs. When the seat of dulness changes with the position of the patient, the cause is, necessarily, fluid in the pleura.

AUSCULTATION is the art or practice of listening to the sounds produced in the chest, or, indeed, any part of the frame, by movements of its contents. During expiration the air enters the lungs, traverses the bronchial tubes and ramifications, and expands the air-cells, in some degree like as a collapsed bladder would be expanded by blowing into it. During inspiration the lungs collapse, and the air passes out in consequence of the tension being removed and the equilibrium established. The passing of the air in these different directions gives rise to the production of sounds—the *inspiratory* and *expiratory* sounds—which differ at different points examined, and have various degrees, according to the diameter and other peculiarities of the tubular arrangement. Again, the lungs, as two bodies, covered by thin double serous sacs, glide in health noiselessly over these serous surfaces during inspiration and expiration, but in disease various sounds are elicited, which are exceedingly distinctive. Auscultation is, in like manner, employed to ascertain the character of the sounds of the heart, and the state of the pericardium, and also of the peritoneum and other abdominal organs, as (for example) to detect the pulsation of the foetal heart and placental sounds in pregnancy.

How is this auscultation to be performed? One way, the original, and at times the most desirable, is to apply the ear close to the chest, a very thin cotton cloth intervening. The other, and now the most common, is through the medium of an instrument called a *stethoscope*, which, as being a hollow cylinder of wood, or other conducting material, conveys the sounds both accurately and distinctly. To Laennec we are indebted for introducing the use of mediate auscultation; and his experience of its use, now after the lapse of thirty years, may be deemed in almost every essential and main feature, correct.

Great difference of opinion exists as to the material and manner which should be adopted in making the instrument. After a large series of trials by many stethoscopists, we may come to the conclusion that wood—particularly cedar or ebony—hollowed into a cylinder with a good bell-mouth tapering gradually to the ear-piece, which should be a solid disc accurately fitted, will give the most satisfactory results.

In examining a chest, the sounds we must expect to hear are—

1st, the breathing sounds; 2nd, the voice sounds; 3rd, friction sounds (morbid); 4th, the sounds of the heart. But in order to appreciate the value of any of these sounds, it is necessary, in the first place, to understand clearly the *natural sounds*, or those heard in perfect health.

The natural breath-sounds are technically termed *murmurs*, and are either inspiratory or expiratory. These are still further subdivided into—1st, vesicular; 2nd, bronchial; 3rd, tracheal; 4th, laryngeal; 5th, pharyngeal. The vesicular, pulmonary, or respiratory murmur is a gentle, soft, breezy sound, longer and more distinct in inspiration than expiration, in the ratio of three or four to one. This " respiratory murmur" is formed by vibrations of the air in the minutest divisions of the air-cells and the surrounding parenchyma. The "bronchial murmur," also called the tubular, is produced in the larger bronchial divisions, by the vibrations of the passing air, and moving parietes. It is louder, and more superficial apparently, and gives a distinct impression of the site of its origin.

The other sounds are still more distinct, and of a blowing character, and besides, present a marked contrast in the duration of the expiratory division, which, in these, is nearly equal to that of the inspiratory.

The healthy " respiratory murmur" of the child is called *puerile*. Here its intensity is increased to a great degree—whereas in old age, the opposite state obtains; and hence a " *senile* respiratory murmur," is a weakened one. It must also be remembered that the expiratory murmur of old persons is naturally prolonged. The ordinary "respiratory murmur" is intensified in the female, and directly in both sexes, as the rapidity of the respiratory movements; and the duration of the murmur can, of course, be materially affected by the depth of the respiration. In examining the chest by auscultation, care must be taken that the " respiratory murmur" be not confounded with the sounds occasioned by muscular movements of the parietes. Let it also be remembered, that the " bronchial murmur" is heard *naturally* at the inner subclavicular and upper sternal regions; and at the upper interscapular, spinal, and superior axillary regions, it may, especially in females, be also heard, In all other parts, we have the " respiratory murmur," which is heard best where there is the greatest mass of the lung.

The sounds of the voice of the patient examined, when heard through the stethoscope, are of great auxiliary value. Naturally, we have certain alterations, of which it is necessary to be aware. Thus, we have natural *bronchophony, laryngophony,* and *tracheophony.*

When the stethoscope is held over the larnyx or trachea, the

voice comes with an extraordinary power of increase, so that you might imagine the person was speaking through a trumpet. A similar sound, but scarcely so intense, is heard at adjacent points round the neck. If you examine at the upper sternum, and between the scapulæ (at the upper part), a more diffused resonance, but still more intense and harsher than the natural voice, designated by the name, *bronchophony*, is heard. At other parts, the natural voice is scarcely altered in quality, though it is obscured. Allowance must be made, in auscultating the voice, for the facts, that the resonance increases with the gravity of the tone—hence more marked in males; varies with the quality of the voice at different ages; is diminished in obese persons; and is more marked in the right subclavicular and right interspinal spaces.

With these preliminary observations, you will better understand the interpretations of the various alterations of these sounds which our examinations in pulmonary disease furnish.

1. The " respiratory murmur" may be exaggerated, *i.e.*, puerile. This occurs in cases of obstruction in some other part of the same lung, or in the other lung. It is hence frequently called *supplemental*. The lesion may be merely bronchitic, or a parenchymatous condensation, or an emphysematous condition, or relaxation from a nervous spasm of the muscles of respiration.

2. The respiratory murmur may be *diminished*, or weak. Here the cause may lie in the lung or larynx, or the pleura. The lesions in the former case may be laryngitic obstructions, bronchial accumulations, effusion of lymph or tubercle, *emphysema, œdema, apoplexy*, or simply general debility. When this weak respiration is only occasional, we meet with it in all nervous pulmonary states. While in *pneumo-thorax, pleuritis*, pleuritic effusion especially, or chronic pleuritic thickening, it is most marked.

3. *The absence* of the "respiratory murmur" is generally observed in cases of *hydro-thorax*, simple *pneumo-thorax*, and their combined state; advanced *pneumonia, emphysema;* in complete bronchial obstruction, and in all cases where râles, or the other "murmurs," are substituted.

4. The "respiratory murmur" may be *divided, or jerking*, instead of being continuous, as in health. This form we meet with, in cases of *pleurisy* (early stage), and nervous states engaging the respiratory nerves. Analogous to this is the *cog-wheel* murmur of incipient tubercle.

5. In place of the usual ratio of three to one, which holds good of the proportion of the duration of the inspiratory to the expiratory murmur, this ratio may be reversed, or otherwise altered. This

prolonged "expiratory murmur" is met with in chronic *bronchitis,* *emphysema,* tubercular infiltration, and less often, in moderate pleural effusion and *pneumo-thorax,* in which it is also weak. It must not be confounded with the natural prolonged pharyngeal expiratory murmur ; and let it not be forgotten that, at the right apex of females, it may be a natural phenomenon.

6. Sometimes we meet with the *harsh* "respiratory murmur." This is a stage between the "puerile" and "bronchial," and is noticed in drying and thickening of the mucous membrane, and slight consolidations, as from tubercle.

7. The *blowing* respiratory murmur is only a form of the bronchial, distinguished, however, by a difference in intensity and quality. It may be either diffused, or tubular. The latter is *the type,* and gives rise to the sensation that air is drawn from the stethoscope, and driven back again. It is especially indicative of hepatization— and, less so, in other forms of consolidation, and likewise in dilated and thickened bronchi. In some cases of tubercular excavations, the *diffused* blowing murmur may be observed ; and even in cases of thickening of the pleura, or effusion, it may be present, and suggest the idea of a different disease. Another variety of this blowing murmur is the *cavernous.* It is hollow, and distinctly conveys the impression of a cavity, and it is, consequently, noticed in tubercular excavations, pulmonary abscess, dilated tubes of large extent ; and generally, cavities, however produced, as, *e.g., hydro-pneumo-thorax.* A third variety is the *amphoric,* or a sound similar to that produced by blowing into a water-croft. It indicates air passing into a large cavity, with dense walls, and may therefore occur in the same cases as the cavernous.

Besides the above alterations or modifications of the respiratory murmur, we have other sounds which are quite distinct, and have been, therefore, termed—

RÂLES, or *Adventitious Murmurs.*—These may be produced in the air-passages, the lung-parenchyma, or the pleural cavities. Under this division, we shall now consider them.

1. *The sibilant râle* is dry, whistling, acute, irregular in recurrence, but sufficiently permament to mark its character. When short, it is a mere click ; when long, the regular whistling sound is heard. It indicates generally diminished calibre of the bronchial tubes by congestion, as in the first stages of *bronchitis,* or by adherent mucus in the more advanced. Some, with Dr. Walshe, ascribe it chiefly to this state of the mucus present. We meet with it also in *emphysema,* as was first pointed out by Laennec. Here it is most marked

in expiration. But it must be remembered that this sign occurs, not as a clear mark of the *emphysema*, but rather of its attendant *bronchitis*.

2. *The sonorous râle* is grave and dry, and well-marked in expiration. Various names are given to its different degrees, as snoring, cooing, rubbing, wheezing, &c. It is a sign of bronchitis, especially in the early stage ; but also in the chronic, when permanent dilatation of the bronchi occurs.

3. *The crepitant râle* is one of the most important. The sound suggests the idea of crackling ; and the sound elicited by throwing salt upon a fire is very similar, or rubbing a lock of hair between the finger and thumb. It is usually persistent, and may be heard generally (in disease) either at the base of both lungs, or a small part of one only. It is a sign indicative of engagement of the air-cells. Authors differ, it is true, as to the exact cause of the formation of the sound, but whether it is formed by "sudden and forcible expansion of the parenchyma," as Walshe is inclined to believe, or, as is more commonly taught, by viscid air-bubbles being formed in the air-cells themselves, certain it is, that these latter are always engaged in some degree in their formation. When thus viewed, we see that this sound may be a sign either of *pneumonia*, or capillary *bronchitis*. In the case of resolution of *pneumonia*, a crepitus is heard which differs somewhat from the one described in being slowly formed, bubbles larger, fewer, and frequently audible in expiration. This is the " *râle crépitant rédux*" of Laennec.

4. *The sub-crepitant râle* is characterized by a distinctly bubbling sound. The bubbles are of larger size and fewer than the crepitant, and are not equal either in character of sound, or in rythm. This is observed also in capillary *bronchitis*, tuberculous *bronchitis*, resolving *pneumonia*, pulmonary *apoplexy*, immediately surrounding the clots, and *œdema*.

Modifications of this râle are called the *dry* and *humid crackling*.

The *dry* is very commonly heard at the commencement of the softening process of tubercle, and incipient cavity, especially at the apex. The *humid* differs in character, and indicates a more advanced stage.

5. *The mucous râle* is known by its large bubbles, variable and unequal, its liquid character, and its distinct variations by differences in the amount of expectoration. It indicates fluid in the larger tubes, frothed by the passage of air, and is, therefore, observed in the decline, and secreting stage of *acute bronchitis*, in chronic *bronchitis*, in *hæmorrhages*, in *pneumonia* and *phthisis* at advanced stages.

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6. A greater and more advanced degree of this râle is named *gargouillement*, or the *gurgling râle*. Here we have large bubbling, similar to the sound heard on blowing through soap-suds. It indicates a cavity containing in part fluid, and in part air. When it is heard in any case, and afterwards suddenly ceases, its cessation is due to drying up of the cavity, or its complete filling up, or bronchial stoppage. It may occur also in dilated bronchial tubes.

7. *The dry, crumpling rale* of Laennec exactly conveys the impression of the expansion of a collapsed dry bladder. It is rarely observed ; chiefly in vesicular *emphysema (Skoda)*.

II. Occasionally sounds like a dry crepitus are heard, as if produced by changes in the parenchyma—as by unfolding of indurated portions of lung ; but are so rare that I need not dwell upon them, but proceed to the last division.

III. *The Pleural sounds*. These are friction sounds. They are superficial, attend both inspiration and expiration, and are distinctly of the rubbing character, suggesting the idea of the friction of paper, leather, wood—of sawing, or grating, or creaking, or rumbling sounds. The inferior parts of the chest, especially immediately under the scapula, are the best points for examining this sign. In any character the sound may assume, you will have some form of lymph exudation from the inflamed pleura, with or without effusion. A large quantity of the latter may indeed be present, without much obscuring the sound, save at the very base. In a few cases of subpleural *emphysema*, Dr. Walshe has noticed this sign—but it is exceedingly rare—though named as an ordinary sign of the disease by Laennec. A mere drying of the pleura is sufficient to induce this murmur, and hence it is frequently the case, that it may be well heard at one part of the same day, and not at another.

Sounds very much resembling a sub-crepitant râle, yet mixed with true friction murmurs, were noticed by Dr. Walshe as occasionally occurring from infiltration of cellular tissue *outside* the lung, but interfering with its movements.

I shall close this account of the auscultatory signs by reference to the phenomena of ALTERED VOICE SOUNDS, as heard through the chest walls.

We have already referred to the natural resonance of the voice. It becomes modified by disease, by becoming increased or diminished, or otherwise altered. The resonance is greatly diminished in *emphysema*, *pneumo-thorax*, and in *pleuritic effusion*. In the last two of

these states, it may be occasionally entirely absent. *Bronchophony*, or increased resonance, is observed in pulmonary condensations, in enlarged and thickened bronchi, and even liquid infiltration of the pulmonary tissue, if near large tubes. Its best specimens are heard in hepatization, and in local collections of tubercle near the greater bronchial divisions.

An important variety of bronchophony is known by the name of *pectoriloquy*. It is a sound of the voice, heard as if the patient were speaking directly through the stethoscope. This was usually considered, for long after Laennec's time, as pathognomonic of cavity, but accumulated cases have since proved that the very opposite state—a hardened mass—if interposed between a main tube and the ear, may produce it; and a cavity may be present, and yet pectoriloquy not be heard; because there are certain conditions required for its formation which all cavities do not present:—Thus, a moderate size, free from traversing bands, emptiness, adhesion to parietes, superficial position, and, of course, free communication with the bronchi. Even a very large cavity, with the other conditions present, may fail to elicit the sign. When, however, it is heard distinctly by whispers, and if the resonance be hollow and ringing, it is the opinion of our best authorities that a cavity must exist.

Amphoric resonance has almost the same import. It resembles the speaking into an empty bottle, and is sufficiently characteristic. It is well marked in cases of *hydro-pneumo-thorax*.

Ægophony is a tremulous nasal-like resonance, suggestive of the bleating of a goat. Its modifications have been also compared to the voice as transmitted through a metal tube, or cleft reed, the voice in Punchinello, and that produced by speaking with a disk between the teeth and lips. It is a sound of rare occurrence, and is mostly well localized. It must be looked for in *pleuritis*, before effusion has reached a certain limit (Laennec says four or five ounces), or after absorption in *hydro-thorax*, when the fluid has subsided to that degree. It is heard to the best advantage at the inferior angle of the scapula, and seldom well elsewhere. When the sign is diffused, and persistent, you may diagnose numerous adhesions. It is also, when present in both sides, a distinguishing mark between true *pleuritis* and simple *dropsical hydro-thorax*—its presence being always indicative of the true inflammatory disease.

Autophonia, or the change by auscultation of the physician's voice by transmission through the chest of the patient, has not as yet been studied so accurately as to lead to any useful results.

Tussive Resonance, or the alteration o the *cough-sounds* of the

patient, as heard through the stethescope, are of very limited appli-
cation.   A few have been made out.   Thus, the bronchial cough,
the cavernous cough, and the amphoric cough, are respectively heard
in condensations and excavations of the lung, and an ægophonic
cough is noticed in *pleuritis*—but they are by no means constant or
well-defined, and are of little independent value.

A few other interesting phenomena remain for our consideration.
The first is *Metallic Tinkling*, a term of Laennec's, applied to a hol-
low ringing sound, simulated by touching a hollow, globular empty
glass with a metallic pin.   When ill-marked, it becomes an *amphoric*
echo.   It is common to the respiratory and vocal sounds.   The
best imitation of the sound is perhaps produced by letting fall a drop
of water into a globular glass vessel containing a little water at the
bottom.   It is rarely heard in practice, as the conditions necessary
are also rare.   Thus it may be met with in *hydro-pneumo-thorax*—
less frequently in simple *pneumo-thorax*, and in large cavities con-
taining fluid and air.   It is best heard while the patient is speaking
or coughing, and therefore in all cases of doubt this test should be
tried.

2. The sounds of the heart are frequently transmitted more or
less distinctly through diseased lung or pleura, and this has there-
fore been made a sign of some value.   When the transmission is
increased, there is usually some consolidation from lymph, blood,
tubercle, or cancer, &c.; or there are dilated and thickened bronchi.
It is also noticed in cases of thickened pleura, and pleural effusion.
A diminished transmission-power is observed in rarefied states of
the lung, as in *emphysema*—and in *pneumo-thorax*.   Drs. Stokes and
Latham observed a sharp blowing murmur in the left subclaviam in
cases of tubercular consolidation of the apex; and many observers
since.   Its cause is not clear.   Dr. Walshe has found it associated
with a left pulmonary murmur, and with an aortal murmur.   Its
existence, however, is indisputable, but it may be locally produced
by pressure of a hardened mass upon a main artery in, perhaps, an
anemic state of the blood.

THE GENERAL SYMPTOMS are frequently highly indicative of pul-
monary disease.   Thus, the *complexion* presents a livid, dusky hue
in *pneumonia*, and in general *capillary bronchitis* and *pertussis* during
a paroxysm; and a pink-tinted cheek and unnatural clearness, in
phthisis.   The *manner* is particularly anxious and painful in acute
pleuritis and *pertussis*.   The *position* is sitting up and forward in
emphysema, *hydro-thorax*, and extensive *bronchitis*; supine in exten-
sive *pneumonia;* on one side only, in *hydro-thorax* or *empyema* of

same. The *voice* is hoarse or absent in laryngeal affections, and rough in *bronchitis*. The *eye* is heavy and dull in *pneumonia*, clear and sparkling in *phthisis*. The *respiration* is frequent and difficult in all inflammatory affections of the lungs; paroxysmally quick in *bronchitis* and *asthma*, sudden *congestions*, and *tubercular pneumonia*. The *pulse* is quick in the same states, and persistently so in *phthisis;* occasionally slow or even irregular in simple *hydro-thorax*. The *tongue* is coated and moist in all inflammatory states; becomes frequently brown and dry in *pneumonia*, and clean or aphthous in *phthisis*. The *skin* is dry in the early stages of the inflammatory affections, intensely hot in *pneumonia*, perspiring in *phthisis* and all other states, if the debility be great. The bowels are loose occasionally or constantly in *phthisis*—generally constipated in other cases. The *appetite* fails in the inflammatory affections, is unaffected in the nervous states, and may be occasionally good, or unnaturally so, in *phthisis*. *Sleep* is mostly disturbed in all pectoral affections, very difficult in pleural effusion or chronic bronchial affections. The *strength* is good at the onset of most pulmonary affections, but becomes especially diminished in *phthisis* and prolonged *pneumonia*. The *general feeling* is, for the most part, febrile in the acute cases, and usually anxious in the other states. The colour of *the blood* is livid in *pneumonia* and *bronchitis*, and great obstruction from tubercle, from stoppage of a main bronchus, or from laryngeal disease.

THE REFLEX SYMPTOMS are simply such sensations or motions as are sympathetically excited in other parts by affections of the lungs. Thus, *frontal headache* is perhaps the most common and distinctive. It is common in the early stages of bronchitis and influenza, and is, indeed, very characteristic. *Pains in the arms* are occasionally felt in inflammation of the lung or pleura. *Abdominal pains* are frequent in bronchitic states, especially when the cough is severe.

Save in *phthisis* (which, however, is a disease rather of the constitution than the lung merely) the range of sympathetic phenomena is very limited.

IV.—THE INTERPRETATION OF DERANGEMENTS OF THE CIRCULATORY SYSTEM.

THE circulatory system consists of the heart, the great vessels or leading trunks of arteries and veins, and the capillaries. The heart

may be compared to a great pumping machine, which drives the blood received from the veins, into the arteries ; and is hence the chief moving power in the circle of the blood's movements.   There are three systems of circulation—the *pulmonic*, which commences at the right ventricle, and ends at the left auricle ; the second, the *systemic*, commencing at the left ventricle and ending at the right auricle ; and the third, the *coronary system*, which begins at the origin of the aorta, and ends at the right auricle.   The pulmonic circulation is used simply for oxygenising the blood—the systemic is for the general nourishment of the body, and the coronary for the nutrition of the heart alone.   The heart is a muscular organ, of the involuntary species, and yet the intimate muscular fibre does not essentially differ from that of animal life, thereby forming an exception to the general rule.   The fibres of the heart are so disposed, that on contraction, the organ is shortened and the cavities emptied.   An average adult heart contracts about 70 times per minute, rather more frequently in the female, and considerably so in the child. Each pulsation drives about two ounces into the aorta ; and calculating the total quantity of blood at thirty-two pounds, the period of complete circulation will occupy three-and-a-half minutes.   From experiments on the lower animals, it is more than probable that this period is longer than the actual fact.   The force of the heart is very considerable.   It has been estimated at more than four pounds. The arteries first receive this shock, and being elastic, yield, expand, and elongate or curve, and hence the pulse is formed.   The arteries possess both circular and longitudinal fibres, which are endowed with inherent contractility.   The capillaries may be said to be a distinct order of vessels.   Their diameter is pretty uniform, and they are disposed always in the form of a net-work adapted to the arrangement and forms of the tissues and organs they supply.   They possess but one coat—a fine membrane through which, by exosmosis and endosmosis, nutrition and ordinary absorption occur.   The blood is observed to flow much slower in the capillaries than in the larger vessels ; and this is accounted for partly by their arrangement and partly by the great resistance which they offer to the flow of the blood—calculated at two-thirds to three-fifths of the force of the heart.   These capillaries are the great centres of nutrition— indeed of all the important processes for purifying the blood.   They can dilate or contract, as the familiar example of the blush of shame and the pallor of fear will plainly prove.   These conditions of congestion and contraction are greatly under the influence of the nervous system, but they also are produced by local irritation, and by increased cardiac action.

These few observations will prepare us for entering upon the cardiac symptoms, and, first,

1. *The cardiac actions.* The action of the heart may be too quick, too slow, too strong, too feeble, or may be irregular.

Palpitation, or too frequent action, is readily induced by exercise, or by sudden mental emotion—as fear, or nervous timidity. Palpitation, as a sign of disease, however, is observed in debility and all febrile states—more especially marked in hectic ; next most frequently are nervous states—as hysteria, and nervous irritation in sympathising organs ; and next are the lesions of the heart itself—especially *hypertrophy,* and (of course) all inflammatory states. Other causes are, poverty of the blood, obstruction to the pulmonic or systemic circulation near the heart—as *anemia,* insufficient nourishment, *aneurism,* or other thoracic tumours, and pulmonary disease. Nervous palpitation is exceedingly common in youth and adolescence.

Slowness of the heart's movements indicates the same states as a slow pulse. When not natural, as in many persons, it is a sign of pressure upon the heart by gastric or pleural swellings, or of compression of the brain—as by effusion, or of approaching syncope or sickness of the stomach. A *strong* cardiac action denotes generally a plethoric or inflammatory state, or *hypertrophy* and valvular disease of the heart. We meet with it in the early stage of all inflammatory diseases, and especially in cardiac inflammations and in apoplexy. It may, however, be purely functional—as when temporary causes, *e. g.,* violent exertion or the use of spirits, strongly excite the heart's action. A *feeble* cardiac action is observed in all cases of debility from any cause, in atrophy and fatty degeneration of the heart, and in inordinate dilatation. An *irregular* action may have many causes—as gastric and biliary derangements, even the irritation of worms—polypi, valvular disease, dilatation—pulmonary obstruction, pericardial effusion, nervous states, and affections of the brain ; in which last, a *varying* pulse is a frequent symptom.

2. *Cardiac sensations* are of various kinds. Thus, a patient may complain of soreness or pain of the heart in various degrees—of a great oppression about the heart, of a sense of sinking, and of a spasm. All these are important indications. *Acute pain* in the cardiac region may denote *pericarditis, pleuritis, flatulent colic, cardialgia, rheumatism, angina pectoris,* or a nervous state. A *dull pain* is more common in *endocarditis, carditis,* and *pneumonia,* and in diseases of the substance. A mere *soreness* may be as serious an indication as the most acute suffering, and is not to be overlooked. Cardiac *oppression* is noticed frequently in plethoric states, and the commencement of catarrhal or inflammatory affections, fevers, and of *apoplexy.* It is

also met with in gastric derangements, as after a surfeit, or any accumulation of undigested food. *A sense of sinking* is observed in approaching swoon, in hypochondriasis, and (moderately), all dyspeptic attacks—especially in atony of the stomach; and *spasm*, especially of the painful kinds, constituting the "angina pectoris," is to be ascribed to either *gout*, *neuralgia*, or other nervous state, or some lesion of the organ itself, such as valvular disease, ossification, &c.

3. *Syncope* is characterised by a failure of the heart's action, a loss of consciousness, and general prostration. The countenance and general surface are pale and cold; the pulse and the heart's action exceedingly feeble; and the respiration scarcely heard. It may occur in *pericarditis, atrophy*, dilatation; nervous states; *hæmorrhage*; extreme debility; *chlorosis*; and occasionally disordered states of the stomach, besides deep mental impressions. When consciousness is still present, though indistinct, the name "Leipothymia" is applied.

4. *Cyanosis* is a state characterised by universal lividity, or blueness, which owes its origin to cardiac, or arterial congenital vice. Before birth the "foramen ovale" is open, and the blood of the foetus is uniformly venous, but with the commencement of aerial respiration this opening gradually closes, and the *ductus venosus* and *arteriosus* also become obliterated, and the ordinary adult circulation is soon established. When, however, it happens that this "foramen" remains patent, or when the "ductus arteriosus" remains pervious, a mixture of the venous and arterial blood takes place to some extent, and the natural healthy florid hue is replaced by the livid tint observed in *apoplexy*, suffocative *catarrh*, or, indeed, any great pulmonary obstruction. A limited example of this mixture of the two varieties of blood is noticed in instances of varicose *aneurism*. This affection (*cyanosis*) is generally peculiar to the first year or years of existence, though we have on record rare instances of life being prolonged to the thirteenth, sixteenth, twenty-first, and even forty-first years. Occasionally, the subject of this distressing malady *recovers* by the natural process of closing of the inter-auricular communication. Besides the causes mentioned, narrowing of the pulmonary artery, or a wrong origin of the aorta, as when it arises from both ventricles will cause the same appearance.

