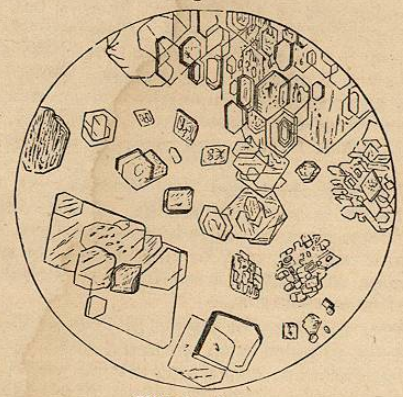
Triple phosphate of magnesium and ammonium, in three-sided prisms with bevelled ends;
Phosphate of calcium, granular, or in long needle-shaped crystals;
Oxalate of calcium, in transparent octahedral or dumb-bell crystals;
Oil-globules (rare), with dark, smooth, and well-defined outline;
Chyle-corpuscles, found in urine of a milky appearance.

Urine **free from deposit** should, in suspected cases, be tested for **albumen** and for **sugar.**

The best test for albumen is the *successive* addition to the urine of *heat* and *nitric acid.* If it become and continue turbid under their combined influence, it is albuminous; but neither alone will suffice. Another test (Millon's) is the acid nitrate of mercury; which causes with albuminous urine a pink precipitate. Fibrin and casein have this reaction also, but they will scarcely ever be found in urine, in the absence of albumen. Other mineral salts (ferrocyanide of potassium, bichloride of mercury, etc.) will precipitate albumen; but the first-mentioned test is the most available.

Picric acid[1] has been lately somewhat used. A drop of the urine to be tested, falling into picric acid, if albumen be present, will make a white streak through it. A dark background will render this more evident. Bowditch has proved this to be a less delicate process for the purpose than that with heat and nitric acid.

Fig. 24.



Nitrate of urea.

We must remember, however, that **albuminuria** is no longer synonymous with Bright's disease. Albumen occurs, *transiently*, in the urine of many acute affections, as scarlatina, diphtheria, and renal congestion from cold and wet. It is only when *persistent* as a symptom that it becomes pathognomonic of degeneration of the

[1] Gazette Médicale de Paris, 1873, p. 122.

kidneys. In rare instances, moreover, this degeneration has been found (post-mortem) to exist *without* albuminuria.

The principal tests for **diabetic sugar**[1] (glucose) are *Moore's*, *Trommer's*, *Maumené's*, *Böttger's*, and *fermentation.*

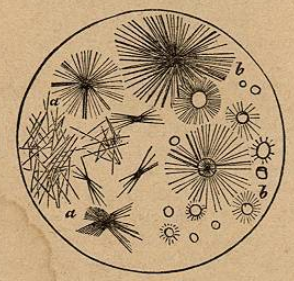
Moore's: Boil the liquid with half its bulk of liquor potassæ.[2] If saccharine, it will become first yellow and then brown, and ruby red by transmitted light.

Trommer's: Add a few drops of strong solution of sulphate of copper to the urine, in a test-tube, and then pour in liquor potassæ, to about half the bulk of the urine. On the careful application of heat, a yellowish or reddish-brown precipitate (suboxide of copper) is thrown down. *Fehling's test fluid* is analogous to this. As modified by Lowe, it consists of sulphate of copper, with soda and a little glycerin.[3]

Fig. 25.

Urates.

Fig. 26.



Urate of sodium.

Maumené's: Dip into the liquid a strip of flannel (not linen or muslin) saturated with a solution of bichloride of tin in twice its weight of water. The strip, on being heated over a fire or lamp to near 300° Fahr., will at once become brownish-black, like caramel.

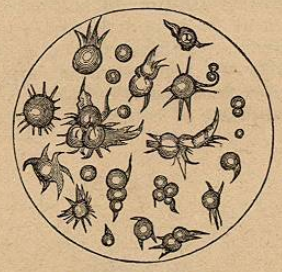
[1] Bence Jones has found a very small quantity of grape sugar in healthy urine.