In order to appreciate the value of the indications from cardiac examinations it is necessary here to refer for a little to the position and other topographical points of the heart.

The heart is enclosed in the pericardium, a strong fibro-serous

sac, which binds it in its place in the anterior mediastinum, between the lungs, and resting upon the diaphragm. This bag allows of a considerable movement; and displacement of the heart is permitted to a very great extent, without, of course, breaking up its natural attachments. The heart is fast at the base, attached as it is, and closely, to "the roots of the lungs" and the great vessels. This base corresponds to the middle sternum, from which the heart hangs in an oblique manner, with the apex beating at the fifth inter-costal space, about two inches below, and one inch to the inside of the nipple, and two-and-a-half inches from the outside of the base of the ziphoid cartilage. The heart is only partially covered by the lungs, a space remaining covered only by the lower sternum and left edges of the inter-costal cartilages. This space occupies from two to three square inches, and includes the right ventricle, appendix of right auricle, the apex and internal edge of the left ventricle.

The pulmonary and aortal valves correspond to the upper edge of the fourth left sterno-costal articulation, and the left side of the fifth dorsal vertebra. Immediately below, are situated the mitral and tricuspid valves. The whole space could be covered by the bell of an ordinary stethoscope. The heart changes its position both during respiration and ventricular contraction. In expiration, the heart is somewhat elevated : in inspiration it is depressed. During the systole, the apex of the heart is tilted forwards and upwards, owing to the sudden contraction and shortening of the vertical diameter of the heart; and besides this, it must be remembered, that altered states of the abdomen,—as distension of the stomach, ascites, tympanitis, tumours, &c., necessarily raise the apex-level.

THE IMPULSE of the heart is a movement caused by contraction of the ventricles, which has the effect of tilting forward the anterior wall, and altering necessarily the position of the apex, which is felt touching, at every pulsation, the fifth inter-costal space. The limits are, however, much extended by a forced expiration. This impulse may be increased, diminished, diffused, or limited, and varies according to the condition of the heart's parietes, the size of the cavities, and the state of the system. Thus an hypertrophied heart will give increased impulse ; also a plethoric state of the constitution. On the contrary, atrophy, dilatation, or fatty degeneration, will weaken the impulse ; as also hæmorrhagic, anemic, or other general state of debility. Hypertrophy, with dilatation, both increases and diffuses the impulse ; while dilatation alone will weaken while diffusing it. Pericardial effusion (especially in the supine position) or adhesions, weaken the impulse, and make it irregular.

I

Irregular impulse also depends upon valvular disease, or gastric
and nervous states. The impulse may be *temporarily* increased by
mental impressions and exercise. Hence the necessity of exa-
mining the heart at a quiescent period. Indeed, even this caution
is scarcely sufficient, for Piorry mentions having examined many
aged females at the Salpêtrière, and found diminished impulse with
hypertrophy of the heart, which led him to believe, that the impulse
depended more upon the force of the blow than the parietal state.
Besides, hypertrophy and dilatation, the proximity of a dense body
may extend the impulse; as (for example,) hepatization of the lung
will transmit the impression so clearly as to give the idea of increased
extent of impulse. I have alluded to the cause of the impulse, as
given by Hope and most others of the British schools, but it is right
that you should know that another explanation has been propounded
by Professor Skoda, of Vienna. He founds his views upon direct
observation of the case of an infant child, a few days old, whose
sternum was congenitally absent—in whom, therefore, the move-
ments of the heart could be accurately examined. According to
Skoda, the heart in systole has a swinging motion in a direction
downwards and forwards: at the same time, the muscular contraction
produces alteration of the shape of the organ, and tilts up the apex.
This swinging movement is due (he thinks) to the *recoil* of the heart.
Davies, in explaining this movement, compares it to the ascent of a
rocket, which rises in a direction contrary to the exit of the inflamed
gas, in consequence of the pressure at the closed end being greater
than at the orifice. Thus the " blood in the ventricles being power-
fully compressed in the moment of systole, re-acts with a corres-
ponding force upon every part of the inner surface of the ventricle;
and on the valves being suddenly thrown back by the rush of blood
through the pulmonary and aortal orifices, the pressure at these
points is reduced to *nil*—and the non-counterbalanced pressure upon
the surfaces exactly opposite to the orifices, tends to swing the en-
tire organ in a direction downwards, forwards, and to the left side."
This theory seems plausible; but I do not think it would bear a
strict test. Thus, if this were the real explanation, why is not the
impulse always weak in mitral regurgitant disease? and why not
greatly increased in pulmonary hepatization?

PALPATION gives you an idea not merely of the impulse, but by it you
can ascertain if any bulging exists, *where* the apex strikes, and the
existence of the *fremissement cataire*, or purring tremor frequently ob-
served in heart diseases. This is a peculiar vibration which, once felt,
you will never after mistake. It generally indicates valvular disease,

or great hypertrophy, with dilatation. At the same time, it must be noticed that disease of the valves may exist without this sign. The *position* of the apex-beat is important. It is low in the epigastrium, in enlarged heart, and emphysema ; laterally displaced in cases of pressure from effusion or emphysema ; and elevated by abdominal pressure, atrophy of the apex of the left lung, and in pericardial adhesions. A bulging exists in pericardial effusion of great extent, in immense hypertrophy, or prominent emphysema. In examining by palpation, it must be borne in mind that in persons whose chest-parietes are fat, soft and loose, or œdematous, the natural impulse is proportionally diminished; also in consequence of co-existent emphysema of the overlapping lung, (a very common part thus engaged,) and of the degree of accompanying dilatation, and of the general states of anæmia, debility, &c., which may be present. It is quite possible to have a hypertrophied heart, and yet a weak impulse ; and again, an increased impulse does not necessarily indicate an enlarged heart. Much may be learnt by examining the *extent* of impulse. This extent varies in health according to the position, being reduced to the lowest point in the supine posture and right decubitus. When the impulse extends over a wide space, it denotes usually an enlarged heart ; but it may be felt over a large space without any disease of the heart, in consequence of condensed lung, or a tumour lying contiguous ;—also in case of malformation of the chest, or in emaciated and nervous subjects.

PERCUSSION.—In order to avail ourselves of the information to be acquired by percussion, we must bring to our recollection the exact anterior disposition of the heart. A small portion of the heart is uncovered by lung. It is an irregular triangular space—one side formed by the margin of right lung ; at right angles to this a line parallel to the base of the sixth rib ; and the oblique or junction side, by a line crossing the fourth and fifth ribs. The area is about two-and-a-half square inches. In the central point, which corresponds to the middle of the left fifth cartilage, the percussion-note is decidedly *dull.* The dulness is rather less in radii to the periphery of the uncovered area. Beyond this, the pulmonary sound begins at all parts, save inferiorly and laterally. A distinct clearness over the centre of the præcordial region, hence denotes one or other of the following states : *atrophy of the heart, emphysema of lung, pneumatosis.*

The contrary state, or increased dulness, is a sign of *pericardial effusion,* solid or liquid—if extensive superiorly as well as laterally and inferiorly—*enlarged heart, aneurism of aorta, pulmonic consolidations, mediastinal tumours.* In calculating from the results of per-

cussion, you must keep in mind the normal dimensions of the heart. Its length in the adult male is 43½ lines; in the adult female, 41. Its breadth in the adult male is 48 lines nearly; in the female, 44. The right ventricle is under two lines in thickness; the left is five lines at the middle; while the weight increases from 8¼ ounces at adolescence, to 10 ounces with age. Now, in practice, hearts have been examined weighing as much as 40 ounces, and whose left ventricle measured upwards of three inches in thickness, and whose entire length reached 8½ inches. Of course, these extraordinary proportions are very rare; but instances of hearts far above the standard are very common. This enlargement may be due in a great degree to dilatation; which, however, is seldom present without some degree of hypertrophy.

AUSCULTATION.—Before entering upon the examination of the heart by auscultation, it is necessary to understand the rythm, and the cause of the sounds.

The order of succession of the heart's movements is the *rythm*, and is briefly thus: 1st. The systole of auricles. 2nd. The systole of ventricles. 3rd. The diastole; and, 4th. The pause. The duration of the first two may be indicated by 2; the diastole and pause, each 1;—supposing the entire period represented by 4. This rythm can only be ascertained correctly by listening to the heart-sounds; though irregularity may be readily detected by the pulse-examination alone. The normal sounds of the heart are two;—one a dull, long sound, synchronous with the impulse and systole; and the other a sharp, clear sound, immediately succeeding, and synchronous with the diastole. You hear the "first sound" naturally best over the central area point, and the "second sound" over the semi-lunars.

The *cause of the sounds* is not yet a settled point in physiology. There are, however, but two theories, which claim about equal support. One is that of Williams, and the other that of Billing. Williams argues that the *First* sound is caused by the muscular contraction of the ventricles, and the *Second*, by the rapid shutting of the semi-lunars; and bases his views upon experiments made in 1841 by the Dublin Committee of the British Association. Billing's views are, that both sounds are produced by valvular movements;—the *First*, by shutting of the auriculo-ventricular, and the *Second* as given by Williams. Laennec, you will remember, adopted the very opposite theory—which, however, has now no advocates—that ascribed both sounds to muscular movements. Professor Skoda modifies Billing's and Bouillaud's views, by considering that the stroke of the apex against the parietes must be an element in the sound. We cannot,

however, dwell upon this point, but hasten on to the practical and more valuable bearings of cardiac auscultation.

The sounds may be heard louder than natural, sharper and clearer, feebler ; or may be entirely altered. They may also be diffused more or less widely ; and they may vary perceptibly in relation to time or rythm, and in relation to the pulse. These points are all of great interest.

The heart-sounds are *loud* in cases of plethoric excitement, in nervous states, and generally in all cases where the circulatory organ is acting vigorously, and otherwise unchanged : also in cases of hypertrophy with dilatation. The first sound is *sharper* in cases of *extreme dilatation, atrophy, anemia*, or any state of general debility ; *feeble* in *fevers* at the close, or mature stage—in *softening of the heart*, and likewise in all cases of general debility. The sounds are *diffused* in cases of *dilatation*, and *irregular* in *valvular disease*, in *pericarditis*, and in some *gastric* and *nervous states* and *hæmorrhages*. The first sound may be prolonged in slowness of the heart's action, or auriculo-ventricular obstruction. The second sound is absent, or rather masked, in disease of the semi-lunars, or from being covered by a prolonged first sound ; and occasionally a duplicate of the second is heard, making three sounds in the one rythm, as when the pulmonic and aortal valves do not act synchronously.

The alterations or substitutes of the heart-sounds are named *murmurs*. These may either displace the normal sounds, or be additions to them. They are either pericardial or endocardial.

The *pericardial* murmur arises just like the pleural, from friction of the two layers of the serous sac under disease. A dry state of the membrane will induce it ; or the actual deposit of lymph, imparting the characteristic rough velvety surface,—or the more irregular sheets and plates, with or without fluid. The pericardial murmurs are always superficial, and distinctly friction-sounds, synchronous with the systole and diastole—the movements of the heart. In the progress of a case of *pericarditis* the sound may suddenly cease, as when a quantity of fluid separates the surfaces, or complete adhesion has taken place. The character of the sound varies much—sometimes like the friction of fine paper, or of new leather, or a grating sound ; and sometimes a distinct *fremissement* is felt and heard over the præcordial region. In diagnosing the pericardial from endocardial sounds, you must remember especially that the friction-sound may, nay does, begin somewhat *before* the systolic contraction ; it is changeable, and never propagated along the course of the vessels. In short, it is not so exactly synchronous with the ventricular contraction as an endocardial murmur would be. Besides, it is almost

always double—and necessarily so, and varies under prolonged ob-
servation, and with different degrees of pressure of the stethescope
in use.   Notwithstanding these distinctions, you must be prepared
for difficult cases, which defy differential diagnosis, at least for a
time.

Endocardial murmurs are synchronous with the systole or diastole
—replace one or both sounds, and are heard best (as a rule) where
the sounds are produced.   They are of all kinds, " bruit de souffle,"
" de rape," " de scie," sibilant, musical, &c., and are necessarily pro-
duced by valvular changes, an altered condition of the blood, or
the varying proportions of the cavities to the vessels, with the thick-
ness of the walls ; and indirectly by pericardial effusions, tumours,
lung-consolidation, and adhesions, which may press upon the large
vessels, or otherwise alter the integrity of their coats.   The valves
may be *obstructed* by vascular thickening, infiltration, and deposit,
or *relaxed* by softening, or by contraction and shrivelling.   Hence
we have valvular *stenosis*, or contraction, and valvular *patency*.
All the valves may be thus diseased *theoretically ;* but in practice we
may restrict ourselves to regurgitant mitral, direct and regurgitant
aortal, and tricuspid patency.

Regurgitancy of a valve may depend on disease of the valve,
tendons and muscles attached thereto, or the ventricular walls.

The causes of stenosis are : 1, rigidity,—from deposit (inflam-
matory) ; 2, vegetations ; 3, adhesions ; all of which, however, may
ultimately establish patency.

The direct murmurs are caused by *friction* of the current of blood
against the rough edges of the diseased valves ; and a regurgitant
in addition, by recurrent passage into a chamber partly filled.

In order to determine which valve is affected, we must remem-
ber, 1st, *where* the murmur is best heard ; 2nd, what *direction* it may
be traced in ; and, 3rd, at what *period* of the sounds is it heard.

The regurgitant mitral murmur is the most common.   It is a sys-
tolic sound, heard *best at the apex*, rarely transmitted along the aorta.

The direct aortal murmur is the next in frequency, and is also a
systolic sound, heard *best at the valves*, and along the aorta.   It is
generally loud, especially in the earlier stages of obstructive disease,
and is nearly synchronous with the cardiac pulse.

The regurgitant aortal murmur is a diastolic sound, heard *best at
the valves*.   It is loud, and attended by carotid pulsation, and a full
but rapidly retreating pulse.

Tricuspid regurgitant murmur is a systolic sound, heard *best at the
inferior part of the sternum*, and occasionally attended by pulsation of
the jugulars.   This lesion is rare ; and the other sounds which are

theoretically laid down in works, being still more so, need not occupy our further attention.

It not unfrequently happens that murmurs, especially systolic, will be heard over the cardiac region, which are merely functional. Now one mode of testing these, besides the accompanying symptoms, is by examining the course of the aorta and great vessels. This brings us to the

CERVICAL EXAMINATION, which frequently gives important information. By applying the stethoscope in the angle between the sterno-mastoid and the trapezius, and immediately over the clavicle, you will hear, in health, the systolic sounds of the heart transmitted along the vessels, and nothing else; but if the case be anæmic, a murmur will be heard distinctly accompanying and occasionally displacing them. These are the "*arterial* murmurs," and owe their origin generally to an anæmic condition. Sometimes the murmur is confined exclusively to the præcordial space, especially *the base* of the heart, and is supposed to be of pulmonic origin. " The *venous* murmurs" are of much interest. They are heard over the jugulars, and upper sternum, and are especially marked by a continuous musical roll or hum, like that of the waves of an agitated sea—swelling distantly and closely alternately. The intensity of this murmur is weakened by the recumbent posture, and increased by deep inspiration. It is most distinct on the right side. The idea that this murmur is indisputable evidence of *anæmia*, has been lately combated by Davies, who examined one thousand persons, of all ages. There is no question, however, that "it is uniformly present in those conditions of the system which are marked by an impoverished condition of the blood," yet in a large proportion of *healthy* children of either sex, it was present, and must then have been due to the rapidity of the circulation, (doubtless under excitement,) the elasticity of the venous walls, and the good vibrating medium. It was ascertained by Davies to be very infrequent after the *middle period of life.* Hence its value as an anæmic sign increases with age; and when the arterial and venous murmurs combine, the existence of *spanæmia* is undoubted.

It is necessary to remind you that arterial murmurs of inorganic origin must not be confounded with aneurismal murmurs.

THE GENERAL SYMPTOMS indicative of heart disease, are at times sufficiently diagnostic. Thus the *countenance* in old cases acquires a hue and cast of features, which the experienced will at once recognize. Under such circumstances it is full, rather pale, anxious,

the lips somewhat livid—and the eyes prominent. In *pericarditis*, anxiety reaches its acme. The *manner* is rather disposed to hurry and excitement than calmness, and the *position* of the patient in exquisite cases is, either sitting or partly supported. The voice and speech are not indicative. The eye is usually prominent, and the expression a little wild. The *respiration* is for the most part accelerated, especially when lying long in the recumbent position, as at night, when the patient is frequently roused up in consequence of the supervention of *orthopnœa*. At times, paroxysms of *dyspnœa* attack the invalid : and the peculiar " sighing respiration" is strong evidence of fatty degeneration of the organ. The *pulse* is particularly marked in valvular disease—it is generally thrilling and jerking—and you may at once arrive at the conclusion that such disease exists. In other cases, as incipient inflammation, it is very quick and *hard*, and when this stage has been neglected, a hectic pulse, frequently irregular and very feeble, becomes permanent. The *tongue*, save as evidencing inflammatory affection, is not significant. The *skin* is for the most part highly disposed to perspiration, which is frequently profuse ; in fact it only assumes a dry state at the very commencement of an inflammatory attack. The *bowels* are not affected. The *appetite* is only impaired in the early stage ; othertimes it is even excessive ; and many cases have died during, or immediately after a meal. The *sleep* is generally disturbed, and a feeling of suffocation frequently rouses the sleeper in the midst of deep repose. This disturbance, is however, only occasional in the chronic quiescent cases. *The strength* seems much above what it is in reality. The patient, after an acute attack, soon fancies himself able for the most laborious employments, and often requests his discharge from surveillance, when we know that a relapse from the least exposure, or over-exertion, is certain. *The general feelings* are, therefore, very deceptive, and except in *phthisis*, in no instance do patients imagine themselves more exempt from disease. *The blood* is varied; plethoric, and highly fibrinous in the acute stage ; but the influence of *chronic* disease is to impoverish it of its red particles, and render it watery and purpuric. Hæmorrhages are, therefore, frequent, as also serous accumulations, which, however, are partly due to the mechanical obstruction which disease of the heart necessarily produces.

THE REFLEX OR INDIRECT SYMPTOMS indicative of heart disease, are not numerous. Headache, vertigo, tinnitus aurium, or sense of fulness, are frequent concomitants ; as also wandering pains of the neck, shoulders, and arms. Pains also of the spine, and gastric disorders, are usual attendants. Hiccup occasionally occurs,—but

much oftener, vomiting; and a slight, dry, but frequent cough is a common complaint. In several chronic cases, a lethargic state is present, which might be very readily misinterpreted. It is due to the effect of an increase of venous blood in the brain, in consequence of the cardiac obstruction. On the other hand, the very opposite state of high mental irritability and even passion may be present in a great degree, arising from cerebral excitement, and as the effect of determination. The special senses of hearing and sight are frequently similarly impressed. In some cases, we have noticed spinal neuralgia and convulsions; and the effect of disordered circulation is observed in dreaming, or vigilance; and in females, uterine derangements are frequent concomitants.

V.—THE INTERPRETATION OF DERANGEMENTS OF THE DIGESTIVE PROCESSES.

THE object of the digestive apparatus is to prepare the food (which may be likened to raw material) for assimilation. It is hence, perhaps, the most important in the animal economy, and will especially demand our earnest attention. Before entering upon an explanation of the symptoms or derangements of this system, it seems necessary that you should fully understand the structure and functions of the different organs engaged, and the different processes in operation in digestion and assimilation. This knowledge will prepare you for clear ideas of the doctrine of " supply and waste," and of the immense influence which digestive derangements possess in determining disease.

The mouth is admirably adapted for the first stage of digestion, or that of mechanical division. Here we have the teeth for dividing and grinding, the muscles that close upon and variously impress the food; and the tongue, that can both receive impressions of the taste and co-operate with the other muscles in rolling the morsel about, and thus, with the aid of the saliva and mucus, produce the most perfect uniformity of consistence. When this is accomplished, the morsel is fit for being carried into the stomach. The masticatory process just mentioned is a voluntary one; though the mere reception of food, as the sucking of the new-born babe, seems originally instinctive and involuntary, and an example of *reflex* motor action. But when the morsel touches the fauces, instantly the glottis is closed, (as also the posterior *nares* by the velum,) and the pharyngeal muscles grasp it; and by a gentle peristaltic action of the œsophageal muscles, it is propelled along to the stomach; and this, too, totally irrespective of its gravitating tendency, as deglutition

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can be performed with the body inverted or supine. Though this is decidedly a reflex motion, yet it is partly under the voluntary influence.

The *saliva* is a clear, slightly glairy, and alkaline fluid, and averages in quantity about twelve ounces daily in the adult. It is produced by the parotid, sub-maxillary, and sub-lingual glands. Examined by the microscope, it consists of mucus and epithelial cells floating in a clear fluid. The solids in the saliva are only twelve per cent., and these solids are chiefly composed of mucus, saline matters, ptyalin, fat, and albumen. *Ptyalin* is the essential ingredient. This is a principle analogous to vegetable *diastase*, and hence named *animal diastase*. It enables saliva to convert starch into sugar, and is therefore a true ferment. The alkalinity of the saliva is due to the sub-phosphate of soda, which amounts to twenty-eight per cent. of the ash. Besides this, we have *chloridum sodii*, the phosphates of lime, magnesia, and iron, and a small but appreciable quantity of the sulpho-cyanide of potassium. This last salt is, according to Dr. Wright's researches, remarkably increased by the use of sulphur. The saliva, while acting mechanically as a diluent, is principally intended for the conversion of the amylaceous food into sugar. It is also capable of absorbing large quantities of oxygen, which is dissolved, and which has its utility in developing the gastric juice. The mucus met with in the mouth is of various kinds. It consists of ordinary mucus—the natural secretion of the membrane—and the mucus of the pharyngeal glands and the tonsils. This last differs from ordinary mucus in being evolved in *masses* of a dark, slightly opaque appearance.

The morsel of food thus masticated and intimately mixed with saliva, is propelled by the action of the 8th pair into the stomach. Here a new process awaits it. It is acted upon by the gastric juice and the ordinary mucus of the organ, and by the systematic movements of its muscular fibres. The *gastric juice* is a clear, yellowish, acid fluid, which seems only to be secreted under the stimulus of food ; as in other conditions, the ordinary mucus of the stomach is alkaline. The stimulus of food, properly masticated, the presence of saliva, and the integrity of the nervous system and the blood, are all necessary conditions for the eduction of this fluid. The gastric juice is denser than saliva, and contains sixteen per cent. of solids, —of these solids, one-third are saline matters, and two-thirds organic, of which a principle called *Pepsin* is the active ingredient. This substance is soluble in water, but insoluble in alcohol. It amounts to two-tenths per cent. It is, like saliva, a true ferment, and similar to *diastase*. It is, however, in the healthy gastric juice, asso-

ciated with an acid, and has the property of dissolving coagulated albumen, fibrin, and casein, and, of course, flesh. The cause of the acidity is disputed. It is supposed to be partly galvanic, arising from the influence of the salival oxygen on the coats of the stomach, and upon the presence of lactic acid produced by the change wrought on amylaceous bodies by the *ptyalin*, and also the development of the acid phosphates of soda and lime. So it appears that the *pepsin*, when associated with alkalies, aids the saliva in converting starchy substances into sugar, lactic acid, and fat; but when acid, dissolves and digests fibrinous and albuminous bodies.

Besides the action of this fluid, remember that the stomach moves, in chymification, in a peculiar manner. Two currents are set up :— one, an *external*, or close to the mucous membrane, *from* the cardiac *to* the pyloric orifice; and the *internal*, in a contrary direction. These currents are due to the periodic peristaltic action of the transverse fibres; and the ultimate effect is, to mix intimately every portion of food, and bring it equally under the action of the gastric juice. It must be remembered that the gastric juice is secreted from the entire surface of the stomach, *in addition* to the ordinary gastric mucus, which I shall now examine. *The gastric mucus* is, like mucus elsewhere, composed of cells floating in a thin glairy fluid, with alkaline reaction. It is situated in little pouches called "follicles." The gastric capillaries, branches of the coeliac axis, are distributed in a close network *around* these pouches, as may be readily seen in any injected preparation; and it is from these that this mucus originates. It is important to have a correct idea of these mucous crypts, and their disposition; as, while they are similar to those of the large intestines, they differ *in toto* from those of the small.

When the food has been some time in the stomach, and undergone the action of the gastric juice and the movements of the fibres, a uniform substance is the result, called *chyme*. This, of course, varies in colour, and density, and composition; for different foods are differently acted upon. Thus, some are totally indigestible, as husks, horn, hair, wood; fibrin is dissolved, and partly converted into albumen; albumen is so dissolved and changed, that it ceases to coagulate by heat; gelatine loses its properties; starchy substances become saccharine; and saccharine changed into lactic acid; while fats pass on unaffected.

This substance (chyme) which you see is variously formed, is now in a state for reaching the *duodenum*, which it does by passing out slowly, and it is believed, intermittently, through the pyloric valve. Here it arrives, it may be said, at the second stomach; for

certain important changes await it here. Two important glands empty their secretion into the duodenum, and exactly at the same part of the tube, viz., the inner and posterior surface. These are the liver and pancreas.

The Liver is the heaviest organ in the body. Sections will shew you that it is of uniform formation. It contains, *essentially*, branches of the *vena portæ*, the hepatic artery and veins, the hepatic ducts, nerves, absorbents, and areolar connecting tissue. It is composed of an immense aggregation of *lobules*, whose minute anatomy has been clearly and satisfactorily explained by Mr. Kiernan. These lobules are small granular bodies, of the size of a millet seed. Divided *longitudinally*, they present a foliated or leaf-like appearance; the stalk representing the *intra-lobular* vein, terminating in the *sub-lobular* or hepatic vein. A *transverse* section shows a *polygonal* figure, presenting a central sprig, which is likewise the *intra-lobular* vein, but the divisions represent the *inter-lobular* fissures and spaces. The yellow bodies of each lobule, (called by Malpighi the *acini*,) are the biliary plexus of each. The surface or periphery of each lobule is formed by duplications of Glisson's capsule, which is similar in use to the pia-mater; and each lobule receives the terminations of the portal vein, which inosculate with the commencing network of the intra-lobular or hepatic veins; and exactly between the meshes of this plexus are fixed the "acini" of Malpighi, or the biliary plexus. Thus the portal vein terminates in the lobule, and though principally composed of the venous return-blood from the intestines, it also receives the venous blood from the terminations of the hepatic artery. The principal, and, in fact, distinguishing part of the lobule is the "biliary plexus," which gives the peculiar colour to the liver, and which receives the first drops of the secretion called *Bile*, which is therefore the secretion wholly of *venous* blood.

It is important to understand the circulation in each lobule, as much may be learned by mere inspection of the colour of the liver at *post mortem* examinations, and this colour may even be diagnosed during life from a knowledge of the existing lesions. Thus any obstruction at the heart or lungs will be sure to cause hepatic venous congestion, which is characterised by *central* darkening. This is passive congestion; while the active form implies congestion of the inter-lobular, portal, or peripheral fissures.

BILE, the product of the portal system, is a compound fluid, of a dark green, or olive hue. When analysed, it is found to contain a fatty acid—the *choleic* (its chief constituent) in combination with soda, hepatic mucus, cholesterine, and colouring matter, which last is itself distinctive. *Choleic acid*, when isolated, is a yellowish,

brittle substance, resembling gum arabic, intensely bitter, soluble in water and alcohol, but not in ether.   When the cholesterine—a substance resembling spermaceti—and the colouring matter, are in excess, biliary calculi are formed, for the most part by inspissation. The bile reaches the duodenum by the *ductus choledochus communis* (the gall-bladder being interposed as a reservoir) and, when there, serves to stimulate the muscular action of the intestines, and thereby keep up a regular peristaltic movement ; neutralizes the acid chyme, and thus permits of the further digestion of any caseous and fatty matters ; besides, it here becomes partly absorbed, for the purpose of supplying the blood with carbon, which is ultimately burnt at the lungs.   In fact, it is proved by experiment, that but one thirty-fourth of the whole bile secreted passes out of the intestines with the fæces.

Besides the bile, you are aware that the *Pancreatic fluid* likewise passes into the duodenum.   This fluid is secreted by the capillaries of the pancreas, a gland whose function has only of late been rightly known.   It is, to render assimilable the fatty matters of the food which pass the pylorus unchanged.   The pancreatic fluid has an alkaline re-action, and this also aids the bile in neutralising the gastric acidity, and thus assists in the further conversion of the amylaceous food into sugar, commenced in the mouth.   The structure of this organ is simply a congeries of minute, reddish-yellow, polygonal lobules, consisting of the ramifications of the minute ducts, terminating in cæcal pouches.

Besides the ordinary mucus which the duodenum secretes, there are certain special glands called Brunner's, (after their discoverer, John Conrad von Brunn, who lived in 1715,) which resemble the buccal glands, and like them, open by excretory ducts.   These glands are peculiar to the duodenum.

The chyme now mixed with the bile, the pancreatic and other fluids mentioned, passes on to the *small intestines,* the jejunum and ileum.   Here a new process is set up, and a new arrangement is seen.   The mucous membrane here is so disposed as to delay the passage of the semi-fluid mass, now called chyle, and at the same time to concentrate in a small compass the very extensive surface. This is effected by certain foldings of the mucous membrane named *valvulæ conniventes,* which are several lines in breadth, and extend from the beginning of the jejunum to the middle of the ileum. These folds are only segmentary or crescentic, and do not embrace the entire circumference.   Secretions are poured out over this tract from three sources : the simple follicles, or the " follicles of Lieberkuhn," which are generally diffused ; the *solitary* glands, which are

small circular patches, surrounded by a zone of simple follicles, and occupy the lower part of the ileum (these are simply flattened sacs without excretory duct); and the *aggregate glands*, or, as they are otherwise termed, Peyer's (after a Swiss anatomist, John Conrad Peyer, who wrote in 1677). These are likewise situate at the lower end of the ileum, opposite to the mesenteric attachment. They are small oval patches, surrounded by simple follicles, similar in all respects to the *glandulæ solitariæ*.

Further, the mucous membrane here presents minute projecting papillæ, called *villi*, which are either cylindrical or laminated—thus differing from the polygonal cell arrangement of the stomach and large intestine. These "villi" contain the beginnings of the lacteal tubes, which proceed to the mesenteric glands, and thence reach the thoracic duct. Now, it is in these small intestines that the chyle, or altered altered food, becomes *absorbed* by the lacteals, for the continual formation of blood. The *chyle* is a milky alkaline fluid, which is sometimes tinged yellow, when fatty substances prevail in the food, or pink in its course through the great thoracic duct. In its passage through the mesenteric glands, (which are but extended coils of the lacteals,) the chyle acquires new properties, rendering it more similar to blood. When minutely analysed, it consists of various cells, *e.g.*, fat-cells; lymph-cells, round, colourless, and about three-fourths the size of blood-cells; chyle-cells, grayish, round, granular, and considerably larger than blood-cells; and also a few perfect blood-cells. Chemically examined, the solids—about seven to eight per cent.—contain about seventy per cent. of albumen, ten to twelve per cent. of fats, the same of saline matters, and barely one per cent. of fibrine; but the proportions are subject to great variations.

The next division of the digestive tract is the *large intestines*, which are separated from the small by the ileo-cæcal valve; and differ by being more bound down in the abdominal cavity. In the cæcum and colon, the mucous membrane is raised into folds or cells; and in the rectum, three valvular folds have been discovered by Mr. Houston, of Dublin: one at the beginning of the rectum, a second at the sacrum, at its middle; and a third at the anterior wall, opposite the base of the bladder. The glands of the large intestine are the simple follicles and the solitary glands. The latter are numerous at the cæcum, and are small, circular projections, flattened and perforated by a minute excretory opening. These glands secrete the ordinary mucus which lines the intestines, and lubricates the passing matters. These matters are chiefly indigestible and effete substances, mixed with mucus, water, and bile, and constitutes the *fæces*, or usual alvine evacuations.

The passage of the food along the gastro-intestinal tract, from the pharynx down, is effected by the peristaltic action of the muscular fibres, aided by the abdominal walls and diaphragm. The œsophagus has its circular and transverse fibres—the latter pass into the stomach, and are observed chiefly at the lesser curvature. The circular are seen best near the pylorus, where they are greatly developed; and a fold of the mucous membrane here constitutes the pyloric valve. Oblique fibres traverse the greater end. The small intestines have their circular and longitudinal muscles, too; while in the colon, the latter are arranged into three bands, one anterior and two posterior; and, being shorter than the intestine itself, dispose it in sacculated cells. The two posterior unite in the descending colon, and near the anus the fibres become strong and bulky, and join the circular ring called the *internal sphincter ani.*

I have not (purposely) referred to the structure and functions of the spleen, because this, by recent researches, forms no part of the process of digestion, though it is intimately concerned in the production of the blood corpuscles; and as one of the organs of the lymphatic glandular system, will be considered in another place, along with the thymus, thyroid, supra-renal capsules, and lymphatic glands generally. It only remains, ere we proceed to the symptoms, to mention the nerves which supply the digestive tract. These are the glosso-pharyngeal, the pneumo-gastric, the phrenic, the sacral plexus, and the branches of the solar, mesenteric, and hypogastric plexuses of the ganglionic system.

The derangements of the digestive system have reference, of course, to the different organs engaged. Hence we may examine them in this way, commencing with the complaints of the patient first, and then proceeding to the indications from actual examination.

1. THE TASTE.—The integrity of the sense of taste depends very much upon the condition of the digestive organs, especially the stomach and duodenum. The mucous coat being continuous, and the interlacement of nerves being sympathetically perfect between the most remote parts, irritation of any one part of the canal or *diverticula* therefrom, is sufficient to bring on such a state of the tongue, as to impair or alter in a great degree the sense of taste.

The taste may be bitter, foul, sweet, salt, acid, or metallic; or depraved; or altogether absent. It is *bitter* in duodenal and hepatic affections, arising, most probably, from excessive absorption of bile. A *foul* taste is noticed in diseases of the gums or teeth, or other

parts inside the mouth, in chronic pulmonary suppurations, in low fevers, and intestinal ulcers. A *sweet* taste indicates diabetes, hæmoptysis, phthisis, besides nervous states—especially hypochondriasis. An *acid* taste is noticed in gastric irritation, and indeed all acute dyspeptic states. When protracted, organic gastric or hepatic disease must be thought of. *Insipidity* is observed in worms, gastritis, and fevers generally,—especially the catarrhal. A *depraved* taste is an index generally of the hysteric constitution, or of gastric disease ; while complete *absence* of taste is equally a symptom of gastric and cerebral disease.

2. DEGLUTITION may be difficult or wholly impossible : it may be an uncontrollable desire ; and again, it may be audibly performed.

Difficult deglutition, or "dysphagia," has many causes. Thus, all the forms of sore throat, sore tongue or parotid, aphthæ, affections of the larynx and œsophagus ; the presence of foreign bodies in or about the throat ; spasmodic diseases, hysteria ; the close of prolonged diseases ; and all cerebral states and nervous spasmodic movements involving the masticatory or cervical muscles, may induce this symptom. When cough or dyspnœa attend, we must look out for aneurism or other tumour pressing upon the œsophagus and trachea.

Aphagia, or the absolute impossibility of swallowing, is most frequently fatal, especially if it occur in the later stages of disease. It arises either from local inflammation or injury, stricture of the œsophagus, hysteria, or cerebral disease, inducing paralysis. A constant *desire to swallow* argues the presence of some irritant body in the pharynx, an elongated uvula, or hysteria. This last cause is more especially indicated by the feeling of *globus*. When difficult deglution is performed with a gurgling noise, and no local lesion present, it indicates extreme debility.

3. THE APPETITE, when morbid, is increased, diminished, or peculiar, and includes the desire for drinks, as well as for food. We shall first consider the appetite for drink.

Thirst is noticed clinically in the formation of all fevers, in *diabetes*, in cholera, and generally also when perspiration is abundant, as after exercise. It is noticed frequently in cases of diarrhœa ; and is commonly present after taking salines, especially the common salt. In some obscure cases thirst becomes an important symptom, and may alone lead to the proper interpretation. The absence of thirst is, of course, usually a normal state. Yet it is of serious import in fevers, and is noticed in delirium. It is especially so, if after a

state of thirst, and without a corresponding remission of the other symptoms.

The appetite for food may be too great, too little, or directed to peculiar articles, generally of an indigestible kind.

Hunger may be natural, as in cases of destitution, or in those of rapid recovery from acute diseases ; or (as frequently observed) in pregnancy. When the appetite is keen, food plenty, and yet emaciation goes on, it is a sign of *phthisis, diabetes,* or perverted sensation. A craving for food may be excited by stimulating the nerves of the stomach, as by the use of spices, &c. ; but it is also clinically noticed in worms, and occasionally in phthisis ; and in certain nervous states, as hysteria. *Bulimia,* and *fames canina* are the designations given to this form of hunger. Sometimes the craving is but a notion, and the mere sight of food dispels it. Here there is really no appetite. Peculiar articles of diet are frequently inordinately desired. Thus the chlorotic girl longs after the most indigestible things ; the dyspeptic would often prefer acids, and food the very opposite to what is suitable ; the hysteric would give anything for valerian or other stimulant drinks ; and the *roue* can only be satisfied with the strongest incentives.

Anorexia, or the absence of appetite, on the other hand, is met with in all fevers ; especially in gastric and intestinal chronic disease ; in most cases attended by debility ; and after the use of certain medicinal agents. In giving a value to this symptom, you must remember that the aged, the sedentary, and the nervous, of the female sex especially, demand a very small proportion of nutrition ; and hence, what might be deemed anorexia in the child or adult may be the natural state of the former. Anorexia may be dependent, like its opposite, upon ovarian and uterine disorders, and is among the earliest symptoms of " the constitutional states." Aversion to food is of a more positive description, and most commonly met with in association with sickness of the stomach or nausea. We observe it in pregnancy, particularly in *primiparæ* ; in the commencement of the poison-fevers ; in cases of hysteria ; in all intestinal irritations, as the presence of worms ; and in muco-enteritis.

NAUSEA AND VOMITING are allied symptoms, the former expressing but a minor degree of the latter state. *Loathing* is simply an aversion to articles of diet, while *retching* is an ineffectual attempt at vomiting ; or the anti-peristaltic action set up, when there is little or nothing in the stomach. These states argue irritation of the pneumo-gastric, direct or indirect. Hence we have two sets of cases in which nausea or vomiting may occur. Thus, local states

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of the organ, such as distension by gas, or inordinate accumulation of food or fluid; the irritation of bile, of undigested food, of any excessive stimulant, of the irritant poisons; altered mucus, or depraved gastric juice; congestion or inflammation, ulceration, cancer, will all readily induce vomiting: while another class of cases will operate through the brain, directly, or by reflex action. Thus cerebral and spinal disease, concussion, hysteria, the motion of a vessel at sea, fever of all kinds when first formed, especially the infectious and symptomatic, and Asiatic cholera : and the reflex state is induced by worms, peritonitis, pericarditis, strangulation of intestines, inflammation of the kidney, pregnancy, uterine disease, bronchial affections, hepatitis, passage of calculi, orchitis. This symptom is, therefore, by no means one easy of interpretation in actual practice in many cases, and simply in consequence of its many possible causes.

Painful vomiting generally indicates a local inflammatory cause ; while *difficult* vomiting is due either to local disease, or a nervous state. *Chronic* vomiting is a sign of great importance, sometimes due to cerebral disease, but most frequently to local or abdominal disease. In young children, when not cerebral, mesenteric disease should be suspected. The vomiting of food immediately after ingestion, argues either gastritis or gastric irritation, when not purely nervous; when chronic, disease of the cardiac orifice or œsophagus must be looked for; and when hours elapse ere vomiting of food comes on, the pylorus may be considered diseased.

A kindred symptom—*Regurgitation*, or Eructation, is most frequently a sign of gastric disorder or organic disease. It is observed also in pancreatic affections. It is called also " Ruminatia," when the food is again masticated. This is most frequently a habit, and, indeed, hysteria may simulate this affection.

ACIDITY.—The stomach is naturally acid immediately, and for some hours after, food is taken. This is owing to the presence of the gastric juice ; but this degree of acidity is not perceived in the healthy state. Whenever acidity is *felt*, whether before or after food, we have a derangement present. Any substance in food, then, that will protract the process of chymification, will induce such a quantity of acid, as to make itself felt. The excess of acids, however, may occur without such stimulus—as by mental anxiety. It argues always imperfect digestion, which may have its causes in the organ itself, the effects of ingesta, the state of the blood, nervous disorder, or central cerebral disease.

PYROSIS originally meant a painful burning sensation at the

epigastrium, accompanied by a degree of fever; but since Cullen's time, it has been used to express the discharge of watery fluid from the stomach, whether or not fever attends. The discharge is sometimes very sudden, but is generally preceded by some degree of sickness. "Water-brash" is the vulgar term. The fluid ejected may be acid, insipid, bitter, or salt. It is a morbid secretion, and is caused by some irritation, direct or indirect. The *acid* kinds of fluid are noticed generally long after a meal, while the *insipid* and *salt* varieties are met with most frequently in periods of fasting. It must be distinguished from *ptyalism*, which is by no means rare in dyspepsia. In the latter case, however, the fluid is salivary, and comes in streams, and not gushes, as in *pyrosis*.

FLATULENCE AND TYMPANITIS.—There is naturally much gas in the stomach and intestines. It is accummulated by being taken in with the saliva, by being swallowed, by being secreted, and occasionally from decomposition. The ordinary gases of the stomach are *carbonic acid, nitrogen,* and *hydrogen,* but in disease, *sulphuretted hydrogen,* and perhaps *phospuretted* and *carburetted hydrogen,* are also formed. Now when these gases are in excess, either the stomach has lost its tonicity, or the secreting power is too great, or some matters have been allowed to decompose. Paralysis will cause this state, as also hysteria and all dyspeptic states which tend to produce atony, and disorded secretions. This state induces *eructation,* or belching, and *borborygmus.*

Tympanitis is a gaseous accumulation in the intestines, to such a degree as to present the fulness and rotundity and clear resonance of a drum. It may be enteric, and arise as it does in the case of flatulent stomach, or it may be peritonitic. In either case, it is a frequent sign of chronic peritonitis; of intestinal obstruction and strangulation; and of want of tone, as occurs in hysteria: it also arises from vermic irritation. It is a state frequent in the old—in females, and weakly children, and is more or less connected with impaired digestion from any cause. It is frequently accompanied by pains; hence we meet with the "flatulent colic."

HICCUP is an abrupt inspiration which seems to be performed by the diaphragm alone—contracting when the glottis is suddenly closed, and then suddenly opened. It manifestly then must arise from irritation of the *phrenic,* direct or indirect. Flatulence will induce it, debility and cerebral states also, as we see in low fevers and gangrene; and further, hysterical and mental emotions may likewise occasionally originate it.

ABDOMINAL PAINS must arise from one or other of the following states : local disease, general states, central disease, or reflex action. In cases of indigestion, they are most frequently felt at the epigastrium or sternum ; in *enteritis*, at the umbilicus ; and in general *peritonitis*, they are diffused ;—in other diseases, according to the part affected. The " general states " causing, among others, abdominal pains, are hysteria, chlorosis, debility (especially from blood-losses), nervous irritability, and rheumatism. The central diseases causing abdominal pains, are spinal arachnitis or myelitis, spinal irritation, aneurism, and other tumours pressing upon the spinal nerves, and nephritis *;* and the *reflex* forms are instances of peripheral nervous irritation, inducing cramps and other spasmodic movements.

The *kind of pain*, or *soreness*, may occasionally give information. Thus, weight, distension, or oppression, arises from flatulence, or accumulated food, or chronic peritoneal thickening. *Aching* pain is most usually a dyspeptic sign, as its seat is invariably near the epigastrium. A hot or burning pain, or "heartburn," technically termed *Cardialgia*, is also a sign of indigestion. *Cramp* arises from sudden and tonic contraction of the circular muscular fibres of the stomach or intestines, and is caused by direct or indirect irritation. It is frequent in gouty habits, and is then accompanied by cramps elsewhere. It is noticed also in cases of *cholera* and *colic*.

Acute pungent pain is usually inflammatory, indicating peritonitis. *Dull* and deep-seated pain denotes inflammation of the organ underneath, according to the situation. *Tensive* pain in the right hypochondrium indicates portal congestion, or chronic hepatic peritonitis. *Intermittent* pain of a severe character is neuralgic. " Colic" is an acute, spasmodic, twisting, remittent pain, accompanied by *flatus*, sickness of the stomach, and, generally, constipation. *Shifting* pains, induced by abdominal movements, are chiefly rheumatic. Besides causes, it must be remembered that dyspeptic and hysteric pains these may simulate any or all due to organic lesion.

THE STATE OF THE BOWELS.—I shall refer here merely to the indications derived from knowing that they are loose, constipated, or irregular. Other particulars will be described in another place.

Diarrhœa is not an unnatural state in very young children. It is usual for the infant to have several movements daily, without the limit of health being overstepped. With this exception, it is a sign of disease. Diarrhœa may arise merely from laxative food, or a surfeit ; sudden changes of food ; from undigested food ; from irritation of worms—of accumulated vitiated secretions ; from certain medicines ; from inflammation of the mucous membrane and its

follicles; and from reflex irritation, as teething; or from mere prostration. The diarrhœa may be also painful before, during, or after the evacuation; or it may be painless. It may be preceded or accompanied by vomiting. It may be acute or chronic; and the stools may be involuntary. Diarrhœa must be distinguished from mere *tenesmus*, and from *dysentery*. And it should be remembered, that even the presence of hardened fæces in the cells of the colon or cæcum may determine this state. As diarrhœa is commonly noticed in all muco-enteric irritation, we are prepared hence to meet with it in *tabes mesenterica* and *phthisis* at the advanced stages: and in *fevers*, especially of the typhoid type.

We see here how many and how various are the conditions which may be connected with diarrhœa, and how difficult it may be in many cases to select the appropriate line of treatment.

But again, the bowels may be *constipated*. The peristaltic action may be in abeyance. Here the cause must be looked for in the state of the hepatic and intestinal secretions, which are generally deficient; in torpor of the colon from slowly accumulated fæces, which have distended and paralysed it; in all cases of enteric inflammation, which engages the peritoneum, or produces thickening of the intestine; in cases of cerebral and spinal disease, which induces paralysis; in certain nervous states, as hysteria, various forms of insanity; chronic dyspepsia; and further, in all cases of intestinal obstruction, (even as high up as the pyloric orifice of the stomach,) produced by inflammatory or hernial stricture, peritonitic bands, intussusception, and tumours. Constipation, with pains of the abdomen, is apt to assume the inflammatory form, though it may originally be mere obstruction from fæcal accumulations. With vomiting, if the latter be early, it is not an unfavourable case; but if vomiting *succeed*, danger is at hand. When fever attends any of these states, inflammation must be expected.

The *irregular* state of the bowels is noticed in the *tabes* of children; in chronic muco-enteritis, and in worms. Sometimes a constipated state is associated with tenesmus. Here the anus and rectum must be examined, as the irritation, whether fissure, piles, or tumour must exist there.

INSPECTION.

THE MOUTH.—An examination of its interior, in practice, generally discloses much useful information, not only respecting the gastro-intestinal tract, but of the system at large. It directly informs as to the condition of the mucous membrane, the tongue, the teeth and gums, the salivary glands and ducts; and as to the presence of tumours or ulceration, or even any past mischief which may have left traces, such as old syphilitic ulcers, tonsillitis, &c.

The Mucous Membrane may present different degrees of vascularity, of thickness, and of the usual discharge. The follicles may be inflamed, hypertrophied or atrophied. The epithelium may be formed in excess, altered, or deficient. The membrane may be aphthous, or in the state of diphtheritis, or variously coated with altered mucous discharge.

These different conditions present occasionally important indications. Thus, 1. if you find the mucous membrane pale, it denotes the anæmic state; if extremely vascular, it denotes hyperæmia, or congestion, as we notice in catarrh of this membrane; or in the exanthematous fevers, especially *scarlatina.* Should the congestion assume a livid hue, pulmonary, cardiac, or cerebral vascular obstruction will be present. 2. The membrane may be very much thickened, as the result of repeated inflammatory attacks, or attenuated, as in extreme debility, especially in chronic wasting diseases. 3. When the mucous discharge is in excess, catarrh of the membrane, or ptyalism, has been established; when deficient, we meet with it in all fevers, and the formative stage of local inflammations. 4. " Follicular inflammation," in all its stages, is generally associated with erethism of some part of the digestive tract, and the degree indicates the stage of that erethism. When the follicles become atrophied, it has arisen from the effect of long-continued pressure, or repeated inflammatory attacks, ending in obliteration. 5. Pityriasis, or excessive exfoliation of the epithelium, occurs in secondary syphilis, and chronic dyspeptic states. When the epithelium is also altered, we have *psoriasis,* noticed occasionally on the lips; but when deficient, it argues the existence of exanthematous fever, phthisis, or an inflammatory state of the intestines. 6. The mucous membrane may be variously coated. When *lymph-shreds* are thrown out upon a highly inflamed, erysipelatous ground, it denotes diphtheritis—a most severe form of inflammation, liable to spread and engage the larynx.

Other times, you will meet with an *albuminous* coating in scattered points. This is the first stage of aphthæ ; eventually pustules, (or rather follicular suppuration,) occur. This state is frequently co-existent with pulmonary or intestinal inflammation ; but the milder forms are met with usually in children as the result of simple irri-tation—dental or gastric—and co-existent in other cases, with *herpes* of the lips. 7. When tumours are noticed in the interior of the mouth, if recent, they may arise from inflammation of the jaws, the cheek, salivary glands, the tonsils, the pharynx, the tongue ; if chronic, you must look to the state of the *bones*, and periosteum—palate, or jaw.

An examination of *the teeth* will frequently detect diseased states. Thus they may be elongated, loose, crowded, or irregularly set, coated with altered mucus, or with " tartar ;" they may be carious, or simply pained and sensitive.

Elongation generally arises from retraction of the gums, and is seen in scrofula and scurvy ; *looseness*, in ptyalism and scurvy ; *crowding*, or *irregular position*, is frequently met with in young scrofulous subjects. A grey or yellow mucus or "sordes" covers them habitually in persons who neglect customary cleaning ; also in dis-ordered gastric functions ; after the long administration of mercu-rial preparations, and during the progress of inflammatory and febrile affections generally. *Tartar* deposit upon the teeth of old people and others, arises from sheer neglect of daily cleansing. It consists of phosphate and carbonate of lime, which at times abounds in the saliva. *Carious* teeth occur at all ages, but especially in adolescence, and indicate long-continued irregularity of digestion, early sperma-torrhea, or the scrofulous diathesis. The failing, however, seems in many cases hereditary. *Pained* teeth, without apparent local cause, may yet be caused by suppuration at the fang, but are most fre-quently rheumatic, neuralgic, or syphilitic. When very sensitive, without local disease, we should look narrowly to the state of the stomach, or the nervous system.

The Gums present various conditions in disease. Thus they are pale in anæmia ; red and spongy in scurvy, and just prior to pty-alism, but if of partial extent, diseased jaw. It is said, also, that a livid red state denotes the approach of a hæmorrhoidal discharge or dysmenorrhœa. Of late years, the existence of a fine purple-red line at the margin of the gums has been noticed very frequently in phthisis, and in lead poisoning.

THE SALIVA in disease may be increased in quantity, diminished, or variously altered.

When inordinately increased, it is called *ptyalism*, and is noticed

in various conditions. Thus, in all local irritations arising from inflammation of any organ or tissue in the vicinity of the mouth ; from painful affections of the face or jaw ; from the use of certain medicines called *sialogogues*, (as mercury, iodine, arsenic, antimony, tobacco, mezereon, the spices, pyrethrum, armoracia, angelica, catechu, rhubarb, &c.)—indirectly from digestive derangements, hysteria, insanity, and certain fevers (especially confluent small-pox), and mental emotions.

The saliva is *diminished* in the formative stage of all acute fevers, and inflammations ; and partially in cases of obstruction of the salivary ducts. It may be variously *tinged* and of various density. Thus it becomes yellow or greenish in hepatic disorders; bloody in hæmorrhage ; thick and viscid in cases where it is likewise diminished ; and frothy in apoplectic and convulsive states. When the saliva is distinctly *acid*, it denotes gastric acidity.

An examination of the *fauces* and *pharynx* generally gives indication of local states only, but occasionally, also, of others ; as remittent hacking cough may be at times explained by an *elongated uvula ;* and an altered voice, or aphonia, understood by examinining the velum, or the epiglottis. A diffuse redness, without much swelling is seen in scarlatina simplex : and *hysteric* dysphagia, sorethroat, and aphonia may be diagnosed by a close inspection of this region, which under these circumstances will, of course, be normal. Deafness may be traced occasionally to its cause, *e.g.* tumours, or other states of the pharynx, interfering with the patency of the Eustachian tube. The source of hæmorrhage may here likewise be detected ; and many anxious surmises as to its pulmonic origin set at rest. The previous, or present, existence of syphilis, is frequently disclosed by an examination of the pharynx, which will present the characteristic ulceration, or its traces. Chronic tonsillitis is easily recognized, and "quinsey," or *cynanche tonsillaris*, will be not less readily diagnosed ; and their differences from common catarrh, influenza, diphtheritis, and pharyngeal abscess, may be ascertained from a careful examination.