[2] Dr. M. Tidy (Med. Times and Gazette, June 3, 1871) prefers this test for the approximate determination of the *quantity* of sugar in diabetic urine. A series of solutions is prepared, each containing a different amount of grape sugar (say from one-fourth of a grain up to two grains), but all the same amount of potassa. The difference of the tint is well marked. In testing the urine, a solution of 1 grain of potassa to every 7 grains of water is made; of this 70 grains are added to 70 grains of the urine; boil one minute, dilute with distilled water in a 4 oz. vial (similar to those used for the test solutions), and then compare with the solutions containing known quantities of sugar, until the exact tint is found.

[3] London Lancet, Sept. 24, 1870. *Pavy's* solution consists of 320 grains of sulphate of copper, neutral tartrate of potassium 640 grains, caustic potassa 1280 grains, distilled water 20 fluidounces. This gives an opaque yellow color with diabetic urine.

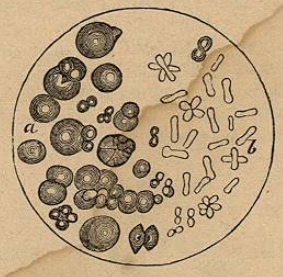
Böttger's: Add a few drops of dilute solution of nitrate of bismuth in nitric acid; make the liquid alkaline with carbonate of sodium, and boil for a few minutes. When sugar is present, it becomes dark, and will gradually throw down a grayish-black deposit. If the urine were healthy a *white* deposit would fall.

Fig. 27.



Urate of sodium.

Fig. 28.



Urate of ammonium.

Fermentation, on the addition of yeast, at 80° Fahr., will only occur in saccharine, not in ordinary urine. During this process, the white scum which forms is found, under the microscope, to contain the oval vesicles of *torula* (saccharomyces) which characterize vinous fermentation.

Trommer's test is the one most generally employed. Occasionally a substance called *alkapton* may be present, which likewise reduces the oxide of copper; but it will not ferment, nor cause a dark deposit with bismuth. Its possible existence does not interfere with the practical value of this test for sugar.

Coloring matters taken as medicine or food may sometimes occur in the urine; as rhubarb, senna, logwood, coffee, etc. Mineral acids will change the color of rhubarb or senna to a bright yellow. Aqua ammoniæ will turn the orange hue of rhubarb to crimson. Indigo coloring matter (*indican*) is said (Hassall) to have been found in or educed from normal urine; although Ralph asserts the color to be due to Prussian blue or cyanide of iron.

The following passages from a late work[1] contain much information in regard to the meaning of urinary changes in disease:—

"The quantity of urine is increased in hysteria, neuralgia, the beginning of fevers, diabetes, the beginning of cirrhosis of the liver, and of hypertrophy of the heart; diminished in the hot stage of fevers, more advanced cirrhosis of the liver, and hypertrophy of the heart. An increase in quantity after diminution is favorable, as it shows that the disease has reached its acme.

"The density of the urine is reduced in different nervous affections, in granular degeneration of the kidneys, the cold stage of fevers, and in many instances of that period of collapse which

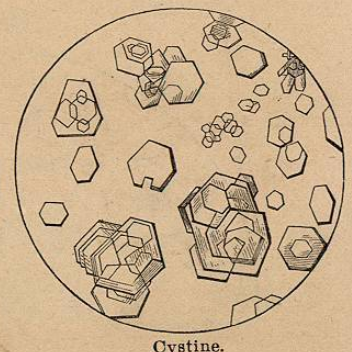
[1] Black, in St. Andrew's Med. Graduates' Association Reports, 1870; condensed by J. H. H., in Am. Journal of Med. Sciences, Jan. 1871.

ushers in local inflammation. The tendency in all diseases, and especially in inflammations, as they approach termination, is to give rise to an increase of the specific gravity of the urine, except in granular degeneration of the kidney, the influence of which is, from first to last, to lower the specific gravity of that secretion.

Fig. 29.

Triple phosphate.

Fig. 30.



Cystine.