It is sometimes necessary, in cases of dysphagia, even of the hysteric form, to examine the state of the œsophagus by means of a suitable " probang." It will disclose to you the extent and seat of any stricture, and elicit the degree of sensitiveness in the affected part. " Œsophageal Bougies" are also used to dilate such when stricture is diagnosed. If the instrument pass easily along, it must then be either hysteric, or the result of pressure from without, as an aneurism, which may then be diagnosed by other, and special modes.

THE MATTERS VOMITED, when seen or accurately described, afford data useful in diagnosis. They may be simply the unchanged ingesta, as in cases of, overloading of the stomach, concussion of the brain shortly after a meal, syncope, intense pain, (as in sprains,) an apoplectic attack, poisoning, diseased gastric states, especially the cancerous, and mere morbid irritability, without organic disease. When the food is partly digested before thrown up, it may occur from any of the causes mentioned, when they act some time after a meal. *Bilious* vomiting is very common in hepatic derangements, and in relaxed states of the duodenum, which permit of an accumulation, or when an anti-peristaltic state is set up; hence it occurs frequently after protracted *emesis* from any cause. It is met with in pulmonary, diaphragmatic, pleural, and peritoneal disease; is frequent in the tabes mesenterica, and is noticed repeatedly in the commencement of *synocha* and cerebral inflammations.

Vomiting of *mucus* is met with in gastric erethism, and irritation of the digestive tract in general.

Vomiting of *acid* watery fluid, with dark granular masses, like tea-leaves and grounds, occurs frequently in cancer; while the *rice-water* or gruel-water discharge is most usually met with in the Indian cholera.

Sudden, uncontrollable, and *painful* vomiting of mucus or acid frothy watery matters, renders the suspicion of poison probable. When coagulable *lymph* is thrown off, it is a case of croup, or acute effusive inflammation of the pharynx or œsophagus. *Pus* in the matters vomited must have its source in some abscess or ulcer of the stomach or larynx, lung, or pharynx; or, indirectly, the liver or pleura, by perforated communication.

Haematemesis, or the vomiting of blood, may occur by exhalation, without visible rupture; by visible rupture of a vessel, as from a wound, ulcer, or aneurism; or from purpura. Thus in diseases of the liver it is very common, without any trace of an open vessel, while local states will easily explain its occurrence. The absence of froth in the matters vomited, the dark colour, fluidity, mixture with ingesta, together with the fulness, pain and heat of the epigastrium, and the co-existent nausea, will enable you to diagnose its source.

The vomiting of *worms*, of course, indicates their presence, and from their species you can understand their probable *locale*. Thus, the *trichocephalus dispar*, or " long thread-worm," is found in the cæcum; the *ascaris vermicularis*, or " maw," in the rectum; the *ascaris lumbricoides*, or large " round worm," in the small intestines;

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the *Bothriocephalus latus*, or the "broad tape worm," in the same; the *taenia solium*, or "common tapeworm," in the same; and the *distoma hepaticum*, or "fluke," is occasionally found in the liver and gall-bladder.

The *Colour* of the matters vomited gives occasionally important suggestions. We have already noticed the lighter shades, and bilious vomiting. The varieties of black or brown, and coppery green remain. The former are always of serious import, denoting either malignant disease of the organ itself, or a low fever. When analysed, this colour is found to be due to altered blood. The green vomiting implies altered bile, and has frequently the same import; especially the coppery green which is noticed most frequently in acute cerebral diseases, and hence is importantly suggestive.

An excess of liquid matters over and above the quantity in the ingesta, is noticed in *Indian cholera* and *yellow fever*, and occasionally in ordinary *British cholera*. The matters vomited may further contain an excess of acid, and a yeasty matter, full of fungi, —the *sarcina ventriculi* and *torulae fermenti*. Acidity denotes the same states as the feeling of acidity already described. The "sarcina" vegetable growth was first distinctly described by Professor Goodsir, of Edinburgh. It is characterized by its peculiar shape, being a block of parallelograms, resembling a corded "wool-pack," (hence its name). The presence of these sarcinæ is always associated with the fermenting condition of the vomited matters. In fact they are accompaniments of fermentation of a certain kind. To distinguish them, it is necessary to use the microscope; but whenever you have yeasty matters, with light-brown sediment, habitually thrown up, you should suspect their presence. *Torulae* are minute oval bodies, formed in the fermentation of saccharine substances, and are well seen in the mould that forms on the surface of diabetic urine, when allowed to remain a day or so in a warm place. They are likewise accidents· of the fermenting process, and can only be properly diagnosed by the aid of the microscope.

THE ALVINE EVACUATIONS vary naturally according to the ingesta, and the age, occupation, and habits, of the patient. The *meconium* of new-born children is green; children in arms have frequent evacuations of fluid yellow fæces. The consistence increases with age, and the colour darkens to an olive-brown. Sedentary occupations increase the consistence, lengthen the intervals of defecation, and induce hæmorrhoids. Intemperate habits cause irritability of the rectum and colon, and determine anal congestion. Animal diet also increases the consistence, and delays the periods of defecation.

The evacuations may be profuse, watery, alimentary, too solid, scybalous, bilious, bloody, mucous, purulent, flocculent; and besides, may contain worms and calculi, and become peculiarly formed, and variously coloured from medicinal substances. The evacuations are *profuse* in diarrhœa from any cause, and cholera ; *watery* after saline and hydragogue purgatives, and in cholera. They may contain food very little changed. This is *lientery*, and indicates gastro-enteric irritation, and is frequently seen in disorders of children, and nervous females.

Very hard fæces are characteristic of *constipation* in all its forms, denote delay of the matters in the colon, and absorption of the fluid parts, and occasionally pressure from a tumour, (as the impregnated uterus,) or stricture of the bowels. *Scybalae*, are small dark round masses, which seem to be impressed by the form of the cells of the colon, in which they have become impacted. They are with difficulty removed, and are of importance, as causing many anomalous symptoms. *Bile* in excess in the evacuations denotes irritation of the liver or duodenum. Thus a dose of mercury will bring down large quantities, preventing its being absorbed by hastening its flow. It is frequently associated with diarrhœa. *Blood* in the stools may have its source in the anal veins, inflammation of the colon and rectum, inflammation of the small intestines, the cause of hæmatemesis, and injury. When the blood is unmixed, it proceeds from the anus or rectum ; when intimately mixed, higher up the tract, in direct proportion to the intimacy of the mixture. Fæces containing an excess of *mucus*, denotes dysenteric catarrh, whose intensity is directly as the tenacity of the mucus. *Pus* may be formed in the same state in the advanced stage, but may likewise owe its origin to abscesses in the liver, kidney, spleen, uterus, or any part of the pelvis or abdomen, which may have communicated with the intestine. The so-called " flocculent fæces" are composed generally of diluted mucus, shreds of lymph, and fatty substances, without any bile. They are noticed in dysentery and cholera, and, in thicker consistence, in phthisis and mesenteric disease.

The *Calculi* which are seen in the fæces are either biliary or intestinal.

Biliary calculi are various. They consist generally of the constituents of bile with more or less phosphate of lime. When *white*, they are mainly composed of cholesterine (first detected in the bile by Chevreul). The very dark specimens are merely inspissated bile. The latter are rough and cinder-like, the former are smooth and facetted. The presence of biliary calculi in the stools is preceded generally by *gall-stone colic*, and other dyspeptic symptoms, simulating inflammation.

Intestinal calculi are rounded masses or concretions, formed around some undigestible nucleus, such as a plum-stone or piece of bone, &c. The fibrous matter is usually alternated with laminæ of phosphate of lime.

The *form* of the evacuation may sometimes give important suggestions. When globular, there is constipation; when flattened, there is ulceration, or incipient stricture, or the pressure of a tumour. When quill-shaped, there is marked stricture. The fæces are variously *coloured by medicines*, and by disease. Thus iron blackens them; rhubarb renders them yellow; green herbs, green; blood in quantity, as in hæmatemesis, darkens them.

White, or clay-coloured, evacuations are generally indicative of absence of bile, as in hepatic and duodenal disease. The *black* stools may be either bilious or hæmatic; in the former case, the colour is not imparted to water. *Grey* evacuations are seen in enteritis and cholera : *Red*, in dysentery or melæna. *Green* stools, especially those like "spinach," are seen after the use of mercury, and in hydrocephalus. The "green stools of children" have been analysed by Golding Bird, who believes them to be a form of melæna.

ABDOMINAL EXPLORATION.

Before you can derive much benefit from exploration of the abdominal walls, it is necessary to have definite notions concerning the regions into which the surface has been divided, and the relative position of the organs situated in each. The regions are partly natural and partly artificial. They are eleven in number; seven of these are anterior, viz., the epigastric, umbilical, and hypogastric; the two hypochondriac and two iliac; and posteriorly, there are two lower dorsal and two lumbar.

The *epigastric* region contains the pyloric half of the stomach, the left lobe of the liver, the *lobulus spigelii*, and hepatic vessels, the head of the pancreas, the cœliac axis, and semilunar ganglion, and part of the *vena cava inferior, aorta, vena azygos*, and thoracic duct. The *umbilical* region contains the omentum, mesentery, transverse duodenum and colon, and some convolutions of the jejunum. The *hypogastric* region contains the urinary bladder, omentum, small intestines, and (deeply situated) the rectum; and in the female, the uterus. The *right hypochondrium* contains the right lobe of the liver, the gall-bladder, part of the duodenum and ascending colon, and (deeply situated) the renal capsules, and part of the right kidney. The *left hypochondrium* contains the large end of the stomach, the

narrow extremity of the pancreas, the spleen, part of the colon at the angle, and (deeper situated) the left renal capsule, and part of the left kidney. The *right iliac* region contains the cæcum, the termination of the ileum, and beginning of ascending colon; and the *left iliac* region, the sigmoid flexure, and part of the descending colon. The *right dorsal* contains the upper part of the right kidney; the *left*, that of the left kidney. The *right lumbar*, the cæcum, and lower part of the right kidney; and the *left*, the sigmoid flexure, and lower part of the left kidney. This arrangement, it must be remembered, does not hold good universally, but it is a correct average, and any great and permanent deviation must be deemed morbid.

In examining the abdomen, we employ various methods, the first of which is

INSPECTION, which discloses the size, form, and movements. Allowance must be made for age, sex, habits, state of the parietes, and condition of stomach and intestines, not necessarily morbid. Thus the abdomen of the child and the female, and of sedentary individuals generally, is usually fuller; and a degree of obesity or anasarca will likewise obliterate the natural muscular markings.

The *size* of the abdomen varies much in health. At the same time, excessive enlargement may be sufficiently diagnosed for all practical purposes by taking into account the state of the frame generally, and by making the allowance already referred to. Increased size of the whole abdomen may arise from ascites, ovarian dropsy, tympanitis, pregnancy, and morbid solid tumours. Ascites is of uniform rotundity, and gradually increased in all directions. Ovarian dropsy originates in one side, and causes irregular enlargement. Tympanitis is a uniform gaseous accumulation, and is frequently co-existent with ascites. Pregnancy is denoted by an increase of an original hypogastric tumour, which is solid. Morbid tumours generally commence at the side, and assume an irregular prominence. *Partial* bulgings are readily seen by inspection. Their diagnoses must be made out by reference to the site, the effect of position, the mode and rapidity of growth, and the signs ascertained by palpation and percussion. The opposite state, of depression or retraction of the abdominal walls, is seen in cases of extreme debility and emaciation from any cause; also from lead colic, cholera, and tetanus. When there is little fat present, the form of the stomach and intestines may be clearly traced.

Inspection will enable you to detect any abnormal position of the umbilicus, which will give occasionally important information. Knowing that the umbilicus is nearer the pubis than the ster-

num, and exactly in the median line, in the ratio of six and a half
to eight, any deviation may be readily detected, and hence the seat
of the original disease may be discovered, by remembering that
when it is superior, the upper distance will be correspondingly
increased.   The umbilicus itself may be too prominent, or too de-
pressed, or flattened.   Relaxation, debility, emaciation, will cause
the first; obesity and adhesions of the obliterated umbilical cord
internally, may cause the second; and some affections of the parietes
may distend the umbilical attachment, and originate the third.

Enlargement of the superficial veins of the abdomen occurs
in venous obstruction of the great trunks, and is actually a vari-
cose state; but, in the case of tumours, may indicate an aneurism,
or a cancerous mass.

You may also, by mere inspection, detect inordinate pulsation
of the great vessels in the abdomen.   Thus, if in the epigastrium, it
may be the action of the heart, cœliac axis, or the aorta; further
down, the aorta and the common iliacs—which may arise either
from aneurism, tumour over the vessel, or hysteria.

The *movements* observable may be parietal, enteric, gastric, or
uterine.   When parietal, they are either respiratory or spasmodic.
The respiratory movements may be defective, as in cases of ab-
dominal tumour, preventing the contraction of the diaphragm, or
in peritonitis, which prevents abdominal action in consequence of
pain.

Increased respiratory movements of the abdomen occur in thoracic
disease, or hysteria.   Gastric and enteric movements are generally
vermicular, and arise from the peristaltic action, or the displacement
of gas, and are readily detected; yet in certain cases they have
been confounded with fœtal movements, which, however, occur in
an irregular jerking manner, without noise or pain, and in a solid
tumour.

By employing the tape-line, or other meter, to the abdomen, we
may sometimes improve our means of diagnosis.   Measurements
are generally used to compare the lateral bulgings; to note the
diminution or increase of a tumour, to discover the effect of re-
spiration, and to detect any deviation of certain points which are
determined in the healthy subject.   In using the tape to compare
the two sides, you must bear in mind that the right hypochondrium
measures half an inch at least *more* than the left.

But either of the means explained above fails to impart any
thing so definite as

PALPATION, or the manual examination of the abdomen, which

should never be neglected in suspected abdominal disease. Palpa-
tion informs us most accurately of the form, size, position, con-
sistence, elasticity, and movements of any organ at all accessible by
the hand. Thus a large part of the liver, the stomach, the colon,
the cæcum, the mesentery, the peritoneum, the urinary bladder, the
kidneys, the uterus, the rectum, are all within the manual reach.
In examining by this mode, it is of the utmost importance, that the
parietes should be *completely* relaxed, as much valuable information
has been lost in certain cases by neglecting to have the *recti* and
other abdominal muscles in a soft and quiescent state. I have
known rectal contractions simulate tumours *to the life*. Besides
the examination of the organs, as already mentioned, you can also
ascertain, by palpation, the *nature* of most tumours, superficial or
deep ; and notice accurately the tenderness and the sense of con-
sistence of any part. Palpation enables you to distinguish between
peritonitis and hysteric dermalgia of the abdomen, or colic. It
traces accurately the limits of tumours—enables you to ascertain
whether a certain tumour is an enlargement of an organ, or a se-
parate growth, in many cases. The exact outline and superficies
of a tumour may be traced out, and its degree of mobility will
disclose the nature of its attachments. Palpation will also discover
the fœtal movements, gaseous vibrations, (as in cæcal ulceration,)
peritoneal frictions, and cutaneous emphysema.

Fluctuation may be readily detected by using both hands ;—one
open, applied flatly to one side, and the other to tap the opposite
surface. If fluid be present, a distinct wave is felt beating, at every
tap, against the open hand. When this is very distinct, the parietes
are thin, and the fluid copious ; when indistinct, the reverse, or the
fluid is associated with a state of tympanitis. Assistance to this
mode will be gained by altering the position of the patient
variously.

An aneurism of the aorta or iliacs, or any pulsating tumour, may
be manually examined in thin subjects. If the latter be produced by
the position of the tumour over the artery, removal of the tumour,
if possible, *off* the artery, will necessarily stop the pulsation.
Fremissement cataire may occasionally be felt in anæmia or aneurism,
or the friction of the diaphragm over a tuberculated liver. In ap-
plying the hand to the abdomen, it is important to do so *gently*, and
with the hand open ; and while making pressure, to remark the
variations of the patient's features, rather than the oral expressions ;
and if possible endeavour to draw off the attention from your
manipulations by conversation. Much aid will be further afforded
by adding the results of

PERCUSSION, which will detect the extent, consistence, direction, tenderness, and depth of organs and structures. By percussion you elicit sound, which varies according to the condition of the parts underneath the surface percussed. In health, the exact limits of the liver, spleen, kidneys, and bladder may be distinguished by the extent of the dull sound, while the stomach and intestines may in like manner be identified by the tympanic sound. The colon may sometimes elicit a dull sound, in consequence of accumulated fæces. By percussion, then, we can readily discover any excess in the upper limit of the liver, as when it reaches the level of the third rib; or its lower limit, when it is pushed down four or five inches below the margin of the ribs. It must be remembered that these positions may be assumed *without* any disease of the organ; but then, the cause of displacement will be easily apparent, such as abdominal tumour or distension, on the one hand, or emphysema or pneumo-thorax on the other. When these states are absent, these deviations from the normal limits are morbid, whether they be within or over. The limits of the spleen may be readily determined by remembering that its natural length is three and a-half inches, and its breadth one and three-fourths inches. The gall-bladder may be sometimes diagnosed by combined palpation and percussion, and organic disease of the stomach and pancreas may (if present) at least be strongly suspected in like manner. The difference between *ascites* and *tympanitis* may be ascertained by percussion; yet both may co-exist, and cause difficulty. Ovarian and peritoneal dropsy must be distinguished by the *shape* of the enlargement, the history, and the presence of the solid parts of the ovarian cyst in the former case.

AUSCULTATION has been but recently employed in abdominal diseases. An original essay thereon appeared in the *New York Journal*, for July, 1840. Sounds may be elicited in the abdomen from peritoneal frictions, gastro-intestinal movements, or those of the contents, gaseous or liquid, or from vascular contents. Friction sound is especially audible in peritonitis, particularly hepatic; and in tuberculated states of the liver, and superficial hydatids.

Crepitation arises from the rubbing of solid bodies, as calculi, &c., in the intestines, gall-bladder, or in the case of emphysema of the abdominal parietes. *Arterial murmurs* may be single or double, and may arise from aneurism, or tumour over a healthy aorta, or in anæmia. *Venous murmurs* are continuous and humming, and may be heard over the *vena cava* in anæmia, and occasionally over enlarged spleen. Besides these, in pregnancy, after the third month,

you may hear the fœtal heart-sounds and the uterine murmurs, or *souffle.* Again, you will hear intestinal and gastric sounds, but these, from their very nature, can be of little clinical value.

In addition to the indications from abdominal exploration already laid down, I may here state a few which I find I have overlooked. *Fulness* of either hypochondriac region, may arise from thoracic disease, as empyema. Retraction of the epigastrium, in chronic disease of the stomach, frequently denotes scirrhous pylorus. Fulness of the umbilical region may spring from fæcal accummulation in the colon, peritoneal tumours, or mesenteric disease. *Hardness* of the abdomen may denote spasm, enteritis, or peritonitis. Hardness in the right hypochondrium may, and generally does, indicate enlarged liver; but it may denote (right) *nephritis, colitis,* or duodenal disease; and, in like manner, hardness of the left hypochondrium may imply enlargement of the spleen, left kidney, or colon : an ovarian cyst, or omental tumour, though, may simulate any of these. When a *clear* sound is heard in percussion over the right hypochondrium, either there is atrophy of the liver, inordinate tympanitis, or it is an instance of gas secreted within the liver itself, of which there are two examples on record.

In order to understand the state of the rectum and neighbouring organs, when complained of, it is usual to examine this part by anal inspection and manipulation. By inserting the forefinger well-oiled (the bowel and bladder having been previously emptied), you can ascertain the degree of tenderness, smoothness, or hardness, the existence of any tumour, the state of the prostate, bladder, uterus, and sacrum. You can also ascertain the seat and extent of any ulcer, or fissure ; the temperature, the resistance, any degree of stricture, the site and extent of hæmorrhoids. Such information may, on occasions, be sufficiently definite from this mode of examination ; but it is frequently necessary to add the important test of visual inspection. This is done by means of an instrument called "the speculum ani." By its aid you can *see* the state of the mucous membrane for several inches up, and consequently apply your local remedies with more judgment and effect. Whether the painful defecation depend on hæmorrhoids, ulceration, stricture, spasm, prolapsus, polypus, fistula, cancer, warts and excrescences, or impacted fæces, the speculum will at once enable you to diagnose the case.

THE GENERAL SYMPTOMS.—The general *appearance* characteristic of deranged digestion is usually care-worn and haggard, with some degree of emaciation. The *complexion* is either sallow, or indicative

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of chronic organic disease. The *expression* is usually anxious; the *manner* listless. The *tongue* indicates much. The red tongue, with or without small white shreds scattered over it, denotes enteric inflammation, when not scarlatinous or purely febrile. The papillæ are prominent in irritative dyspepsia. The tongue is coated white in disordered gastric and duodenal secretions, and indented in colon-accumulations. The *skin* is generally dry in diarrhœa-states, (except in ulceration of the intestines,) and moist in constipation; and more or less are its functions sluggish in disordered digestion. The *appetite* is invariably bad or perverted: the *sleep* disturbed; the *strength* reduced, much more apparently than really, though; and the *general feelings* are a degree of malaise, more or less persistent.

THE REFLEX SYMPTOMS, indicative of abdominal disease, are various altered sensations and movements observed in other parts of the body. Thus "headache" in dyspeptic states; "grinding the teeth" in intestinal irritation; "nightmare" in gastric disorder; "pains of the shoulder" in hepatic and splenic disease; "asthma" in worms, and gastric and hepatic disorder; "palpitation" in the same; "cramps" of the calf in intestinal irritation; and sundry pains and aches, creeping sensations, pruritus, and numbness, owe their origin frequently to the same cause.

VI.—THE INTERPRETATION OF DERANGEMENTS OF THE URINARY FUNCTIONS.

THE urinary organs comprise the kidneys, the bladder, the connecting tubes (the ureters), and the urethra.

THE KIDNEYS are among the most important and essential organs of the whole economy. The due performance of their functions is necessary to health, and, in many cases, to the maintenance of life itself.

To understand thoroughly the physiology of the urinary organs, it is necessary to premise an acquaintance with their structure; and as their intimate, or minute, anatomy has only of late years received elucidation, I shall describe it fully.

The kidney is a dense organ, whose chief structures are well observed in section. You will notice two apparently quite separate and independent formations—the *tubular* and the *cortical* portions—surrounded by a firm unyielding capsule. In the centre you have a cavity—the *pelvis*—lined with a continuance of the ureter, presenting three diverticula, or *infundibula*, which are bounded by

certain conical projections, eight or ten in number, whose base re-sembles the appearance of a cup, and has received the name of *calyx*. These cones are the converging extremities of the straight uriniferous tubes, which are here of about the diameter of a hair. At first view, you would suppose the cortical portion had nothing in common with the tubular part; but microscopic researches have shown that it contains an immense extent of convoluted tubes. When this cortical part is examined closely, it will be found to contain a mass of capillaries, and a great number of small red globular masses, which are called "*Malpighian bodies.*" These are about the one-hundredth part of an inch in diameter, and each is composed of tufts of capillaries, and the beginning of a uriniferous tube, the diameter of which is but the four hundred and eightieth part of an inch. This tube is a compound structure, consisting of basement membrane, a net-work of vessels without, and "ciliated epithelium" within. The circulation of the blood is thus arranged : an artery enters the cortical part, divides and sub-divides, and sends branches to the Malpighian bodies. The branch upon entering the body, forms a net-work of capillaries, which surround the beginning of the uriniferous tube. These capillaries include the returning veins, which leave the body by one, or at most, by two vessels, which may be called *portal*, inasmuch as, after leaving the body a little way, it re-divides in a large plexus which ramifies upon the tubes, and eventually ends in a venous trunk. There are hence two centres of circulation in the kidneys—the mass of capillaries at the Malpighian body, and the venous plexus sur-rounding the tubes. Between these two centres, the portal, or efferent, vein is situated. It is the opinion of Mr. Bowman, that the watery parts of the urine, and such substances in solution as might be passed through by means of diuretics, are eliminated by the Malpighian plexus; but that urea, uric acid, and the other essentials of urine, are separated by the portal venous plexus. The compound fluid thus formed, passes into the straight tubes of the tubular portion, and thence into the pelvis of the kidney. Here it may accumulate to a small extent; but soon passes down the *ureters*, which are two membranous tubes about eighteen inches long, and about one-quarter of an inch in diameter. The diameter diminishes a little at the inferior extremity, where it penetrates the posterior and lateral part of fhe bladder, passes obliquely between the muscular and mucous coats, and opens upon its inner surface at the posterior angles of the base of the bladder, about two inches apart. An opportunity sometimes occurs of *seeing* in the living subject the termination of the ureters. I remember one case of malformation

of the bladder—in whom the posterior wall of the bladder formed part of the abdominal parietes, and the urine could be observed distilling (as it were) through the two apertures. I say *distilling*, for the form and rapidity of the drops were *exactly* similar to that observed in the ordinary distillation of water. The ureters have no muscular coat, but consist of an external fibrous tunic, and an internal mucous membrane. Hence we sometimes find bloody or albuminous urine from mere pressure of the ureters by the gravid uterus, causing a passive exudation from the renal capillaries. The *vessels* of the kidney are supplied direct from the aorta, and return directly to the *vena cava inferior*. The *nerves* are solely ganglionic, and hence will explain the many sympathies which renal disorder originates.

THE BLADDER is a compound membranous bag, which acts as a reservoir for the urine. It is composed of mucous membrane internally, muscular fibres underneath, and externally, partly serous and fibrous tissue; the reflection of the peritoneum covering only a part. It is retained in its situation by the two anterior, and lateral, the two umbilical ligaments, and the urachus, which, however, permit of a considerable degree of distension of the organ. It is intimately connected with the rectum, (and uterus in the female,) and intestines. Ordinarily its contents might be one pint and a half, but at fullest distension, it has been known to accommodate several quarts. The muscular coat, consisting of external longitudinal, and internally of oblique and transverse fibres, enables the organ to be completely emptied. According to Mr. Lane (*Lancet*, Vol. I., 1842-3), muscular fibres surrounding the commencement of the urethra, perform the office of a *sphincter vesicae;* and Sir A. Cooper has demonstrated a band of fibres around the urethra, as it passes through the prostate, which serve to close it against the involuntary passage of urine. Into this, the longitudinal fibres of the *detrusor* are inserted; and hence, by their action, the urethra is kept open for egress of the fluid. The papillæ of the mucous membrane are very minute, and of follicles scarcely a trace exists. One spot of this membrane is peculiar; it is situated at the base, and is smooth and pale. It is called the *trigone*, and is the most sensitive part of the entire organ. Its position is well-marked externally and internally. In the former, the boundaries are, laterally the *vesiculae seminalis*, and internally, the angles are formed by the openings of the ureters, and the *uvular* eminence.

Immediately in front of the neck of the bladder, and between the urethra and the rectum, is situated the *prostate*—a gland of three lobes, about the size and shape of a Spanish chesnut. Its lobules

are a series of pouches, and it secretes a peculiar fluid, which reaches the urethra by fifteen to twenty ducts. The urine in eva- cuation passes out through the urethral canal, first, traversing this, the *prostatic* portion (about one inch in length), which, in addition to the prostatic secretion, receives the semen through the two ejacula- tory ducts; next the *membranous* part (of equal length), into which the two "Cowpers' glands" pour their mucus ; and lastly, the *spongy* portion, which is full of *lacunae*, or large follicles devoted to the supply of the lubricating, clear mucous fluid, whereby any injury from the irritating urine is avoided. The bladder is supplied by the sacral plexus, and ganglionic nerves. It is hence partly under voluntary control.

From this slight sketch of the structure and functions of the urinary organs, you will be better prepared to take up the consi- deration of their derangements, or symptoms, and the results of exploration.

1. *Lumbar pains* are pains felt in the lumbar region. They may originate from a great variety of causes. Thus they may be *local*, as from disease of the vertebræ, the spinal cord, injury, rheuma- tism, renal calculi, nephritis, psoas, or lumbar abscess. Again, they may proceed from "general states," as incipient fever, espe- cially small-pox, acute *purpura*, hysteria, neuralgia; or they may be of central origin, as cerebral disease; and lastly, they may be reflex and sympathetic, as, *e.g.*, the pains in this region connected with disease of the bladder, penis, testes, uterus, rectum, and irritation of any of the anterior branches of the lumbar plexus ; besides numerous diseases of other organs only connected by the ganglionic system with the lumbar region.

2. *Hypogastric pains* arise in a similar general way; but are locally connected with derangements of the bladder (or uterus in the female,) in addition. Thus irritability of this viscus—disten- sion by urine, the irritation of certain medicines, cystitis, the presence of calculi, peritonitis, enteritis, any form of cutaneous and sub-cuta- neous inflammation, neuralgia, are all *local* causes. Spinal disease, or injury involving the cord, soon establishes a sub-acute inflam- mation of the vesical mucous membrane (supposed to arise from the irritation caused by excess of ammonia), and thus becomes a cause of local pain. Besides this source, *central* disease not un- frequently causes neuralgia and spasms of the abdominal muscles, especially in the lower part of the abdomen, which attack this region.

3. *Dysuria*, or difficulty in micturition, has many sources. It may

arise from such causes as irritability of the bladder, inflammation, in any of its stages, diseased prostate, abscess in the vicinity, prolapsed rectum, hæmorrhoids, calculi, diseased urethra; secretions, as irritant urine, from certain medicines, or from admixtures of gravel, blood, &c. It also occurs frequently in pregnancy and altered positions of the uterus; and in hysteria, and affections of distant organs setting up reflex irritation. Dysuria has degrees, of which *strangury* is the most aggravated, in which the urine is passed only in *drops*, and with excessive fainting pain.

4. When blood is passed with the urine, the symptom is called *haematuria;* and it is of the greatest importance to be enabled to interpret it aright. It may arise in excessive strangury, (by rupture of, or exhalation from, some of the vessels of the neck,) from a high degree of cystitis, from ulcerated, or other open surface of the mucous tract; from the irritation of sounds, bougies or catheters; from calculi, from injury of the bladder by a fall, from renal congestion, renal calculi, pressure of the gravid uterus, scarlatina; some states of Bright's disease; from purpura; vicarious menstruation; and hæmorrhoidal discharge; low fevers, of the purpuric form; and from certain poisons. In these cases, the urine is either smoky brown, black, or of the port wine hue; and under the microscope, the blood-discs are readily discernible.

5. *Incontinence of urine,* or " Eneuresis," has many degrees, and is most commonly met with in childhood and old age. The urine may be continually passed in small quantities, or more or less may be retained for a little space. This state has local, central, and general causes. Thus, increased sensitiveness of the *trigone,* ulceration or other chronic disease of the neck, a foreign body keeping the vesical end of the urethra open, vesical fistula; paralysis of the neck of the bladder, from cerebral or spinal disease, or fevers; irritability of the bladder from acrid urine, spasm, hysteria; and congenital smallness of the bladder.

6. *Retention of urine* must be distinguished from suppression. Retention implies obstruction to the egress of the urine at some part of its course, as from calculi in the ureter, or at the neck. In the latter case, change of position relieves. Spasm of the sphincter vesicæ, paralysis from cerebral or spinal disease; injuries, causing rupture and blocking up of the urethra by clots; stricture; hysteria; fever (especially the low forms), pressure of the head of the fœtus, abscess in the perinæum pressing upon the urethra, enlarged prostate, are all sufficient causes. The passing of the catheter will diagnose between this state and the next to be considered, which is a much more serious affection.

7. *Suppression of urine* implies diminished secretion of urine, or complete "ischuria renalis." It is observed in nephritis, certain states of fever, cerebral and spinal disease, and Asiatic cholera. It can be always diagnosed by observing the condition of the hypogastric region, and the use of the catheter, in addition to the cerebral and other symptoms due to retention in the blood of the constituents of the urine. A diminution of urine is frequent in all febrile states, in profuse diaphoresis, in diarrhœa, in pregnancy, in hæmorrhagies and dropsies, and in cerebral convulsions; after scarlatina and measles, it is frequently the forerunner of anasarca.

8. *Diuresis* is the opposite state, or an increased flow of urine. "Diabetes insipidus" is another name. It is met with after the use of certain medicines (diuretics), the sudden application of cold externally, especially to the feet, exposure to a cool, evaporating, drying air; in hysteric paroxysms, cold stage of intermittents, and above all, in *diabetes mellitus,* and in cases of excess of urea.

INDICATIONS FROM EXPLORATION

Comprise the results of the physical external examination of the urinary regions, and the internal examination of the urethra, prostate, and bladder.

To make this knowledge at all available, you must remember the situation and size of the organs. Recollect that the kidneys are placed in the lumbar regions, behind the peritoneum, and on each side of the spine. Their upper parts approximate, the inferior diverge, and the right is somewhat lower than the left. They are about four or five inches in length, and two and a half broad, and one and a half inches thick, and weigh normally from three to five ounces. They rest partly upon the diaphragm, and partly on the *transversalis* muscle, and the *quadratus* and *psoas*. The liver and descending duodenum rest anteriorly upon the right, while the stomach, spleen, descending colon, and flexure, in like manner, cover the left. The posterior surface is flattened, and the convex lateral border is always external.

The ureters pass down behind the peritoneum, lying on the psoas, and crossing the iliacs, terminate behind and inferiorly in the bladder. The bladder immediately occupies the hypogastric region, and is readily felt when distended.

By *percussion* you may detect great enlargement of any of these organs; and by *palpation* the degree of tenderness present, which

is much more essential.   The ureter can only be felt in great dis‑
tension from calculous obstructions.   A very dull sound over the
hypogastric region, argues retention, which, however, the use of the
catheter will at once test beyond any doubt.   The examination of
the prostate is to be made by rectal manipulation.   In making the
external examination you must remember not to rely too much upon
mere extent of dulness.   The lumbar region may be universally
dull in an obese subject ; hence *palpation* is of much more extensive
and decided utility here.   The examination by means of sounds,
catheters, and bougies, is of great use in discovering stricture, stone,
the state of the mucous membrane, retention, or suppression, and
the state of the prostate.   In all cases of doubtful dysuria, or reten‑
tion, never fail to employ this aid.

THE DIAGNOSIS OF THE DIFFERENT KINDS OF MORBID URINE.

1. Excess of *urea* in a given specimen of urine, is thus detected—

The high density of the urine, as ascertained by the " urinometer," and the
formation of the characteristic crystals of nitrate of urea by the addition of
nitric acid to a slightly concentrated specimen.   If the crystals appear in
large numbers, and almost immediately, the urea is in excess.

2. *Lithic acid* in excess is ascertained by

Observing if any of the characteristic crystals deposit on the sides of the
vessel as the urine cools.   Its deposit is hastened by adding a little muriatic
acid to concentrated and warmed urine.   This urine is always *acid*.
    Another distinctive test of uric acid is its behaviour with nitric acid, and
ammonia.

3. *Urate of ammonia* deposits copiously as the urine cools, and
opportunity is at once given of examining it

By the aid of the microscope, which exhibits its characteristic form.

The deposit will re-dissolve by heat, or potass.   If it do not altoge‑
ther dissolve, it is owing to the presence of the phosphates or the
purpurates.   The urates are decomposed by dilute mur. acid and
acetic acid ; and the uric acid set free, which, crystallizing, may
be readily distinguished.   When a patient has taken soda for a
length of time, the urate of soda is the usual deposit.   The same
is also observed in gout.   The salt is readily recognised by the aid
of the microscope.   It is frequently associated with the lithate of
ammonia.

4. Urine containing excess of *hippuric acid* has been but little examined. It is, however, mostly pale (like whey), and of low density.

Muriatic acid added to a concentrated specimen of hippuric urine will cause crystals of the hippuric acid to appear; and from their characteristic form no difficulty need be experienced.

5. Urine containing *mucus* in excess is observed cloudy at the bottom of the glass.

When this cloud, or deposit, is stirred up, it does not mix uniformly with the liquid, but keeps separated as a tenacious ropy mass. The urine soon becomes, if it be not when passed, alkaline. The mucus under the microscope presents mucous and epithelial cells.

And it must be remembered that it is frequently associated with the earthy phosphates or urates.

6. *Purpurine,* or the purple colouring matter so frequently met with in lithatic urine, may be confounded with blood by a superficial observer. It may be distinguished

By microscopic examination, by observing the usual co-existent crystals of uric acid, and by precipitating it by adding a little warm aqueous solution of urate of ammonia.

7. *The Fixed Alkalies* (soda and potass) may be readily diagnosed

By adding to a concentrated specimen some bichloride of platinum, and (for the latter) tartaric acid in addition. The platinum throws down a yellow precipitate, with the crystals of the chloride of sodium in the case of the soda, and the tartaric acid gives a white precipitate.

8. *The Phosphates* occur generally in pale urine, at first acid, but soon becoming alkaline. A sediment is always present, which varies from a white to a yellowish brown. The *white* specimens are usually associated with mucus and epithelium; while the *dark,* with the urates. The mere fact of the precipitation of the phosphates is not *per se* conclusive evidence that they are in excess.

The microscope readily detects the triple and bibasic phosphates by their beautiful crystals; while the phosphate of lime occurs merely as a granular powder, which may be further tested by applying the chemical tests requisite to distinguish phosphoric acid and lime: as thus, to the nitric acid solution of the phosphate, add a few drops of a solution of nitras argenti. Then neutralize with ammonia, and the *yellow* phosphate of silver will be precipitated. The presence of the lime is detected by merely neutralizing the acid solution with ammonia, and adding oxalate of ammonia, when the characteristic oxalate of lime will be precipitated. The phosphates may also be

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examined by observing the effects of the dilute mineral acids, and acetic acid, which readily dissolve. They may be re-precipitated by neutralizing with ammonia. The ammoniacal phosphates, when heated with an excess of potass, give off ammoniacal fumes, which may be tested by the muriatic acid test.

When there is a diminution of the phosphates present in any specimen of urine, it may be known by the behaviour of ammonia, which will fail to bring down any quantity.

9. Urine containing *sugar* is seen only in cases of diabetes. The sugar is that found in fruits, and is called grape sugar, and " glucose," and differs in some respects from cane sugar, and sugar of milk. Saccharine urine is pale, but of high density, from 1030 to 1050. When allowed to stand in a warm place for some time, a white scum gathers, which is composed of myriads of oval bodies, called " *Torulae*"—a cryptogamic plant. This test is very conclusive. The characteristic taste, and the hay aroma are also excellent tests. Besides these, three other tests have been proposed, viz.—Trommer's, Moore's, and the fermentation test.

Trommer's.—When the specimen receives a drop or two of a solution of sulphate of copper, it acquires a pale blue tint; and a slight precipitate of the blue phosphate of copper occurs. Let a solution of potass be now added in excess; at first a precipitate of pale blue hydrated oxide of copper is thrown down, which speedily re-dissolves, and the mixture acquires a purplish blue tint. This is next to be gently boiled for some minutes, when a reddish or yellowish brown precipitate of sub-oxide of copper will be deposited. Had there been no sugar present, the deposit would have been the *black* oxide.

Moore's test is less complicated. Add about equal to half the volume of the specimen, a quantity of liquor potassæ, and boil the mixture gently for about five minutes. A brown or bistre tint will soon be perceptible, which, in the absence of sugar, in ordinary cases would likewise have no existence.

The *fermentation* test requires at least twenty-four hours, ere it can give decided results. You fill a test tube with the suspected urine, and add a little fresh yeast, invert the tube over a saucer, and let it stand in a temperature of seventy to eighty degrees. In the course of twenty-four hours, if sugar be present, a quantity of carbonic acid will have formed, and displaced some of the fluid at the top of the tube. This test is founded on the fact, that the saccharine fluid, when favourably situated, readily undergoes the vinous fermentation, *i.e.*, becomes decomposed and converted into carbonic acid and spirit.

10. Urine, containing *albumen*, could not be always suspected by mere inspection. Sometimes, and when special symptoms are present, we may ; but generally we can only rely upon careful examination, as thus :—

Take a specimen, and see if it be acid or alkaline. If the latter, you must add a drop or two of nitric acid ; for the coagulation of albumen is prevented, if an excess of alkali, or of phosphoric, acetic, or tartaric acids be present. Then raise

the temperature to 170 degrees, or higher, and immediately the albumen will appear as a dense cloud or white precipitate. This appearance varies, of course, according to the quantity of the albumen present. This test is, however, not of itself sufficient, as boiling has the effect of bringing down the phosphates. Hence it is necessary to add the nitric acid test, which throws down a copious precipitate. When both these tests succeed, there can be no doubt about the presence of albumen.

11. Urine containing *blood* is either of a yellow, red, brown, or port-wine hue; and upon settling a specimen, a distinct red deposit may be observed. If the quantity be large, the fibrine coagulates, and causes a gelatinous appearance; which, indeed, is a test of the presence of blood. But an undoubted result may be obtained

By submitting a little of the coloured part near the bottom of the vessel to the test of microscope, which will enable you to detect at once the unmistakeable blood-discs. This urine will, of course, coagulate on the application of heat, on account of the existence of albumen.

12. Urine coloured with *bile* is generally of a yellow orange hue, and has a decidedly bitter taste. There are several tests for ascertaining the presence of bile. One is named after *Pettenkofer*. It is managed thus :—

A little of the urine is mixed with two-thirds of its bulk of strong sulphuric acid, which must be added, *guttatim* (the tube being held in cold water). A small quantity of syrup is now added, the mixture shaken, and allowed to stand a few minutes. If bile be present, the fluid will assume a more or less intense red tint, with a tinge of violet. *Caution*—When the chlorides are present in quantity, the colour is of a *brown* hue, and any albumen present must be first coagulated, and the urine filtered.

Second—The next test is known as " Heller's test."

Add to the specimen a little of a solution of albumen, and coagulate by nitric acid. If bile be present, the coagulum will appear of a dull green or blueish colour.

Third—A commoner test than either of these is the action of nitric acid upon a specimen placed upon a white dish or plate, which sucesssively presents the hues of pale green, violet, pink, and yellow; and in any case a greenish tint will be clearly perceptible.

13. *Purulent urine* is so like the mucous and the phosphatic specimens, that particular tests are necessary.

The deposit is creamy, and of a pale greenish hue, and lies at the bottom of the vessel. Stirred up, it mixes intimately with the clear portion, and the

entire presents a turbid aspect. It is always albuminous, in consequence of the *liquor puris.* Under the microscope, the peculiar pus-cells are seen of uniform character, without any of that striated hazy appearance, which is observed in mucous deposits; and besides, epithelial scales are with pus less common. Fat cells are ordinarily accompaniments of pus. The addition of a solution of potass to pus produces a thick gelatinous mass, highly characteristic.

14. Urine containing *fat and chylous matter* is of a milky appearance. The microscope will enable you readily to distinguish this variety by presenting the characteristic globules, save in cases where the oily matter has been intimately mixed with albumen, as in advanced stages of " Bright's disease." The " ether test" is also applicable—

You agitate a little ether with the specimen, and a distinct stratum of oil will, soon after settling, be observed floating on the surface.

Chylous urine contains small white cells similar to the white blood-cells observed in chyle in the thoracic duct, or in the blood in splenic enlargements.

15. The urine of pregnancy, distinguished by the formation of *Kiestein,* is more or less turbid. The Kiestein appears as a pellicle floating on the surface, resembling a flake of spermaceti ; and on examination under the microscope is found to consist mainly of " the phosphates" and a few oil-globules resembling butter.

16. Urine holding *semen* in suspension is readily diagnosed by the presence of the *spermatozoa,* peculiar to the seminal fluid, and which a good microscope will enable you to detect. Specimens may be had from cases of spermatorrhœa.

17. Urine containing *oxalate of lime* is usually of a strong straw colour, and mostly acid. Epithelial scales abound. When you allow the urine to stand a few hours in a conical glass, and decant off the upper portion, submit a drop of the remainder to microscopic inspection, and the beautifully-figured crystals will at once be apparent.

18. Urine containing *cystine,* presents this substance in a deposit of a pale fawn hue. An examination by the microscope determines its characteristic outline readily.

The deposit dissolves rapidly in ammonia, which is a characteristic test; and the crystals on evaporation of this solution are a little, but characteristically, altered. Cystine urine is generally pale, of low density, has " the aroma of the sweet briar," and readily decomposes. Cystine may be further distinguished by being soluble in the fixed alkaline carbonates, very sparingly in water, and nearly insoluble in the acids and alcohol. The principle, however, is very rare.

19. Urine containing *medicinal substances* may be tested by the usual reagents.

Thus *iron*, by the ferrocyanide of potassium ; *iodine*, by the starch test; *indigo*, by sulphuric acid ; *prussian blue,* by digestion with liquor potassæ, &c.

Let us now bring the foregoing precepts to the test, by explaining the course of proceeding with a specimen of morbid urine, whose nature is unknown :—

To set about this properly, you must provide yourselves with a hydrometer, test papers, nitric and hydrochloric acids in purity, liquor potassæ, colour-less aqua ammonia, pure sulphuric acid, solution of sulphate of copper, solu-tion of bichloride of platinum, nitrates of silver, baryta, and a few other che-mical reagents, besides test tubes, watch-glasses, blow-pipe, glass rods, spirit lamp, but above all, a good microscope. I don't mean to say that *all* these are necessary for examining the more usual specimens, but for a complete stock they are indispensable.

Now, suppose we have a specimen of morbid, but otherwise un-known, urine, handed to us, how are we to proceed ?

You first put the specimen into a conical phial, and let it rest for some hours, notice then the colour, the state of turbidity, and then the kind of deposit, if any. Then try the test papers, observing if acid faintly or decidedly, alkaline or neutral. Then take the density by means of the hydrometer; and then, if you are acquainted with the amount of urine passed in twenty-four hours, you can calculate the amount of solids, by simply multiplying the last two figures of the specific gravity, by the number of fluid ounces passed in twenty-four hours. Thus, if the specific gravity of a given specimen be 1020, and the quantity of fluid passed be 30 ounces, then 600 grains will represent the amount of solid matter in 30 ounces.

If there be any deposit, let the clear part be decanted off, and put in a separate phial, and proceed to test each in turn, beginning with the solids.

The first test you may apply is heat. Light the spirit lamp, and gently heat a little of the deposit in a test tube (which you must remember should be always perfectly *clean*)—1. If the deposit *readily dissolves,* it is probably the urate of ammonia; and if so, it may be further tested by the potass solu-tion ; the production of the characteristic uric acid crystals by the muriatic acid test; and by the aid of the microscope. 2. Suppose that the deposit does not dissolve, then add a little *acetic acid*, and if it now dissolve, it probably consists of the " phosphates," which may be further tested by the microscope, and by the other chemical tests already mentioned. 3. If again the acetic acid does not dissolve it, try the *hydrochloric acid diluted.* If it now dissolve, it is most probably oxalate of lime, which may be further tested by neutralizing the acid solution, and examining the white precipitate thrown down, which will be carbonate of lime ; or examined by microscope, when by evaporation, crystals are made to appear. 4. If again the hydrochloric acid fail to dissolve it, then it is most probably *uric acid,* and the tests for this must then be applied.

When time is an object, it will be most convenient to examine a

little of the original deposit, unaffected by chemical reagents, under the microscope; which method may, at a glance, disclose the nature of the case. Yet much may be made out in its absence, by remembering that—if the deposit be greenish yellow, and easily and generally diffused by agitation, you may reasonably suspect *pus*—

If the deposit be ropy and tenacious, and not readily miscible, it is most probably *mucus*.

If it be dark red, coagulable by heat and nitric acid, you may deem it *blood*.

If ether commixture throws up an oily flake, it contains *fatty* matter.

If of a milky hue, you may suspect *chylous* matter.

If the deposit be pale yellow, soluble under heat, yet yielding no traces of ammonia, it is very probably *urate of soda.*

If again, a pale deposit be insoluble under heat, or in dilute hydrochloric and acetic acids, but readily soluble in ammonia, and the resulting solution furnish crystals on evaporation, you may look for *cystine.*

You may now proceed to examine the clear fluid, or a specimen *without* any deposit.

If the urine be alkaline, examine for *albumen.*

If the specific gravity be higher than natural, look for excess of *urea* or *sugar.*

If heat cause a precipitate, it must either be *albumen* or the *phosphates.* If the addition of nitric acid dissolves the precipitate, it is the latter; if more be coagulated, it is the former.

If a precipitate be soon produced by nitric acid, but not by heat, examine for *uric acid.*

If crystals fall soon, upon the addition of muriatic acid to a concentrated specimen, and they present a needle-shaped appearance, there is an excess of *hippuric acid.*

If the urine be dark-coloured, you must examine for *blood, bile, purpurine,* or excess of the "*yellow* colouring matter,"—which last is tested by hydrochloric acid, which, when mixed with the boiling specimen, changes it to a red colour. Purpurine may be proved by the "urate of ammonia test," and the bile and blood, as already mentioned.

In this way, may a tolerably correct knowledge of the chief morbid constituents be arrived at. Practice, which you should take every opportunity to profit by, will, of course, be the only means of making you expert.

It is important and encouraging to remember that the study of urinary pathology is rendered much more easy than what you might *a priori* be led to expect, by a knowledge of the fact that the different principles, morbid and otherwise, WHEN ONCE WELL SEEN, are very seldom forgotten by the attentive student.

INDICATIONS FROM EXAMINATION OF THE URINE.

Before proceeding to the Pathological INDICATIONS FROM EXAMINATION OF THE URINE, I shall premise (at the risk of some repetition), some further particulars, relating especially to the chemical composition of the normal fluid.

HEALTHY HUMAN URINE is an amber-coloured clear watery fluid, containing a large number of substances in solution, and holding suspended a very small quantity of mucus derived from the urinary membranes. Its density is very variable—from 1003 to 1025—the variety depending on the varying quantity of water present. Thus the urine passed immediately after copious watery potations is of very low specific gravity (1003-9), and is called the " urina potus." That passed after a solid meal, or the " urina cibus," or chyle, is of high density, reaching up to 1030 ; while the morning urine, or the " urina sanguinis," presents an average specimen, which is about 1015-22, and may be deemed as containing the constituents in their normal proportions. The amount of urine passed in twenty-four hours varies also very much, according to the diet, state of the temperature and moisture, degree of exercise taken, habits of the person, &c. An average may be noted at two pints and a half. Urine has an odour closely resembling that of urate of ammonia, which imparts a slight aroma. Passed immediately after a meal, it gives an alkaline reaction ; but in general, as at all other times, it is acid. When left some time, and before decomposition sets in, a slight opalescence may be observed, which becomes more and more dense, and eventually forms a kind of *sediment*. This is composed chiefly of the earthy phosphates. With the progress of putrefaction, several crystalline salines fall, a cryptogamic mould forms over the exposed surface, and animalculæ are also produced.

Urine holds about 7 per cent. of solids in solution. These solids are thus composed :—

45 per cent. of Urea.
1½ ,, Uric acid.
10½ ,, Alkaline sulphates.
8½ ,, Phosphates ; and
34½ ,, Ammoniacal salts, and chloride of sodium, and extractives.

It will be plainly seen from this analysis that UREA is the chief constituent. This is a solid, crystalline, natural substance, soluble in its own weight of water, colourless when pure, and crystallising in four-sided prisms. When analysed, it is found to contain 46·7 per cent. of nitrogen. It is the most highly azotized body known. It is readily decomposed, when any mucus, alkalies, or albumen, is present, and is then transformed into the carbonate of ammonia. Urea unites readily with the nitric and oxalic acids; and the compounds are characterized by their crystals, and by their insolubility. This fact is made use of in testing the presence and quantity of urea, and may be readily illustrated by the simple addition of the acid to a concentrated specimen. The amount of urea is greatly increased by an exclusively animal diet; diminished by a vegetable, —and especially a diet of starch, sugar, and oil. Its relative amount rises from infancy to manhood, and declines with age; and it is more abundant in males than females.

URIC ACID (Lithic acid) is a brilliant white powder, tasteless, inodorous, and all but insoluble in cold water, and but slightly in boiling water. It dissolves in dilute nitric acid, with evolution of, carbonic acid and nitrogen; and when this solution is evaporated, it acquires a pink colour, which, if ammonia be added, changes to a beautiful purple red hue, highly characteristic.

Uric acid is only found in small quantities in the urine of man and the carnivora, but in serpents and birds it copiously abounds. Of course, then, in man it increases under a purely nitrogenous diet. Its presence may be readily detected in urine by concentrating a little, adding some muriatic acid, and permitting the mixture to remain some time in a cool place. Soon, crystals will fall, which, when seen under the microscope, will exhibit various forms of the "rhombic prism." Uric acid combines with potassa, soda, and ammonia. The urate of potass requires 85 times its weight of hot water for solution; the urate of soda 124 times; and urate of ammonia 243 times of hot, and 1720 of cold. Hence, then, we frequently meet with this salt depositing whenever the urine, fresh passed, is allowed to *cool.*

The reaction of nitric acid may also be employed to detect the presence of uric acid. Thus :—

Place a little of the uric acid in powder on a watch glass, and let fall on it a drop or so of pure nitric acid, it will dissolve with effervescence, carbonic acid and nitrogen being evolved. Let the residue be evaporated nearly to dryness, when it will be seen of a red hue, which, when cold, if moistened with a drop or two of ammonia, will exhibit the beautiful and characteristic purple.