In phthisis, fluctuations are observed, and we are frequently able to draw important inferences from them; thus a high specific gravity, with only slight diurnal fluctuations, indicates an acute form of the disease; a lower specific gravity, with a greater daily range, a chronic form; while a density nearly normal occurs in cases in which the disease is stationary. In cancer of the stomach or liver, and in hypertrophy, cirrhosis, and abscess of the liver, the density is increased; and this is also the case in any disease involving a mechanical obstruction to the flow of bile.

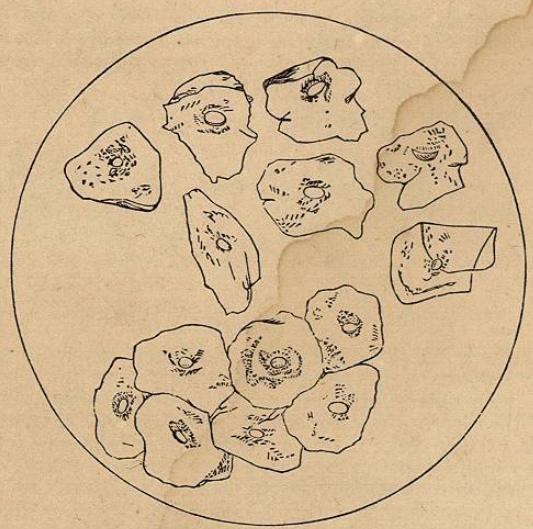
"The color of the urine is made pale by nervous diseases, by diabetes, by granular degeneration of the kidney, and by the phosphatic diathesis. It is milky whenever it contains pus or chyle. In oxaluria, in active inflammation, in fevers, it is of a yellowish or brownish-red color.

"The occurrence of the urates, as a deposit in the urine, indicates either an excess of food, or of disintegration of the tissues. In an acute disease a deposit of urates is generally indicative of a tendency to recovery, but in wasting diseases, as phthisis, their amount is simply a measure of disintegration. They occur during convalescence from inflammation, and depend probably on the absorption of the exudation, and hence will be deposited for a longer time after inflammation of a serous than of a mucous membrane, because in the former case there is no direct outlet for the exudation as in the latter. If, after the eruptive fevers have attained their height, no urates are observed in the urine, complications or sequelæ are to be feared; or if in acute gout or rheumatism the improvement of a joint is suddenly followed by the disappearance of the sediment from the urine, another joint will soon be involved. The urates will be reddish in color in inflammatory dis-

eases, and in functional disturbances of the digestive organs; pinkish in acute articular rheumatism, but whitish whenever there exists nervous irritation rather than inflammation."

The **quantitative** analysis of urine, to determine the amount and proportion of its different ingredients, requires considerable chemical proficiency.

Fig. 31.



Vaginal epithelium in urine.

The following statement of the **normal average** amount of the constituents of healthy urine, passed in twenty-four hours, is from Thudichum:—

Solids altogether	850 to 1020	grains.
Urea	463 to 617	"
Uric acid	7.5	"
Creatin	4.5	"
Creatinin	7.0	"
Hippuric acid	7.5	"
Chloride of sodium	154 to 200	"
Sulphuric acid	23 to 38	"
Phosphoric acid	56	"
Earthy phosphates	19	"
Ammonia	10	"

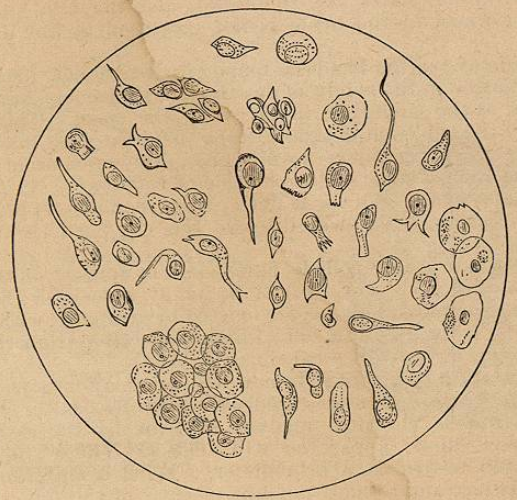
Besides *sarkin*, *uræmatin*, *uroxantin*, *potassa*, *soda*, *lime*, *magnesia*, *iron*, *trimethylamine*, *carbonic* acid, *phenylic* acid, and *damaluric* acid in undetermined amounts.

As the specific gravity of the urine varies in health from 1017 to 1024, and in disease from 1005 to 1070, an approximative estimate of the amount of solids may be obtained by *doubling the last two figures of the specific gravity*. Thus, urine having a specific gravity of 1025 will contain *about* 50 grains of solids.

Heavy and **dark-colored** urine (diabetic urine is straw or amber colored), with a strong odor, may be inferred to contain an excess of solids from waste of tissue; among which **urea** is the most important.

When excess of urea is present, the addition of a few drops of strong colorless nitric acid to the urine on a watch-glass will throw down a number of crystals of *nitrate of urea* (delicate, rhomboidal, like those of saltpetre). (See Fig. 24.)

Fig. 32.



Epithelial cells from bladder, ureter, and kidney.

For determining the amount of urea, Bowman gives the following directions: "A measuring-tube, twelve or fourteen inches long, is provided, easily closed by the thumb, and graduated to tenths and hundredths of a cubic inch. This tube is filled rather more than one-third full of mercury, and a measured quantity (50 to 60 grains) of urine poured into it. The tube is then quickly filled to the brim with solution of hypochlorite of soda, closed by the thumb, and inverted under a saturated solution of common salt (which being heavier than the solution in the tube, prevents its escape), contained in a small mortar. The tube is allowed to stand for three or four hours, or until the volume of the nitrogen ceases to increase, and the amount of urea is calculated (1.549 cubic inches of nitrogen gas representing 1 gr. of urea). In this process

the carbonic acid is retained by the excess of chlorite of soda employed. To prepare this solution of hypochlorite of soda, 500 grs. of good chloride of lime (bleaching powder) are stirred with boiling water, filtered, and the residue washed once or twice with the boiling water; 1000 grs. of crystallized carbonate of soda are dissolved in a little water, and added to the solution, which is then filtered and made up to 20 oz. with water."

Excess of **phosphates** *is generally associated* with disintegration of brain and nerve-tissue. Bence Jones and others have found the phosphates deficient in the urine in delirium tremens, and in excess in inflammatory affections of the brain. Dr. Luther H. Wood, however, in an elaborate investigation, disproves the supposition, based on some previous observations, that mental activity causes a general increase of the phosphates. He finds that the *alkaline* phosphates are *slightly* increased by mental exertion, but the earthy phosphates are *diminished*, and the total amount of phosphoric acid in the urine is not increased to any important extent.[1]

Chloride of sodium has been found (Redtenbacher) to *disappear* from the urine in the height of an attack of *pneumonia*, and (Beale) to appear at the same time in excess in the *sputa*. This may be tested by the addition of a few drops of nitric acid, followed by solution of *nitrate of silver*—a white precipitate of chloride of silver indicating the presence of the chloride of sodium.[2]

Fatty matter in the urine is detected by the microscope, and by the use of ether, which will dissolve the oily particles from the extract.

Kyestein is a greasy pellicle found on the surface of the urine (after standing a day or two) of pregnant women, or (Kane) in those whose mammary glands are excited by sympathy with uterine irritation. *Urostealith* is a solid adipose concretion (Roberts), now and then making part of a calculus.

In a **low state of vitality** (Inman) the urine, after being passed, *undergoes decomposition* more rapidly than during health.

For diagnostic chemical analysis of urine by the student or practitioner, simple apparatus will answer. There are needed half a dozen test-tubes, a urinometer, a spirit lamp, litmus and turmeric paper, and a small amount of each of the following reagents: nitric, hydrochloric, sulphuric, and acetic acids, liquor potassæ, aqua ammoniæ, nitrate of silver solution; and sometimes alcohol, solution of chloride of barium (to test for sulphuric acid or sulphates), and ether.