The blow-pipe decomposes uric acid with an ammoniacal smell, combined with a trace of almonds.

3. HIPPURIC ACID, so copious in herbivorous animals, is occasionally present in perceptible quantity in human urine, especially when a strict vegetable diet has been used. It is met with in long, transparent, four-sided crystals, has no odour, and a faint, bitter taste. It is difficultly soluble in cold water, requiring 400 times its weight; but freely in hot water and alcohol, and readily unites with alkalies. Heat first melts it, as if it were of an oily nature, but eventually transforms it into benzoic acid and benzoate of ammonia. It is readily isolated—

By concentrating to a syrupy consistence a specimen of the urine of the horse, or other of the herbivora; then, after cooling, saturating with muriatic acid, which will throw down impure hippuric acid of a brown hue. Let this precipitate be dissolved in hot water, and again crystallized. Re-dissolve in hot water, and pass a current of chlorine through the fluid till the colouring hue is destroyed. After neutralizing the re-crystallized acid with carbonate of soda, boiling the solution with animal charcoal; the *pure* acid may be isolated by adding the muriatic acid, and again crystallizing.

4. THE PHOSPHATES are observed in neutral or alkaline urine, under three forms :—
1. The ammonio-phosphate of magnesia, or the " triple phosphate."
2. The ammonio-phosphate of magnesia, with excess of ammonia, or the " bibasic phosphate."
3. The phosphate of lime.
The " triple phosphate" is readily separated by adding a few drops of ammonia to healthy urine, or by simply allowing the urine to stand a few hours. It is observed as a white crystalline gravel, or as a thin iridescent film floating on the surface, or as a dense ropy white deposit resembling mucus or pus. Its appearance under the microscope is that of the " double prism." The " bibasic phosphate" generally assumes the *stellar* forms, while the phosphate of lime occurs as an amorphous deposit.

5. AMMONIACAL SALTS.—Ammonia is observed in healthy urine in combination with muriatic, uric, sulphuric, or phosphoric acid, but generally in small quantity. It can be detected

By concentrating a specimen of urine nearly to dryness, and adding a little caustic baryta. The fumes of ammonia then passing off may be proved by dipping a glass rod into muriatic acid, and holding it over them, when the white flakes of the muriate will speedily appear.

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6. THE ALKALINE SALTS constitute about 13 to 14 parts in the 100 of healthy urine, and consist of the sulphates of potass and soda, the chlorides of sodium and potassium, and the phosphates of soda.

The *chlorides* may be tested by nitrate of silver ; the *sulphates* by baryta ; *potass* by the bichloride of platinum ; and *tartaric acid* and *soda* by the same salt of platinum, or by the antimoniate of potass.

Besides the above, we always meet with traces of *mucus* and *epithelial cells.* Their presence is indicated by a cloudy appearance, and proved by the aid of the microscope, which exhibits their characteristic appearance.

We shall now proceed to give the interpretation of all the altered states of the urine arising, by physical or chemical changes, in any of the constituents ; or from the presence of matters altogether foreign to the fluid.

I. PHYSICAL CHANGES.

Under this head, we include differences of density, of colour, of consistence, of odour, and taste, and the different appearances of the sediments.

The DENSITY or specific gravity varies with the relative amount of water and solids—as a glance at the accompanying table will abundantly prove. Very light urine, *i.e.*, urine, say under 1010, is either the urina potus,—or, if permanent, implies the same conditions as diuresis, *i.e.*, the effect of diuretics or hysteria ; but it is also seen with scanty urine. In this case it argues the existence of " Bright's disease."   A high density has a more extended range of causes, as *diabetes mellitus*, gout, or acute rheumatism, fevers in the last stage and crisis.   The density may reach above 1050.   The mode of examining this point is by means of an instrument called a " urinometer," or " hydrometer."

The COLOUR of urine sometimes gives important indications.   It may be colourless, whitish or milky, yellow, green, yellowish red, dark red, or purpurated, brown, and even black.

Colourless urine is generally observed in diabetes ; in diuresis from any cause; in hysteria ; in cold stage of fever, and in some cases of cerebral inflammation.

Milky urine arises usually from the admixture of pus, mucus, fat, or lymph; and is hence observed in inflammation of the urinary organs at any part ; and generally in suppuration going on in any organ ; or in " constitutional states " characterized by hyper-secretion of mucus, as in gastric and puerperal fevers ; and the same

is frequently observed in the fevers of children, and occasionally in arthritis.

Yellow, *orange*, or *green* urine is noticed in hepatic and duodenal affections, whereby the biliary colouring matter is in excess in the blood : also in intermittent, rheumatic, and hectic fevers.

The *yellowish-red* urine is also called the inflammatory urine, *par excellence.* It is well seen in all fevers from local disease ; but particularly in the rheumatic, and the crisis of the poison fevers.

The *dark-red* urine arises in some cases from the presence of " purpurine ;" in others, from admixture with blood. In the former, it is observed in acute rheumatism, in hepatic congestion, and some dyspeptic states. In the latter case, it has the same indications as the dark brown and black, viz., high inflammation of some part of the urinary aparatus, calculi—and indirectly, the purpuric state, the pressure of tumours (as the gravid uterus), the effect of medicines acting specially on the urinary organs, vicarious hæmorrhage, and other causes of hæmorrhagic exhalations. A thick and turbid urine denotes either local inflammatory disease, or the crisis of various fevers, or arises from error of diet, and hence called the " urina jumentosa."

The urine and its deposit have been sometimes seen of a decidedly *blue* tint. This arose from the admixture of " cyanourine," indigo, or the prussian blue. The indications are unknown. It can be artificially produced by giving to a patient, who has been taking iron, a few doses of the ferrocyanide of potassium.

The *black* pigments in urine, when not of blood origin, are due (it has been stated) to peculiar principles called by Prout *melanic acid*, and " melanourine ;" but " it is more than probable (according to G. Bird) that in some instances at least, these pigments ought to be regarded rather as the altered colouring matter of blood than any thing else."

Besides these tints, various colouring substances taken internally so colour the urine as occasionally to present some difficulty in diagnosis. It is, therefore, well to remember, that beet-root, pyrola, rubia, rhubarb, indigo, hæmatoxylon, are all of this nature.

The characteristic ODOUR of urine is *absent* in cases where the specific gravity is very low, from excess of water. It is *ammoniacal* in low fevers and other " general states," spinal disease, or injury, and some states of dyspepsia ; also from admixture with substances which readily putrefy (as mucus, pus, &c.), and which are formed in cystitis, or inflammation of any other part of the urinary apparatus. A *sweet* odour is noticed in diabetes, especially when the urine is permitted to rest a little in a warm place. Certain medicines im-

part peculiar odours to the urine. Thus turpentine gives a violet odour; while ether, gin, grain spirit, and wines, impart their distinctive odour but little changed.

It is seldom that patients examine their urine by the sense of taste. In cases of diabetes mellitus, however, they have been occasionally the first to draw attention to the characteristic sweetness.

The appearance of the sediment in urine gives but partial information. Thus, the *whitish* deposit may be mucus, pus, or phosphates, or even urates. The *dark red*, or brick sediment, consists mainly of coloured urates, lithic acid, and purpurates. The *brown*, or *black*, imply some admixture of blood.

II. CHEMICAL AND MICROSCOPIC EXAMINATION.

The indications from a chemical and microscopic examination are next to be considered.

The deviations from health thus ascertained may be—first, either excess, defect, or want of some of the normal constituents; or, secondly, may arise from the presence of substances *foreign* to the fluid. Under these heads we shall discuss this subject.

1. As we have already disposed of diuresis, and its opposite state, we need not here further dwell upon changes in the quantity of the *watery* ingredient.

Urea in excess occurs in urine of high density; and in the opposite condition to *diuresis*, from saline diuretics, in fevers, in rheumatism, in chronic hepatitis, and generally all cases of acute inflammation. But it also occurs in excess in persons in good health when under a purely animal diet.

The urea is diminished in "Bright's disease," but accumulates in the blood; also in Asiatic cholera.

Lithic acid in excess, or, when the habitual state, the "lithic acid diathesis," as it has been termed, is generally characterized by the deposit in the urine, on cooling, of the urate of ammonia. It arises from error of diet, (causing indigestion,) excess of exercise, especially after meals, abundant animal diet; defect of exercise, or a sedentary life, with full and generous living; certain debilitating causes, such as mental anxiety and depression, long fatigue, and fasting; and certain atmospheric conditions.

The varied *shades* of the lithates give different indications. Thus, the yellowish sediment is most common in health under error of diet; and in children, under any slight irritation. The reddish-

brown and pink are commonly lateritious, and are highly tinged with the purpurates of ammonia and soda. They are observed especially in hepatic disease, congestion of the kidneys, fevers, acuter rheumatism, and gout.

Excess of the earthy phosphates, or the " phosphatic diathesis," is observed under characteristic circumstances. It occurs generally in persons long suffering from general irritability, and especially digestive derangements, (indicated by a sallow and haggard countenance,) encephalitis after injury, and acute *meningitis*; (hence a differential test between these maladies and *delirium tremens*). Spinal disease and injury are frequent causes of at least a temporary increase; as also disease of the bladder and urethra. *Mollities ossium* is another condition favourable to the production of this deposit.

The earthy phosphates are deficient in renal degeneration.

The excess of sulphuric acid or the sulphates is not distinguished by any sediment. It is observed after increased food or exercise, after the administration of sulphur, and of sulphuric acid. Its indications in disease, have not, however, been sufficiently studied to enable me to lay any decided results before you.

The *chlorides* are temporarily deficient in pneumonia.

Alkalescence of the urine may spring from ready conversion of urea into carbonate of ammonia, or the actual excess of alkalies. In the former case, the change generally takes place in the bladder, and by means of mucus or pus thrown out by inflamed mucous membrane. The latter case is caused by the excess of the carbonate or phosphate of soda. In this, phosphate of lime may be precipitated. The original cause is indigestion. Another source of alkalinity may be an excess of urea. This state has, however, been already referred to.

Mucus and epithelial scales in small traces are met in healthy urine. In disease they are increased, and form a deposit of a whitish colour, and of ropy consistence. It occurs thus in all inflammatory diseases of the urinary organs.

2. We come now to the second class of changes, or the existence of substances foreign to the fluid.

Blood is observed in the urine as a colouring agent, and as a deposit; and possesses the same indications as bloody urine already described.

Albumen, one of the chief constituents of blood, is observed in renal congestion; in " Bright's disease," in all its stages; in pregnancy; in the exanthematous fevers at the close, especially scarla-

tina; and in Asiatic cholera. Besides, it is necessarily present when pus or blood is discharged in any appreciable quantity.

Pus is observed in the urine in all cases of severe inflammation of the urinary mucous membrane ; and in abscesses of any organs connected therewith by new-formed communication (as rupture of the purulent sac); also, in absorption of abscesses elsewhere, and in purulent deposits.

Bile is found in the urine in cases of jaundice.

Kiestein, or a filmy, fatty substance resembling casein, in combination with the triple phosphate, is observed in most cases of pregnancy.

Sugar is noticed in *diabetes mellitus.* In health, the mamma and the liver are the only organs that secrete it ; but never is it in such quantity as to be perceptible, as such, in the blood.

Fat passed in the urine is observed either as a constituent of chyle or milk, or as a separate element, thrown off occasionally in obese subjects, but much more frequently in " Bright's disease," along with the " tubular casts."

Chyle, as containing albumen and fat, and spontaneously coagulated, is easily distinguished, and is observed in a small proportion of " Bright's " cases.

Milk. There is, according to Bird, no evidence that it is met with in urine during lactation, even when excessive or suppressed. So-called milky urine has been either fatty or purulent.

Casts of the urinary tubes are seen in cases of " desquamative nephritis," arising from injury or disease of the kidney, or the irritation of calculi ; or even the irritation of the organ by renal stimulant medicines.

Oxalate of lime occurs as minute octohedral crystals, in size varying from $\frac{1}{150}$-$\frac{1}{3600}$ of an inch in diameter. It is insoluble in water and vegetable acids and potass, but readily soluble in nitric and muriatic acids. Though frequent as a constituent of urinary calculi, it is seldom seen as a deposit. It occurs usually suspended in the urine in cases of chronic indigestion, excess of diet, sedentary life, cutaneous affections, gout, rheumatism, fever ; and yet it may occur (but never largely) in the absence of any of these states. Indeed the recent researches of Bence Jones quite oppose the views of Golding Bird, as regards the *serious* import of this salt. Jones agrees with Prout in considering that it possesses the same indications as the " lithic acid diathesis." It is due, however, to Golding Bird to state that he was the *first* to draw attention to its extreme frequency. This he did in 1842.

Uric oxide, or *Zanthic oxide*, discovered in a calculus by Dr.

Marcet, is but little known as an indicator of disease. From the affinities it possesses to uric acid, it is supposed to imply the same pathological indications.

Purpurine " is almost invariably connected with some functional or organic mischief in the liver, spleen, or some other organ connected with the portal circulation." It is especially noticed in the " cirrhosis" of drunkards. It may be deemed, therefore, an approximative test of the *source* of an ascites. Golding Bird is confident of the correctness of this view.

Cystine is rarely met with in diseased urine. Dr. Wollaston first discovered it in a calculus. From the nature of its composition, there seems little doubt that it is especially connected with an excessive elimination of sulphur, and it is formed by those elements of our tissues which would normally have been converted into urea and uric acid. In the few cases in which it has been seen, it occurred in decidedly scrofulous habits.

Carbonate of lime very rarely exists alone. It is formed almost always associated with the earthy phosphates, and possesses the same pathological indications.

Silicic acid has been observed in very minute quantity as part of a calculus. It may, therefore, form part of a urinary deposit. Its indications are unknown.

Spermatozoa occasionally occur in the urine of the male adult, and sometimes in quantity sufficient to cause an opalescence. Their occurrence is invariably caused by the presence of semen, and this in various ways, *e.g.*, from extreme constipation, accumulation of semen by stricture, paraplegia, excessive venereal indulgence, and the habit of onanism.

Vibriones are met with recently after micturition, in some rare cases of excessive debility, syphilitic cachexia, and in mesenteric disease, and generally, it may be presumed, such states as will favour the putrefactive fermentation.

In addition to the above, certain substances taken as food or medicine, exhibit themselves again in the urine. The vegetable acids, as citric, malic, and tartaric acids reappear, but in combination with alkaline bases. Iodine may be readily detected by the starch test; chlorine and the nitro-muriatic acid by the bleaching test, and the neutral salts pass out either unchanged or partly transformed into carbonates of the base.

THE DIAGNOSIS OF URINARY CALCULI.

URINARY CALCULI are, like deposits, composed either of substances already present in healthy urine, or of others foreign to that fluid, and only observed in disease, and again, of combined specimens of both. Besides, there are accidental substances which form frequently the *nuclei* of the calculi. In addition to the crystalline substances, calculi contain *animal* matter in variable proportion.

The most common calculi are composed of two or more ingredients. It is seldom they consist of but a single substance.

I. The most common of all the urinary calculi is the URIC ACID. The external characters are, a smooth or a slightly tuberculated surface, a pale brownish hue, and the acid incrustation disposed in layers.

EXAMINATION TESTS:—1. (*Blow-pipe*)—If a small portion is heated by the aid of the blow-pipe, it immediately blackens (from charring of animal matter) and evolves an odour of burnt feathers and almonds; ultimately the charred part is consumed, and (*test-paper*) an alkaline ash remains, consisting of phosphate or carbonate of soda.

2. (*Nitric acid*)—Pulverize a little of the calculus, and add a drop or so of strong nitric acid. The powder dissolves *with effervescence.* Let the mixture be evaporated to dryness, and a *red* powder will be seen, which, when cold, and tested by a drop of ammonia will assume the characteristic purple.

3. (*Potass*)—Dissolve a little of the specimen in a solution of potass, warm, no smell of ammonia is perceived; neutralize with muriatic acid, and test for uric acid by (2) as above.

II. URATE OF AMMONIA calculus is seldom met with. It is most commonly seen in combination with the uric acid, or the earthy phosphates. It is generally small, of a pale slate or clay colour; with thin concentric layers, and a smooth or slightly tuberculated surface.

1. (*Potass*)—It dissolves readily in a warm solution of potass, and gives off ammonia. By neutralizing this mixture with dilute muriatic acid, the uric acid is thrown down, and may be separately tested.

2. (*Blow-pipe*)—Before the blow-pipe, this calculus behaves as if uric acid.

III. THE PHOSPHATE OF LIME calculus is smooth externally, with defined concentric laminæ, of a pale fawn, or stone colour.

1. It will *not* fuse before the ordinary blow-pipe, but chars, then whitens, and leaves a neutral residue.

2. Nitric and hydrochloric acids *diluted*, readily dissolve it:

a Take one portion of the acid solution thus found, and neutralize with ammonia, and the phosphate of lime is again precipitated unchanged.

b To another portion, add a few drops of nitrate of silver solution, and neutralise this with dilute ammonia. The phosphate of silver, of a yellow hue, and soluble in both ammonia and nitric acid, will be precipitated.

c Nearly neutralize a third portion with dilute ammonia; add oxalate of ammonia, which will cause a copious white precipitate of oxalate of lime.

3. Mixed with twice its bulk of the double phosphate of ammonia and magnesia, the powder of this calculus will readily fuse before the blow-pipe, though by itself nearly unaffected by very strong heat.

IV. THE TRIPLE PHOSPHATE is most commonly mixed with other substances—seldom alone. It is pale, drab, or stone colour, and its surface rough.

1. The blow-pipe flame chars, evolves ammonia, swells it, and imperfectly *fuses* it.

2. It dissolves readily in dilute muriatic and nitric acids, and is re-precipitated by neutralizing with ammonia. Examine this precipitate by the microscope, and the characteristic crystals will be well seen.

3. Heated in a potass solution, it is decomposed, magnesia is precipitated, ammonia evolved, and phosphate of potass remains in solution.

V. THE FUSIBLE CALCULUS is very common, and may constitute the entire mass. It resembles " a lump of chalk," and is of an irregular, oval shape.

1. The blow-pipe flame fuses it readily, but *does not consume it.* This test is characteristic, as it is unique.

2. Dissolve in dilute hydrochloric acid, nearly neutralize with ammonia, and add oxalate of ammonia. Oxalate of lime will be thrown down.

3. And again, if you add ammonia to the acid solution, until a precipitate appears, a microscopic examination of the deposit will exhibit the crystals of " the triple phosphate."

VI. OXALATE OF LIME calculi are occasionally *entirely* composed of this substance ; but the uric acids, or the urates, frequently intermingle. The colour is dark brown or olive, or a dirty purple, and the surface is very irregular. They are called the "*mulberry* calculi ;" and another form, the "*hempseed* calculi." These latter are very small, roundish, and smooth, and only occasionally met with.

1. Oxalate of lime calculus, when pulverized, dissolves readily in dilute nitric and hydrochloric acids, without effervescence, and may be re-precipitated unchanged by neutralising with ammonia. Should any carbonate of lime be present, some effervescence must, however, be expected.

2. The blow-pipe flame chars, and evolves an odour of burnt feathers—ultimately it whitens, and carbonate of lime is then formed, which will effervesce on the addition of the hydrochloric acids. The resulting solution, if neutralized with ammonia, and treated with oxalate of ammonia, will precipitate the oxalate of lime.

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VII. THE URATE OF LIME is only observed as *part* of calculi. It is readily suspected, by remembering that it is the only salt of lime found in calculi which is *soluble in hot water;* and that, after pounding some of the calculus and boiling it in water, the hot aqueous solution will yield oxalate of lime, by the addition of oxalate of ammonia.

VIII. CALCULI OF CYSTINE are exceedingly rare in the human subject, but frequent in the dog. They are small, faint yellow, or green, laminated, soft, and somewhat crystalline. They are readily soluble in water, and if the solution be allowed to evaporate slowly, the characteristic crystals will become apparent by the aid of the microscope.

You may ascertain the nature of any given calculus by observing the following points. First, examine its form, size, colour, and surface. Then make a section, and notice whether it consists of one or more ingredients. If the latter, each must be examined separately. Next apply the blow-pipe flame, and observe whether the specimen is combustible or incombustible. *If combustible,* notice these things:

1. See if it dissolve in *hot* water. If not, by a solution of potass —this may. Then test the solution with nitric acid and ammonia; and if *uric acid* be present it will give the characteristic coloured residue.

2. When soluble in both hot water and potass, with disengagement of ammonia fumes, and answers to the "uric acid test," then it is *urate of ammonia.*

3. When insoluble in hot water, but soluble in ammonia, the solution, when evaporated, will yield most probably the *cystine* plates.

The incombustible calculi are the phosphate of lime, the triple phosphate, the fusible phosphates, the oxalate of lime, and the urate of lime, which may be tested sufficiently accurately by the modes already described; but I shall here recapitulate briefly. 1. The phosphate of lime is an *amorphous* white powder, soluble in dilute hydrochloric acid. 2. The triple phosphate is tolerably fusible, soluble in dilute hydrochloric acid, and has peculiar and *distinctive crystals.* 3. The fusible calculus is very readily *fusible,* and possesses the same properties as the two last. 4. The oxalate of lime is soluble in diluteh ydrochloric acid,—the solution, when neutralized with ammonia, yielding a *white* precipitate; but if a specimen be gently ignited, it dissolves in dilute hydrochloric acid, *with efferves-*

cence, and the solution yields no precipitate when neutralized with ammonia. 5. The urate of lime dissolves in hot water, and gives a white precipitate with oxalate of ammonia.

THE INDICATIONS OF URINARY DISEASE FROM THE GENERAL SYMPTOMS.

The *general appearance* is only affected in the acute painful forms, and the chronic degenerations, as "Bright's disease," which is characterized by a sallow, earthy, bloated face and body.

The *complexion* varies in the same way.

The *expression* is very anxious in the acute forms, especially from the irritation of calculi.

The *manner* and *position* are indicative only under suffering.

The voice and speech, and eye, are not affected.

The *respiration* is mostly subdued, in order to relieve the abdominal muscles, and indirectly, the affected organ.

The pulse varies with the intensity of the local state, and the tongue in like manner.

The *skin* is exceedingly dry in diabetes, œdematous in "Bright's disease," and varies much in other urinary affections. The bowels are not specially affected. The *appetite* is impaired, but thirst is in general great. The sleep is disturbed, the strength is defective; while the general feelings and state of the blood are not particularly affected, save in a few decided cases, as the excess of urea, and deficiency of the red-cells in "Bright's disease."

THE INDICATIONS FROM THE REFLEX SYMPTOMS.

Vomiting is among the most common symptoms in nephritis, and is purely reflex. Headach, pains in the thighs ℞ inner side, the penis, testis, and perinæum, are common from irritation of some of the urinary organs; besides, in hysteric subjects, many anomalous complaints are referable to the urinary organs.

VII.—THE INTERPRETATION OF DERANGEMENTS OF THE FEMALE
REPRODUCTIVE SYSTEM.

THE female reproductive system comprises the ovaries, the uterus,
and their appendages, the fallopian tubes, the vaginal canal, besides
various accessory ligaments.   Of all these, the ovaries are the most
essential for reproduction.

THE OVARIES, two in number, are situated in the right and left iliac
regions, respectively.   They are compound glands, oblong, flattened,
and oval, and externally of a whitish colour.   They are situated
in the folds of the broad ligaments, and are connected with the
upper angles of the uterus by round cords—the ligaments of the
ovaries.   Internally, each ovary consists of an areola, fibrous paren-
chyma, blood vessels, and special cells, called " graafian vesicles,"
with an immense number of microscopic ovisacs, all enclosed in a
capsule of three layers.   These layers are, internally, a vascu-
lar ; a middle, or fibrous ; and externally, a sheath of peritoneum.
The " graafian vesicles" are about fifteen to twenty in each ovary.
These contain the " ovula," which were originally discovered by
Von Baer.   The outer capsule is composed of two membranes, the
inner of which is lined with epithelium.   The ovulum is a very
minute object, and occupies but a small part of the vesicle, the re-
maining space being filled with albuminous fluid, in which micro-
scopic granules float.   It contains a fluid and the " germinal vesi-
cle," in which is the " germinal spot."   This spot is opaque, and
contains corpuscles analogous to the nuclei of " formative cells."

THE UTERUS is also a compound organ.   It is essentially a mus-
cular bag.   It has three tunics : an external serous—or peritoneal,
a middle—or muscular, and an internal—or mucous, which is con-
tinuous, by the vaginal canal, with the skin at the labia majora,
and with the peritoneum at the fringed extremity of the fallopian
tubes.   The layers of muscular tissue are various.   Thus, super-
ficially, they are vertical, or longtitudinal, and oblique.   The deep
layers are circular at the fallopian angles and at the cervix.   The
mucous membrane is ciliated, and has columnar epithelium.   The
ciliæ commence at the middle of the cervix, and extend to the ex-
tremities of the fallopian tubes.
The uterine dimensions in the virgin adult are, 3 inches in the
long diameter, and 2 in the transverse.   Its cervix is 1 inch in

length, and its entire weight about 1½ oz.; after parturition, from 2 to 3 oz., and at full period of gestation, about 2 to 4 lbs.

THE FALLOPIAN TUBES are real "oviducts," and occupy the upper border of the broad ligaments. The diameter is smaller at the uterine ends; hence, they are trumpet-shaped. Their length is about four to five inches. The fringed-like termination of the fallopian tubes is also named the *fimbriated* extremity, and, by a stretch of fancy, the "morsus diaboli." The tube has three tunics —an external peritoneal, a middle muscular, and an internal mucous, which is capable of distension. The muscular fibres are longitudinal and circular.

The vaginal canal is a compound structure, composed of a mucous coat internally, which presents transverse rugæ and papillæ, extending on each side of the middle *raphe*, which is well seen at the upper surface. It is covered by epithelium. Underneath the mucous coat, we have the erectile layer, which is composed of *erectile tissue*, between two layers of fibrous tissue; and externally, the *dartoid layer*, which is fibrous, and connects the canal with the neighbouring parts, especially the bladder. Into this canal the urethra opens anteriorly, on the upper wall.

The CERVIX connects the *os uteri* with the body. The *os* has two labia, an anterior and posterior. The opening is circular and very small in the virgin, transverse and wide in the matron. The opening narrows in both towards the cavity of the uterus. The interior of the cervix is characterised by peculiar folds of the mucous membrane, two or three longitudinal and converging oblique, imparting a resemblance to the stem of a tree, and hence designated the "arbor vitæ uterina;" and the disposition of the mucous follicles, thereby effected, when their orifices are closed, gives rise to those vesicular eminences so frequently observed here, and called the *ovula of Naboth*.

The *arteries* that supply these organs are the internal iliac and spermatic. The *veins* of the uterus are of great dilatability, and rather resemble "sinuses," especially during gestation. The *nerves* are ganglionic, from the hypogastric and spermatic plexuses, and cerebro-spinal, from the sacral plexus.

THE MAMMÆ are auxiliary organs, devoted to the secretion of milk. They are, of course, only developed in the female, though present rudimentarily in the male. The left mammæ is generally a little larger. They are of a semi-globular shape, and consist of lobes, lobules, and vesicles, capsuled and supported by dense fibrous

tissue, and enveloped in fat. The lactiferous tubes arise at the vesicles, are lined with mucous membrane, and terminate by ten to fifteen of large size, which are parallel, and constitute the chief bulk of the nipple. The nipple also contains elastic tissue in great abundance, and hence its capability of erection. The skin around the nipple is coloured from deposit of pigment, *after* impregnation, and is supplied with a considerable number of sebaceous follicles, which become prominent during gestation.

The *vessels* which supply these glands are the axillary, intercostal and internal mammary; while the *nerves* are the intercostal, and the thoracic branches of the brachial plexus.

Now, let us briefly notice the uses of these organs. The ovaries contain the ovules, and, it is believed, and recently taught, shed these periodically along with the menstrual flow. Every twenty-eight days, after menstruation has been commenced (which in these countries may be as early as the thirteenth year), a flow of blood is observed trickling down from the uterus. From two to four ounces may be thus lost in the course of three to six days. When analysed, this blood is found to contain very little fibrine, and hence remains uncoagulated. It is mixed with mucus and epithelial debris. In other respects it is identical with ordinary blood. Menstruation ceases during pregnancy and lactation, as a rule.

The *first* menstruation is generally ushered in by constitutional disturbance, as pains in the loins and legs, sickness, and slight feverishness; and its periodical return is frequently characterised by similar symptoms (called " molimia"). The *last* menstruation may occur any time between the forty-fifth and fiftieth year, or even later.

When the female is impregnated, the uterine mucous membrane becomes congested, and the "membrana decidua" formed to receive the ovum, which leaves the ovary some time about six to eight days after impregnation. The *yellow* spot marking the place where the ovum had been, is named the " corpus luteum," which may be known from *false* corpora lutea by observing the large size, and the central cavity which distinguish the *true*.

The ovum, as it enters the uterus, is received into an inversion of the decidua, which then at this part receives the appellation of " decidua reflexa," its place supplied by another mass called the " decidua serotina." The cavity of the decidua vera is occupied by an albuminous fluid, which, however, disappears about the third month; the two decidua having by that time become contiguous; and eventually two layers, which are with difficulty discover-

able, as they become more and more atrophied, till the end of gestation.

The ovum and decidua soon become connected. The former is seen surrounded with minute filamentous mossy vessels, which proceed from its own outer tunic, the " chorion," and imbed themselves in the semi-fluid deciduous secretion. These vessels are called the " shaggy chorion," and in the course of the growth of the ovum, become concentrated at one spot, to form the " placenta," which is the most essential of the fœtal appendages. This placenta contains the termination of the umbilical arteries and beginning of the umbilical veins, or the fœtal capillary tufts, which are in close contact with the vessels of the uterus, and from which they derive such vivifying changes as renders the fœtal blood more adapted to sustain life. The exact nature of this connection is yet a matter of dispute. When the ovum becomes mature (or, in case of accident, earlier), the reflex action of *parturition* is set up, and the fœtus expelled.

During the gradual enlargement of the ovum, there must necessarily be exercised some degree of pressure upon the branches of the lumbar and sacral plexus; beside engagement of the ganglionic nerves, and also of the principal iliac vessels. The consequence is, various symptoms, reflex and direct, which indicate the state independently of any examination. These points will be further elucidated.

We are now in a position to understand the various derangements of the reproductive system.

First let us consider these derangements under the term :—

STATES OF MENSTRUATION.—Menstruation may be too early, too late, too frequent, too dilatory, and irregular. It may be painful, or the discharge may be suppressed, retarded, or profuse. These different states all present important pathological indications, which we shall now proceed to explain.

The pathological indications (if any), of a too *early* menstruation, further than being considered a sign of early development, are not known. Menstruation appearing *late*, betokens constitutional delicacy, or chronic disease—as phthisis, original malformation, or a laborious or too confined mode of life. Too *frequent* menstruation, *i.e.*, when the menses occur every two or three weeks, indicate inordinate determination of blood to the uterus, which may arise from the habitual use of certain medicines, unusual excitement, or again from debility. When the menses are too *dilatory*, *i.e.*, when they occur only every other time, or every six or eight weeks, it is a sign

of some concurrent chronic disease of another organ, or general debility. Irregularity has similar indications.

Painful menstruation, or " *dysmenorrhœa*," must arise from uterine congestion, cold, frequent abortions, hysteria, or some other source of uterine irritation. It is always accompanied with, or preceded by, acute pains of the uterus and adjacent parts, and occasionally in the mammæ, while the discharge is scanty, and in the worst cases, presents fibrinous threads, *i.e.*, coagulable lymph. It is possible to confound a case of dysmenorrhœa with one of early miscarriage, as the membranous exudation may, to a superficial observer, simulate the true decidua. This, therefore, should be kept in remembrance.

The suppression and retention of the menses are included in the varieties of *amenorrhœa*. Thus the menses may never have appeared, from congenital deficiency of the ovaries, uterus, or such other malformation as would prevent it: or again, they may have been inordinately delayed, from the causes already mentioned ; or it may occur after puberty in the excessively plethoric, or the irritable and hysteric;—in the former produced by congestion from full living and indolence, and in the latter from the general state, called *chlorosis*.

When the menses have been regularly observed for a time, and then a suppression suddenly occurs, it may spring from the impression of cold, or a high state of excitement : or again, from the super-vention of pregnancy, or concurrent acute fevers, the action of severe purgatives, or excessive venæsection. Sudden suppression is sometimes attended with severe symptoms—especially cerebral disease.

Long-continued suppression indicates generally a much more important series of causes. Thus, it may have a local cause or a constitutional one. It may arise from chronic disease of the ovaries or uterus : or again, from the supervention of phthisis or other visceral disease, or confirmed chlorosis. The accompanying symptoms of chronic suppression are, headache, or vertigo, dilatation of the pupil, and facial involuntary spasms, constipation, great susceptibility to cold, deficient muscular power, abundant limpid urine, besides many hysteric phenomena. But the menses may be excreted, and yet not be expelled. This want, in the course of time, will produce a tumour over the hypogastric region, and another in the vagina, owing to the pent-up discharge distending the uterus, and pressing it in all directions. Now this can only occur in cases where the orifice of the uterus, or vagina, is closed up, *e.g.*, congenital ecclusion, or imperforate hymen.

PAINS.—*The uterine* are of various kinds, and require some discri-

mination to enable the observer to distinguish them from peritoneal, vesical, rectal, or other abdominal pains. The situation, the tenderness, the bearing-down character, the occasional reference by the patient to the site of the cervix, the pains felt in the hypogastric or lumbar region, perineum and thighs, and the engagement of the neighbouring organs, more or less, will give you a clue to the proper seat. Uterine pains may be acute or dull, transient or almost constant, aggravated or not by pressure, coughing, and straining. They indicate uterine disease, *e.g.*, congestion, inflammation, the existence of tumours, or other disease within; uterine displacements, abortion, or parturition; or they may be merely hysteric, and imply a state of morbid irritability.

Ovarian pains must be diagnosed by the site, and by palpation, which will frequently elicit tenderness, for (except in disease) these organs are by no means sensitive.

THE UTERINE DISCHARGES are either wholly uterine, vaginal, or both. In health, there is just sufficient mucus secreted to lubricate the parts, but no excess requires removal. In various diseases, however, this discharge becomes profuse, and variously altered, and receives the name of *leucorrhœa;* and when blood forms the chief ingredient, *menorrhagia.* The subject of leucorrhœa has received much recent elucidation at the hands of Dr. Tyler Smith. With the aid of Dr. Arthur Hassall, he has investigated most minutely the anatomy, healthy and morbid, of the *os* and *cervix uteri.* He has observed that the characteristics of the mucous membrane of the *os,* are the dense epithelium, the numerous villi or papillæ, the tesselated epithelium, and the absence of follicles. Within the cervix, the epithelium becomes cylindrical, as in the case of the intestinal villi. The cervical canal is normally filled with viscid semi-transparent mucus, and the mucous membrane is disposed in rows or rugæ, with fossæ, and a large number of follicles in the median depressions. These follicles have been calculated at 10,000 in the virgin. The rugous arrangement is evidently for the purpose of securing a large amount of surface in small bounds, both for secretion, and facility of distension in parturition. The cervix, Dr. Smith considers as "an open gland,"—and it is here, he considers, that leucorrhœa chiefly has its seat. The healthy cervical mucus is very tenacious—a distinctive character—transparent, and *alkaline,* while the vaginal mucus is thin and *acid.*

When leucorrhœa arises from *cervical* inflammation, the discharge is composed principally of mucus cells, occasionally pus-cells, blood-discs, and fat. When from *vaginal,* it is composed, in addition, of

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myriads of epithelial cells, in all stages. When the epithelium is removed from any part of the os, a superficial ulcer appears; but a true circumscribed ulcer includes removal of certain of the villi besides. These two forms will explain the different pathological appearances which the os usually presents, the superficial being, out of all proportion, the more common.

Discharges of altered mucus and pus are also due to gonorrhœa, and vaginal ulcerations, for the most part syphilitic, occasionally cancerous. In the latter case, the serous or ichorous discharge prevails. Besides these, and other local causes, a leucorrhœal discharge may arise from constitutional states; protracted lactation, plethora, and scrofula. Violent exertion may also temporarily induce it.

MENORRHAGIA has for it sources either local ruptures, ulceration, congestions, abortions, and other uterine tumours, or even displacements; or the general states of purpura, profuse menstruation, and plethora. Protracted lochial red discharge comes under the same head, and may arise from relaxation or atony of the uterus, or from injury by carelessness, or manner of living.

EXPLORATION

of the reproductive organs is effected by palpation, inspection, and examination, *per vaginam* and *per rectum.*

By the first method, you can readily observe any enlargement or tenderness of the ovaries, or body of the uterus; while the last will inform you of the state of the vagina, os, and cervix; and, through these, of the uterus and ovaries, if diseased or displaced. Malpositions of the uterus are thus readily detected, whether they be versions of the axis or of the fundus.

In order to assist examination by the fingers, the aid of the SPECULUM is required. The most convenient forms are the glass, and the two-bladed silver. After having determined the position of the *os,* you have only to introduce the instrument so as to cover this before expanding the blades. The position of the patient is either the obstetric, or that for lithotomy; or, as occasionally demanded in performing operations on the vaginal wall, the position for *fistula in ano.*

THE GENERAL SYMPTOMS indicative of uterine disease vary very much with the form and duration of the malady. In

confirmed chronic disease, the complexion is usually sallow and earthy, frequently chlorotic; the expression anxious, the manner constrained, and the position supine; the voice and speech are feeble, the respiration quiet, the eye lustreless, the pulse small and above par; the tongue pale and furred, the skin relaxed, and the bowels confined or irregular. The appetite and strength impaired, the general feelings uneasy, and the blood impoverished.

THE REFLEX SYMPTOMS indicative of uterine disease are among the most variable, nearly as much so as the symptoms of hysteria. Thus headache, vertigo, pains of the mammæ, chest, side, spine, abdomen, loins, and lower limbs, vomiting, and a host of dyspeptic symptoms, attend the various uterine ills. Even *fever* may be simulated; inflammation of the peritoneum, or a joint; palsy, disease of the spine and brain, may be sketched off to the very life; and lead even experienced practitioners widely astray.

The uterine system may be said to claim equal dominion with the stomach or brain, as a centre of radiating vital impressions; and many cases will require all the aids at our disposal to make out a proper interpretation, and, of course, a proper and rational line of treatment.

VIII.—THE INTERPRETATION OF THE DERANGEMENTS OF THE SKIN.

THE SKIN is a compound organ of great extent, enveloping the body and continuous with mucous tracts. In several respects, it is similar to mucous membrane, consisting, as it does, of a fibrous body, a superimposed " basement membrane," and an epithelial layer, together with numerous secreting glands.

In the adult, this organ occupies an extent of surface, calculated at 2,500 square inches; and its glands are supposed to number seven millions. Its structures comprise the following, proceeding from without inwards, viz. :—

1. The horny layer of the *epidermis*, or cuticle.

2. The soft layer of the epidermis, consisting of *recent* cells with pigmentary matter, in certain situations only in the white, but general in the dark varieties of mankind.

3. " *Basement membrane*," a free homogeneous tissue (first demonstrated by Bowman).

4. *The papillary layer*, comprising the termini of the vessels and nerves: the former arranged in loops, and the latter in part so, and at the points of greatest sensory susceptibility (as the bulbs of the

fingers) disposed in a peculiar manner, to form the "Pacinian cor-puscles," which serve to intensify external impressions.

5. *Areolo-fibrous tissues*, which constitute the chief strength of the organ. The interweaving of the *white* and the *yellow* (elastic) fibrous tissues is close externally, becoming very open internally.

6. *Muscular tissue*. This is provided only to a partial extent; being especially marked in the structure of the nipple and the scrotum. It is also observed connected with the glands and folli-cles, as may be demonstrated by the effect of cold or fear, in "bristling" the skin.

7. *Adipose tissue*, to a variable extent, occupies the deepest layer, and is in close apposition with the fascia.

8. *Absorbent vessels* have their origin in the skin, and are inde-finitely arranged.

In addition to these tissues, there are two sets of glands—the *sebaceous*, and the *sudoriparous*. The former short and sacculated, with their ducts for the most part opening upon the interior of hair-follicles; and the latter, long, delicate, and tubular, springing from the adipose layer, and passing outwards by a spiral curve to open on the external surface.

The hair and nails are cuticular appendages; the former springing from special follicles, or tubular duplicatures of the skin, where large papillæ exist; and the latter, directly from similarly enlarged papil-lary structures. The colour of the hair is due to the pigment separated in the cell-formation of the hair, and which accompanies the cells in their external growth.

The USES of the skin are very various; and a knowledge of such is quite essential to forming a proper idea of its derangements.

Every distinct tissue in its composition has its distinctive pur-pose. Thus, the cuticle protects the papillary structure, without in the least impeding sensory impressions, while a mere varnish, or desiccated secretion would have a destructive effect. At the same time, it impedes absorption, and blunts sensibility. It is more de-veloped even in the fœtus, at such parts of the surface as are likely to be exposed to friction or pressure. The pigment is essentially carbonaceous, and its amount is dependent in a great measure upon the external temperature. In the white races, its partial appear-ance is due to increase of cutaneous vascularity, and perhaps ner-vous excitement. The nails protect the chief seats of the organ of touch, and the hair serves as a non-conducting covering and pro-tection to certain orifices.

The cutis, or true skin, while possessing, by means of its fibrous

tissues, the combined properties of toughness, resistance, flexibility, and elasticity, serves as a general and efficient covering of the outer framework of bones, muscles, and ligaments.

The sudoriparous glands remove from the blood upwards of thirty ounces of fluid excretion daily, in addition to a variable quantity of carbonic acid ; and, at the same time, enable the body to preserve a uniform temperature, in the midst of the most opposite atmospheric conditions. *One per cent.* of the fluid referred to is solid, and comprises ozmazome, lactates, and chloride of sodium, urea, iron, and various other salines usually found in the blood. By means of these glands, the skin is eminently a depurative organ.

The sebaceous glands, on the contrary, serve to lubricate the skin, and prevent its desiccation. They are also specially useful in protecting the auditory orifices, and keeping the hair-follicles clear.

The adipose tissue, when fully developed, becomes a non-conducting layer, adapted to retain the temperature of the body. It also acts as a cushion, to prevent shocks or bruises, and may be deemed a storehouse of combustible material, to be used when the body is deprived of ordinary nourishment. The skin may also be viewed as an organ of absorption. The administration of medicines by the *endermic*, or the *iatraleptic* modes sufficiently establish this fact. In this way, mercury, tartar emetic, arsenic, hellebore, rhubarb, sulphur, madder, prussiate of potass, may all be detected in the renal or alvine evacuations, saliva, or breath. And, on the other hand, certain medicines taken into the stomach transpire through the skin.

The faculty of *touch* resides chiefly (though not wholly) in the skin, especially the fingers. The extremity of the middle finger, and the point of the tongue, are accounted the most sensitive points.

The sense of *weight* is also acquired chiefly by means of this organ, while the sensation of *temperature* increases in a direct ratio to extent of surface engaged. This faculty is different from that of touch, as the former may be lost while tactile sensation remains.

The above brief sketch of the structure and uses of the skin will suffice to show the importance and value which we should accord to any deviation from the healthy state of this extensive organ ; and I shall therefore enter, at some length, into the indications which cutaneous derangements afford.

The *growth* of the cuticle may be in excess or defect ; and any

alteration from health which it presents, is due to these forms. A few days after birth, desquamation of the cuticle occurs, apparently in consequence of the stimulus of the physical agencies of the new lfie into which the child has been ushered. This increased epidermic formation may be considered natural, as it is universal. It must be distinguished from that yellowish coating on the skin of the new-born babe which is met with in many cases. This is a sebaceous secretion which, if neglected, crusts the surface, especially where the sebaceous glands abound, as the scalp, axilla, and groins.

In the child or youth, and even in the adult, the hyper-formation of epidermis is observed on the scalp, under the designation of dandriff, or pityriasis capitis. In these cases the slightest ruffling of the hair raises a cloud of fine mealy scales, which darken the collar of the coat. Though it may be occasionally the result of congestion, yet in the majority, it is evidently due to a neglect of cleansing and brushing; as due attention to these requisites will prevent any such affection.

In old age, the skin frequently becomes dry and scurfy, and presents a shrivelled and cracked appearance.

Desquamation occurs always after the local inflammations have subsided, such as in the exanthemata, erysipelas, &c., and also is a constant state of what are designated the squamous affections, such as psoriasis, lepra, and pityriasis. This derangement is well seen in the thickening arising from pressure—as in corns, and in the knees of servants who wash floors, and of shoemakers and other trades. Also, in the instances of grocers and washerwomen, from the irritation of sugar andso ap.

These are among the principal causes, and it will be observed that they resolve themselves into some forms of irritation, directly or indirectly applied, or some alteration of the equilibrium of organs,—as when one takes on the faculties of another, which thereby requires a stimulus.

But there is another condition of the skin which so closely resembles excessive epidermic formation, that some discrimination is necessary to prevent mistakes. I refer to that dry and slightly scurfy state observed in diabetes, scurvy, and the cachexia of children. Here there is no excess; on the contrary, perhaps, a deficient action; but the want of perspiratory and sebaceous fluids permits of free evaporation. At the same time, it must be admitted that excessive desquamation may accompany deficient action of the glands.

Diminished epidermic formation.—This condition is observed in females and males, under the influence of sedentary employments.

The skin becomes very thin, and vicissitudes of temperature and ex-
ternal agents of all kinds are keenly felt. Scrofulous and phthisical
patients are particular examples. This state depends evidently on
defective nutrition.

CHANGES IN THE GROWTH OF THE HAIR may be considered under
the following heads :—

 1. Increase of growth in length and diameter.
 2. Decrease and cessation of growth.
 3. Darkening of the hair.
 4. Blanching of the hair.
 5. Felting.
 6. Trichiasis.

1. Ordinarily, the infant is but scantily supplied with hair, which
is of a downy appearance. The hair-follicles are but little deve-
loped, even upon the scalp. With the growth of the body, however,
the hair grows in length and thickness ; and at maturity is at
perfection. At variable periods after, it begins to fall off, first on
the crown ; and though it never entirely disappears, its develop-
ment having been completed, its further growth is but little changed
on other parts of the body.

Increased growth of hair is rarely general ; but a few instances are
recorded of excess in early life ;—very seldom congenital. But
patches, or tufts of hair, on isolated situations, or *moles*, as they are
termed, are often observed at birth. And occasionally, too, in the
adult, upon the cicatrix of an ulcer, or blister, or other local inflam-
mation. It has also been frequently observed that elderly unmar
ried and sterile married females present a masculine growth of hair
on the chin and upper lip. Instances are mentioned by authors
of excessive length of hair. From the nature of our customs, we
cannot observe this among our own people, except among women,
in whom we know that it often attains the length of several feet.
An extraordinary example is recorded in Rayer's work, of a Pied-
montese, whose head of hair, when frizzled on purpose, measured
in circumference the enormous length of four feet ten inches. The
normal average diameter of hair is about $\frac{1}{500}$ part of an inch : but
much variety exists in the different coloured specimens,—black
being the strongest. Thus it has been calculated that 147 black
hairs grow upon the square inch, while 162 of chesnut, and 182 of
blond hair may occupy the same space. Thickness of hair is also
due to disease. Thus in trichonosis, the hairs are very much
broader. The growth of the hair is generally slow. It is estimated
by Withof that the beard grows one and a-half line per week, so

that if permitted to grow without interference, it would reach six and a-half inches in the course of a year, or twenty-seven feet in fifty years. But in certain conditions of the system, it grows even more readily. The excessive growth in phthisis has often been remarked, and it seems due to a supplemental action which the skin assumes in return for the deficiency of the respiratory office.

2. *Decrease of the growth*, or its total cessation, is called *alopecia*, or baldness. It is natural in the aged ; yet it may be congenital, or it may occur any time during life, as the result of local or constitutional irritation.

Senile baldness is called *calvities*. It commences at a variable period from thirty years on, and first attacks the anterior and crown of the head, leaving the temples and occiput free. It occurs here first, perhaps, in consequence of the inferior degree of vascularity and the tenseness of the integument. This circumstance is, however, not observed in women, which may be owing to the greater deposit of fat in females than males, the fat seeming to favour the growth of hair where ever it accumulates. In calvities, there is eventually complete atrophy of the hair-follicles and bulb.

Congenital baldness is exceedingly rare, and, indeed, when present, is but a temporary arrest of growth, as shortly after, or within the third year at farthest, hair appears. In all children the hair is soft and downy, and on the body, requires close inspection to detect it. It must also be remembered that hairs do not naturally exist on the palms, and soles, and clefts of the fingers and toes, where they would interfere with the proper action of the tactile papilla, and the free motion of the fingers.

Alopecia is frequent after the eruptive fevers, but especially typhus, and occasionally after other acute diseases. The influence of syphilis, and by some, of mercury, is sufficient to cause the hair to fall ; and under these circumstances it is difficult of restoration. Local affections—as favus, trichonosis, or long-standing eczema, impetigo, and psoriasis so interfere with the follicles that a partial baldness is frequently the result, and occasionally this state becomes permanent, in consequence of the obliteration by inflammation of the hair bulb and follicle. In trichonosis, there is more the appearance of baldness than the reality, for the hairs are thin, but altered, blanched, curved, and twisted in the follicle like tow, which, in contrast with the neighbouring healthy hairs, simulates a complete baldness. Sometimes alopecia will occur quite suddenly in circumscribed patches, without any local or general irritation. Seldom, however, is this state permanent, as stimulants applied for a short time are generally sufficient to restore the lost action.

3. *Darkening of the hair* arises generally from an excess of pigment. From infancy up to maturity the tendency exists, so that it frequently happens that a very fair, and even a red-coloured child grows up a dark-haired man. It is observed that phthisis darkens as well as lengthens the hair, especially marked in the eyelashes; and other diseases more or less affect the amount of pigment. A remarkable example of this influence is given by M. Villermi. (*See Wilson, p.* 338.)

Before leaving the subject of the coloration of the hair, it will not be out of place to mention some facts respecting the indications of colour in its permanent state. All persons among the white races may be classified under the following heads: 1. The Fair. 2. The Red-haired. 3. The Auburn ; and, 4. The Black. The hairs of the first two seldom attain any great length, and their size is decidedly inferior to that of the darker forms. Besides, they appear to be associated with defective, or imperfect nutrition, as scrofulous subjects prevail with this kind of coloration. And it has been remarked that febrile attacks are not so well borne. The lymphatic and sanguine temperaments, besides, are generally pictured with fair hair; while the nervous and bilious prevail among the darker species. These points are of more importance than you can at present imagine; as ill-health, or a delicate constitution may be frequently detected by the experienced eye from such small indications as the appearance of the hair.

4. *Blanching* of the hair arises generally from defect of pigment. It may be general or local, congenital, senile, or accidental. The whitening of the hair, or, as it is termed, *canities*, is observed under two different aspects:—first, when the hair appears *opaque ;* and the second, of a silvery and glistening brightness. This difference depends essentially upon the deposit of calcareous salts, which are in great excess in the former, and small or absent in the latter.

General congenital canities may be seen in the albino, which is a perfect specimen of the total absence of pigment, even in the choroid coat of the eye, and rendering the aspect exceedingly peculiar and strange. More generally, however, congenital whiteness is partial, and white spots of the scalp, accompanied with leucopathia, are the most frequently observed.

Senile canities occurs at very variable ages, sometimes appearing very early in life ; at other times appearing, as in some elderly females, only at the most advanced age. I have known several whose hair was perfectly dark at the age of eighty. Age and hereditary disposition are not the sole causes. Mental impressions, anxiety, study, want of sleep, fear, terror, anger, and such like

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agencies operating through the nervous system, seem to be capable of arresting the deposit of pigment, and sometimes quite suddenly. Stories are told of celebrated personages whose hair was blanched in a single night. From the anatomical nature of the hair, this is difficult of credibility; yet by very active absorption, and the deposit of calcareous matter in a fluid state, which might permeate the interstices, the phenomena may be explained sufficiently satisfactorily.

Greyness is frequently a precursor to baldness, as in the case of men at maturity. It attacks the beard and whiskers later in life. Alterations from one shade of colour to another are not infrequent. For example, the hair ordinarily grows darker from infancy on to maturity; but independently of this, changes occur, apparently from internal causes. Thus a severe illness, as fever, may cause baldness, and the next crop of hair be of totally different hue.

5. *Felting.*—When from neglect, the hairs become inextricably interwoven, this condition is said to exist. There does not seem to be any change in the hair itself, or its follicles. It is simply an arrangement, arising merely from neglect, and occasionally from some effusion, disease of the scalp, or profuse sebaceous discharges, which mat the hairs together. This must not be confounded with the Polish plica, which engages the bulbs and follicles.

6. *Trichiasis* is a name given to abnormal directions of the hair, and especially observed on the eyelids, where it becomes a source of annoyance.

ALTERATIONS IN THE GROWTH OF THE NAILS.—Nails vary in thickness. They may become excessive in length. They may curve laterally and longitudinally. They may grow in upon the bulb of the finger. They may exfoliate repeatedly. They may present differences of colour, arising from inequalities of thickness, or differences in the circulation of the matrix. They may present the root nearly exposed, er extensively coloured by reflected cuticle; and they may vary in strength and consistence.

These different states it would occupy too much time severally to analyse. And this is of less consequence, as a little reflection will show, that they must indicate defect or excess of nutrition, arising from constitutional causes affecting the system generally, or some irritation affecting the part alone. But I may, nevertheless, state that exfoliation is a frequent symptom of secondary syphilis; and that curving and fineness of the nails are concomitants of phthisis.

I come now to a more interesting and a more important subject—

THE ALTERATION IN THE DEPOSIT OF PIGMENT in the deep layers of the epidermis. These may be naturally considered under two heads :—

1. The affections characterised by absence or defect of pigment.

2. The affections characterised by excess of pigment.

Leucopathia is the designation of the first class. It may be general or local, congenital or accidental. The albino is a good example of the general and congenital. This peculiar race is not confined to any one region, or clime, or people, and is met with among the white as well as the dark nations of the earth. They are known at once by the red colour of the eye,—which resembles the eye of the white rabbit, arising, as it does, from the same cause, the absence of pigment in the choroid. Such persons cannot see clearly, save in twilight or shaded light. This condition argues defect of nutrition ; and albinos, accordingly, are generally short of stature, and deficient in bodily vigour.

When the leucopathia is partial, it is called *vitiligo*, and occurs amongst the brunettes or darker races. It may be likewise congenital ; but sometimes it is accidental. In these countries it is most common in the aged, and its seat is the scrotum. It must not be confounded with the white marks left by cicatrices, which, of course, destroy the papillæ, and necessarily, therefore, the deposit of pigment.

Excess of pigment receives different names, suited to the intensity of the colour. Thus, we have *lentigo, ephelis, chloasma, melasma, and nigrities.*

Lentigo is popularly known as freckles. They are small, round, yellow spots, seated generally on the upper part of the face and nose,—parts most exposed to the sun's rays ; as also neck and arms, where these are uncovered. They are rarely met with in other regions. They are either congenital or accidental, but are seldom observed after puberty. They are generally observed in persons of light complexion and fine skin.

Ephelis, or sunburn, is the name given to a similar eruption, which appears on the exposed parts of the body, but disappears on the approach of winter. The spots are also larger and more indistinct at the edges, and less raised than in lentigo. Neither is attended with uneasiness.

Chloasma, or liver spot, is known by irregular patches of a brown or yellowish colour, upon different parts of the body, and attended

with some degree of pruritus, and a mealy desquamation. It is most frequent in females, especially such as labour under ovarian derangements, and during pregnancy, and from other sources of in-internal irritation, such as improper diet, hepatic disorders, and phthisis.

Melasma is like chloasma, but of a darker colour, approaching nigrities. It is rare, and is observed chiefly in children or others who have been born in India. It is attended with slight desqua-mation.

The areola of the mamma assumes very much the shade of melasma during first pregnancy. It is generally observed in con-nection with a weakly constitution.

We have now to speak of the *pigmentary nævi*, which are charac-terised by augmentation of pigment in spots, and generally congeni-tal. These spots are called moles, and mother's marks, and vary in colour from a yellow to a black. They are variously situated, but most frequent on the face and back.

Viewing the subject of colour as it exists permanently in the human race, we meet with all the above shades in different nations of mankind. In the tropics we meet with the swarthy negro, in whom the dark pigment is deposited in the greatest abundance; it may be as the result of long centuries of habitation under a vertical sun. In other latitudes we see every variety,—the red Indian of America, the brown Arabian, the fair European. There cannot be a question that time and temperature have exercised the influence necessary to effect these great changes—changes which have been ascribed by some to the assumption that each of these different coloured races must have originated in separate and independent races. To this idea, however, few of our best ethnologists have given in adhesion.

But even among the whites, changes of colour are not infre-quently observed. The English traveller in the East or West Indies soon acquires more or less of the brown tint; and the child, as he approaches puberty, acquires increased pigment in various parts of the body, especially the genital organs; and in the female similar changes occur. Facts like these must lead to the con-clusion that the mere fact of difference of colour should form no argument on which to rest the separate identity of races of mankind.

ALTERATIONS IN VASCULARITY.—The skin is entirely vascular. Hence a slight change, which will drive a very small additional quantity of blood into its vessels, will be at once observable; and

in like manner, the least detraction of the vital fluid will be easily manifested. The various shades of vascularity arise, then, from—

1. Excess of blood.
2. Deficiency of blood ; and
3. Altered character of blood.

Under these heads we shall consider this point.

1. *Increased vascularity* is observed in blushing ; in all the phases of erythema and roseola ; and in simple erysipelas, and burns, and boils. But these being evidently organic lesions, do not demand any attention here. During the progress of acute organic disease of some internal organ ; during anasarca, continued fevers, phlebitis, and other affections, red spots are frequently noticed, and are generally of a transient character. When not the result of local congestion and inflammation, the practitioner should look inwards for the cause, and manage accordingly.

2. *Deficiency of vascularity* is a symptom of much importance. It denotes either loss of blood absolutely, or a chronic cachexy of serious import, or defect of red particles, or contracted capillaries. Thus we meet with this state in hæmorrhages, in phthisis, diseases of the heart, old disease of the kidney, cancer ; also in anæmia, chlorosis, and derangement of the ovary ; and in the rigor of fever, from cold, and fear.

3. *An altered state of the blood* may be observed under very various conditions. Thus it may be dark and venous, as in cyanosis, and in the lividity of pneumonia, or croup ; it may be yellow and orange, as in jaundice ; and it may be various shades from orange to black, as in purpuric typhus, and extravasation of blood from bruises, or scurvy. These conditions have thus a very important meaning, which you should fully understand, in order that their very existence may at once suggest the appropriate treatment.

ALTERATIONS IN THE FUNCTIONS OF THE NERVES.—The skin being not merely the organ of touch or special sensation, but, in common with other parts supplied by ordinary nerves of sensation, susceptible of common impressions, it follows that it must be viewed under two different aspects.

By the special arrangement of the Pacinian corpuscles, the slightest contact or impression is immediately conveyed to the brain, giving intimation of consistence, weight, and form. This tactile power is different in degree and nicety, according to the different regions of the body,—being in perfection at the bulbs of the fingers

Besides this special sense, however, the nerves of the skin take cognizance of the impressions of heat, cold, or variation of temperature. This faculty is independent of the common sensation enjoyed by other organs, and is peculiar to the skin, as in certain states of paralysis, the former may be lost, and yet the latter remain unaffected. The sensation of tickling is induced in parts of the skin little susceptible of impressions of fine touch ; thus proving that it cannot be identified with the special sense.

These preliminary observations will enable us to see that the nervous functions may be variously altered, according to the differences of sensations. Thus, then, we may conveniently arrange such alterations as follows :—

1. Alterations of deficiency or excess in the special sense.
2. Alterations of defect or excess in the impression of temperature.
3. Defect or excess of ordinary sensation.

1. It is well known that the blind are peculiarly gifted with the faculty of distinguishing nice impressions of touch. This fact is probably due to the greater exercise of the organ, from the defect of one which aids in a great degree in the formation of our perceptions of form, and even consistence and weight. It is related of Saunderson, the blind Professor of Mathematics at Cambridge, that he could distinguish a spurious from a genuine medal, when the deception had imposed upon connoisseurs ; and the case of the blind man referred to by Rudolph, who was able to distinguish between woollen cloths of different colours, (of course by some slight variety in their texture,) is rendered credible by many well-attested examples of a parallel kind. This superior discrimination may also be acquired by others, by practice in manipulating small articles ; but it must, at the same time, be added, that such is due, in a great measure, to an education or training of the *muscular sense* as well. It can scarcely be said, therefore, to be a morbid alteration, and consequently, I shall not dwell upon it longer.

Defect of tactual impressions is a much more common state of the cutaneous nerves, and arises chiefly from want of training, and especially from thickening of the cuticle. This is well exemplified in the operative class of labourers, whose hands become so hardened as to blunt even the common sensitive impressions. In others, where this circumstance does not exist, it is a symptom of some importance, as indicating disease of the papillary tufts containing the Pacinian corpuscles ; of the course of the nerve supplying the benumbed part; of the nervous centres, or, lastly, of some distant

but sympathetic organ, which has induced cutaneous insensibility by reflex irritation. The papillary disease will be readily detected; *neuritis*, or pressure on the course of a nerve, may be likewise readily ascertained. The others require nicer data for diagnosis. A cicatrix, of course, implies destruction of the papillæ, and consequently, touch, as a special sense, is wanting, though, it being organised, ordinary impressions will be felt as usual.

2. *Alterations of temperature* are keenly felt in thin-skinned individuals, especially such as are habituated to in-door and sedentary occupations; also, in any condition of the system characterised by deficient vitality. Thus, in convalescence from acute fevers, immediately after a course of aperient, or any lowering treatment,— but especially rheumatic affections, syphilis, scrofulous disease, and the frightful malady hydrophobia,—the slightest vicissitude is immediately telegraphed to the brain. Defect, on the other hand, is frequently acquired by the process of hardening the cuticle, as in the instances of blacksmiths, who, it is well-known, can handle with impunity heated metal, which would inflict a smart burn on immediate contact with other persons. This state is also observed in disease. Thus in the rigor of fevers, or acute inflammations, and still more in cases of algid cholera, hot-baths at a temperature much higher than blood-heat will be readily borne; and in some cases of paralysis, there may be a total loss of this particular sensation, without impairment of either the special or the ordinary sense.

3. *Common sensation* may be diminished or absolutely lost; or it may be preternaturally increased. These different states have received the names of *anæsthesia*, *numbness*, and *neuralgia*, or *hyperæsthesia;* and as these conditions are of moment, I desire to draw your attention particularly to them.

Anæsthesia may be general or local. It may occupy a small spot, or a limb, or one-half of the body, and it may be due to lesion of one or more nerves; or any part of the nervous centres; or it may arise from the hysteric condition. In cases of paralysis, it is frequently attended by loss of motion. By carefully observing the *site* of anæsthesia, it is possible in many cases to detect the exact nerve affected, and trace it up to the cerebral tracts.

All nerves are either nerves of motion or sensation, or of special sense, or compound, or ganglionic. Thus in cases of anæsthesia of the face, we know that it must be the *fifth* which is affected, as the *seventh* is a nerve of motion. Again, if the eye be amaurotic, the *second* must be involved,—and so on. Tumours pressing upon any nerve of sensation, or any compound nerve, will produce this state.

I have said that anæsthesia is sometimes general.   This may occur in cases of ramollissement, or general paralysis, in the insane, and occasionally in highly nervous individuals, from prolonged nervous impressions, and from certain anæsthetic agents, as alcohol, ether, chloroform, opium, and other medicinal substances ; even extreme cold may induce this state.   You have heard, and perhaps witnessed, what are called mesmeric experiments.   However much it is to be deplored that ignorant pretenders in physiological science have duped the public from time to time by professing to "cure all manner of diseases," and virtually to work miracles through the instrumentality of such means, there cannot be a doubt that a state of insensibility to pain can be produced by fixed impressions in susceptible individuals.   Hysteria occasionally assumes this form, with or without sleep.   And hence, in undertaking the management of anæsthesia, we must inquire—1st, as to the seat, and if possible, the nerve or set or nerves involved ; 2nd, as to the other local circumstances ; 3rd, as to the state of the nervous centres ; and, 4th, as to the kind of constitution.

Hyperæsthesia, or augmented sensation, is observed in every degree, from the slightest itchiness to the most agonizing pain.   It is an almost constant accompaniment of local inflammations,—especially lichen, prurigo, and parisitic irritation,—and of some of the constitutional cutaneous affections ; but, independently of these, it is observed repeatedly as a symptom of irritation of the nervous centres ; or of irritation propagated by reflex action from some internal organ ; —as, for example, neuralgia from meningitis of the cord ; pruritus from disease of the liver, or from intestinal worms.

As a strictly cutaneous affection, the term *pruritus* is given to the more common form of hyperæthesia, unattended by any organic change in the tissue itself.   Pruritus is general or local.   The former is present when itchiness is felt over all parts of the surface in turn.   It must be distinguished from the pruritus occasioned by pediculi.   It is increased by any internal stimuli ; no relief is experienced from scratching the part, and at night there is absolute torment for a time.   Its attacks are intermittent, and indeed were it not so, this state, from its great protraction, would be perfectly intolerable.   The cause of this general pruritus is usually internal ; either gastro-intestinal, or lesion of the solid organs ; and in the female is associated with ovarian and uterine irritation.

The local forms may be classed as follows :—

1. Pruritus ani,
2. Pruritus scroti,
3. Pruritus pudendi,

as these are the most usual seats.

The first engages the integument immediately in contact with the mucous membrane. It is very obstinate and annoying, and seems due to one or more of the following causes :—Ascarides, hæmorrhoids, ulceration or other form of inflammation of the rectum, congested liver, constipation—when habitual; and, in short, any congestion of the digestive tract. The itching is frequently so intense that actual inflammation may be excited, and excoriations and fissures, and purulent or serous discharge supervene.

Pruritus scroti does not materially differ from the preceding. Its seat is the scrotum. Its causes and terminations are similar.

Pruritus pudendi occurs, of course, in the female, and at all ages; but is most frequently present during pregnancy, or after parturition. Its causes include those of *pruritus ani*, and besides, venous congestion of the rectum by pressure of the fœtus, and irritation of the vagina, caused by parturition.

Before leaving the subject of nervous functions, I cannot well omit alluding to the alterations of animal heat experienced in the skin. Thus the animal heat may be increased or diminished :— increased in all acute inflammatory and febrile diseases, and in tetanus; and diminished in rigor stage of fevers, chronic cachexias, in cholera, in chlorosis, anasarca, and some other affections. This condition mainly depends upon the state of vascularity, though occasionally upon the state of the nervous system. Its indications are, therefore, manifest, and its temporary and permanent management easily suggested.

ALTERATIONS IN THE FUNCTIONS OF THE SUDORIPAROUS GLANDS.

These glands are naturally active in early life, and become sluggish in maturity, and especially in old age, when, in consequence, the skin assumes a harsh and dry appearance. They are also more active in warm and dry atmospheres, and may be stimulated at will by exercise, and by taking certain medicinal agents called diaphoretics.

The excretion, called perspiratory fluid, is ordinarily insensible— coming away by the sudoriparous ducts in exceedingly minute points, usually invisible to the unaided eye. When it becomes sensible, the condition may be deemed disordered ; though in moderation, or after sufficient intervals of rest, and brought on by natural causes, it cannot be deemed a positive disease.

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Derangements of this function may then be conveniently arranged in the following order :—

      1. Excess of normal fluid.
      2. Deficiency of normal fluid.
      3. Alterations of normal fluid.

Excess is designated by various terms, *ephidrosis, sudatoria, dysodia ;* and may be general or local.   The former is observed in acute rheumatism, phthisis, and in remittent fever after the evening exacerbation, at the crisis of continued fevers, and especially the relapse of remittent synocha, and in all cases of hectic fever. Occasionally this state has been observed lasting for years, of which an example is given by Rayer.   In the cases mentioned (especially among females) elevations of the cuticle, called *milliaria,* may be occasionally seen, resembling great numbers of dewdrops.   These cannot, I think, be deemed inflammatory, as they present none of the characteristic pathology.   Their existence in profuse perspiration may be readily explained without any such hypothesis.   This appearance I cannot, therefore, but look on as a mere symptom, indicative of excess of function in debilitated subjects.

The local forms are observed for the most part in the fulness of the hands, soles of the feet, axilla, perinæum, and scalp.

They are always exceedingly annoying, and may last for a very considerable time, even several years.   There is danger in suddenly checking an habitual excess of this excretion, as congestions of internal organs have been occasionally the result.

Diminution of perspiration, or, as it has been termed, *anidrosis,* is well-marked in the incipient stage of the eruptive fevers ; and, indeed, in all acute visceral inflammations, when the febrile symptoms are fully established.   The rigors of threatening inflammation also presents a good example ; and in diabetes, and anasarca, we meet with it more or less.

The perspiratory fluid may be variously *altered*—1st, in colour ; 2nd, in odour and in saline ingredients—*chromidrosis* and *osmidrosis.*

Wilson says he has never seen an unequivocal case of pure chromidrosis ; but cases are on record amongst the older writers, of variously tinged perspiration, as green, blue, yellow, and even black. We cannot, however, now decide whether these were real instances of sudoriparous or sebaceous secretions.

The red sweats are more common ; and generally observed as

vicarious of the menstrual discharge, or in persons of the hæmorrhagic diathesis. They are really transudations of the coloring principle or hæmatosin of the blood ; no aperture in any case having been detected.

Differences in odour have been remarked in various diseases. Thus in scabies, it is of a mouldy character; in syphilis, sweet; in rheumatism, acid ; in scurvy, putrid ; in jaundice and the abdominal affections, musky ; in scrofula, like sour beer ; and in ague, like brown bread. These, however, cannot be considered other than occasional occurrences.

Differences in the saline and other ingredients have been noticed in dropsy, gout, and in hectic, but are not of a constant character, and do not demand much notice here.

Viewing the sweat as an excretion, it will be seen that the lungs, kidneys, stomach, and intestines sympathise with any of its alterations. Thus, where it should be suddenly or extensively repressed, as in the case of cold,—bronchitis, or pleurisy, or pneumonia, frequently occurs ; or an attack of colic or diarrhœa ; or a fit of indigestion; or congestion of the kidney, occasionally ending in Bright's disease, may be the immediate consequence. So that its importance in the economy cannot be questioned.

ALTERATIONS IN THE FUNCTIONS OF THE SEBACEOUS GLANDS.

When their secretion is increased in quantity, a greasy state of the skin is produced,—a state called *stearrhœa*,—attended, in some cases, with a good deal of irritation. So long as there is a free discharge, the glands or their ducts are not altered, and the hair itself is only more oily than natural.

Zeroderma.—A defect of this secretion is common in the aged, and accounts, in a great measure, for the harsh, dry, and scurfy state of their bodies. Indeed in such it is less required than at other periods of life, as the hair, which it keeps in condition, then becomes scanty.

When the secretion becomes altered, in place of being discharged frequently, it either accumulates in the duct, or over the surface of the skin around the sebaceous orifice. In the former case, the little pimples called *comedones*, or grubs, are produced. These are generally seen on the nose and face, and are easily recognised by the round black prominence which surmounts the secretion. This can also be squeezed out by a little pressure.

Besides concreted oil, there are epidermic scales and hairs mixed up as one mass, and in the midst, a little parasite called the *acarus folliculus,* first discovered by Dr. G. Simon, of Berlin, which, it must be remembered, is not limited to the disordered condition under discussion, but its presence is the rule in perfect health.

Sebaceous accumulations are sometimes of considerable magnitude. They have attained the size of a marble one inch in diameter; and when so large, of course the walls of the duct have been distended, and the pressure has caused their thickening.

When the secretion is concreted on the surface of the skin, the disorder is termed *icthyosis squamosa.* It is known by its cracking into polygonal figures, of brown or grey colour, and by their facility of removal, by the greasy state of the skin, and by its hardness.

The secretion, in addition to the characteristics mentioned, may present various marked colorations which immediately arrest notice. Thus, it may present a golden or a black hue. The secretion, when removed, is rapidly reproduced; and in one case which has been fully recorded in the Twenty-eighth Vol. of the *Med. Chir. Transactions,* it was even doubted whether the disease was not feigned. A remarkable example is quoted by Wilson, from the *Philosophical Transactions, p.* 375.

The congenital form, (*ichthyosis spinosa,*) differs much from the one just described, especially in its intractable character.

ALTERATIONS IN THE FUNCTIONS OF THE DERMIC TISSUES.

In many diseases their functions are interfered with. Thus, in anasarca, the elastic property is inactive. In rigor, the muscular action can, in a minute, blanch the entire surface. In old age and all cases of debility, the tenacity of the skin is impaired, and even in diseased states of the stomach and intestines, as in dyspeptic attacks, diarrhœa, and cholera, the skin becomes shrivelled, and the natural functions of the tissues are rendered almost inactive.

It is quite common for veterinary surgeons to detect a morbid state from the character of the horse's coat; in like manner, the state of the human skin is a good index to the presence or absence of disease.

ALTERATIONS IN THE SUB-CUTANEOUS TISSUES.

These are chiefly excess or defect of the fat and areolar tissues, and variations in moisture.

Fatty deposit in excess is called *obesity*, and may be general or local. When I say general, I mean that it is deposited in excess in every usual spot. General obesity usually argues an excess of supply over waste, an indolence of life, and freedom from all care. But there are peculiar constitutions, which are disposed to this condition under all circumstances, and this sometimes in very early life. It is also frequently hereditary. As a symptom of disease, the practitioner must look well to the state of the heart, digestive organs—especially the liver, and the condition of the blood-vessels—especially of the brain. Local collections of fat are noticed in the mamma, the chin, and the abdominal walls in particular ; and, though mostly indicative of the general tendency, may yet arise, like fatty tumours, from local irritation. Obesity is by no means incompatible with good health ; but its tendency should be guarded against for these reasons : Fat requires a great amount of nourishment. Blood and vessels are needed, beyond the ordinary wants of the system ;—hence a large portion of the vital fluid is expended, in a great measure uselessly—as fat cannot add any vital power or strength to the system. On the contrary, there is no question that the amount of available stamina is reduced ; and obese persons, it is often remarked, cannot endure the same amount of privation or disease as the moderately lean.

A deficiency of fat, or *marasmus*, is a sign of great import in many diseases. It is a constant accompaniment of fevers, and all protracted diseases, besides some special ones—as diabetes, phthisis, and tabes, of which it forms an essential circumstance.

Alterations in the distribution of the areolar tissue seem greatly dependent on the amount of fat, for which it is in a great measure a support, and do not therefore require special notice.

All the sub-cutaneous tissues are more or less moist in health. In *anasarca*, this moisture is in excess. This state is either general or local. When general, it arises from venous obstruction of some of the great vessels, or disease of the heart or lungs, or it may be the effect of cold, whereby a temporary retarding of the internal circulation is produced ; or it may arise from some diseased state of the blood, especially an excess of watery ingredients. When local, it is called œdema—and is frequent in the feet and ankles—in disease of the

liver, arising from local obstruction in some of the main vessels, by the pressure of tumours, &c., and occasionally from mere gravity, in elderly or debilitated persons. It is simply a transudation, by exosmose from the vessels, of aqueous fluid into the interspaces of the areolar tissue, and these local forms must be distinguished from the swelling of erysipelas or elephantiasis. The simple test of pitting, is sufficient for the purpose. The opposite condition—that of dryness—cannot be seen or detected during life. It can only be indicated, or supposed present, in the old, or those greatly reduced by disease. It is a sign of no importance.
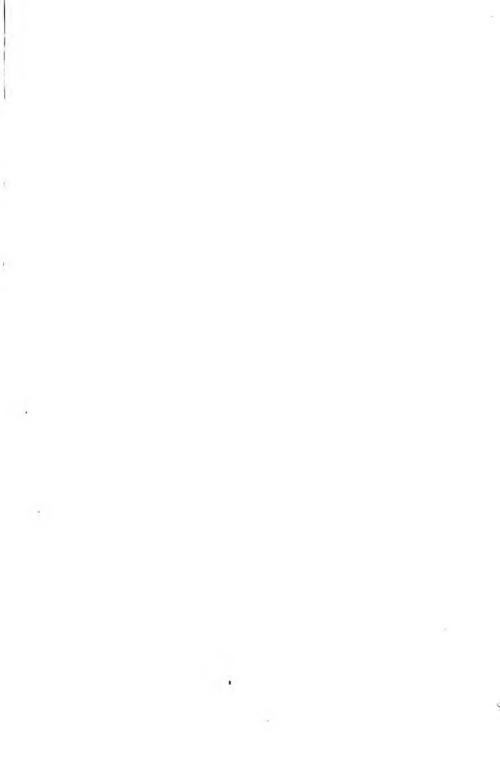
Cutaneous eruptions are frequently symptomatic of internal diseases, or of constitutional states. Thus, the eruptions of the maculated fevers are sufficient, frequently, not merely to indicate the presence of the fever, but the very stage, and the prognosis. *Roseola, lichen, tubercles, psoriasis*, when general, and of the peculiar hue, denote syphilis. *Acne* implies gastric and hepatic derangements. *Pemphygus* and *rupia*, indicate atony of the system. *Herpes* and *lichen*, disorder of the digestive organs. *Herpes labialis* is frequently critical of internal disease. *Petechiæ*, indicate the purpuric state. *Boils* and *carbuncles*, atony of the system and vitiation of the blood ; and *urticaria* has direct connection with gastric derangements.
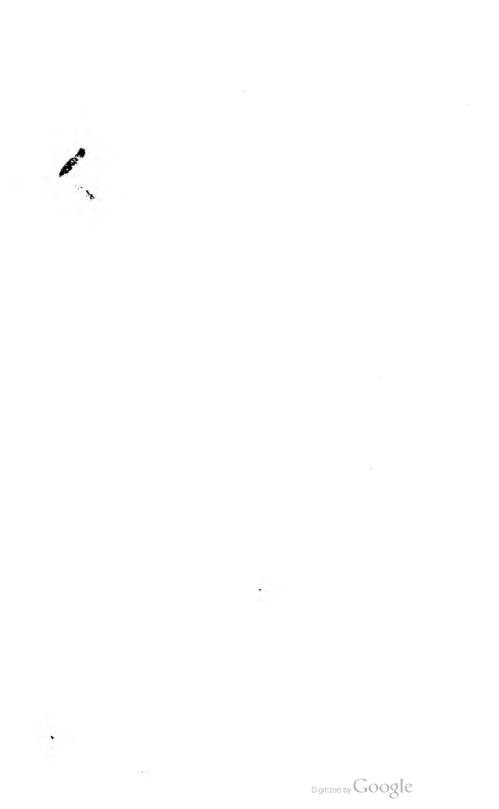
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