Microscopical examinations may be made satisfactorily for ordinary purposes with an instrument of moderate cost; such as Woodward's student's microscope.[3] (Guidance should be sought for in the works of Beale, Carpenter, Hogg, or Richardson, on the microscope.)

[1] Silliman Prize Essay, New Haven, 1869; and American Journal of Medical Sciences, April, 1870, p. 506.

[2] Chloride of ammonium will produce the same reaction; but this salt is rare in the urine or sputa.

[3] Made by J. W. Queen, Philadelphia and New York.

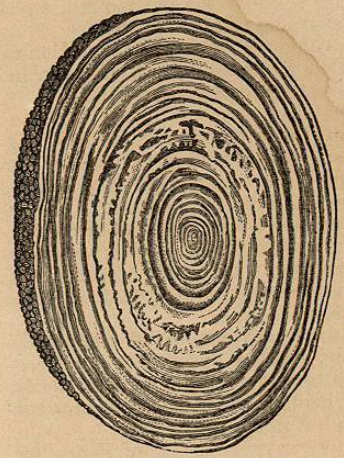
Urinary Calculi.

Gravel, formed in the kidneys and passed, sometimes with much pain, along the ureters to the bladder, and thence out through the urethra, consists usually of *urates* of ammonium and sodium, and uric acid.

Calculi, of larger size, are in a majority of cases composed of **uric acid.** Such are smooth, or but slightly rough outside, formed in concentric layers of different thickness. They will dissolve in a dilute solution of potassa; or in strong nitric acid, with effervescence. The microscope will show the uric acid crystals.

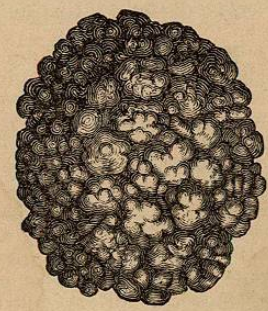
Next in frequency is the calculus formed of a mixture of **phosphate of calcium** with *triple phosphate* (of magnesium and ammonium), called *fusible* calculus; because, before the blowpipe, it melts readily without combustion.

Fig. 33.



Lithic acid calculus (section).

Fig. 34.



Mulberry calculus.

Calculus of *phosphate of calcium* is generally smooth and polished on the outside; it *chars* before the blowpipe. So does the rather rare calculus of *triple phosphate* alone.

Oxalate of calcium forms the so-called *mulberry* calculus; irregular and rugged in structure throughout.

Cystine is occasionally found forming the substance of rather soft, brownish or greenish-yellow calculi.

Urostealith has been already mentioned.

Of 184 stones removed by Sir H. Thompson by lithotrity, 122 were of uric acid and urates, 16 of a mixed character, 40 phosphatic, 1 pure phosphate of calcium, 4 oxalate of calcium, and 1 cystic oxide.

Gall-Stones.

These concretions of biliary matter are formed in the gall-bladder, and frequently cause great pain in their passage along the cystic and common biliary ducts. They are of various sizes, averaging about that of a pea. **Cholesterin** forms the greater part of their substance. mixed with the biliary resinous and acid constituents (cholic and choleic acids, taurin, etc.) and coloring matter.

From a solution of the gall-stone in boiling alcohol, cholesterin will crystallize, on cooling, in *fine scaly crystals*. Though allied to the fatty bodies, it differs from them in not dissolving in a solution of potash. The observations of Dr. A. Flint, Jr., make it probable that cholesterin is converted normally into *stercorin*, in which form it is excreted.

Other Secretions.

The **milk** of a mother may be affected in quality as well as quantity by the physical or even mental state of the individual; so as to become innutritious, or even injurious to her offspring.

In the **parturient** state, the *sudden* arrest of the formation of milk in the mammary gland, with the cessation of the uterine *lochial* discharge, is alarming—threatening child-bed fever.

Menstruation is not a secretion; it is rather a periodical discharge of somewhat altered blood, along with *ovulation*, or the escape of a germ from the ovary. Its occurrence, however, is necessary to the health of the female, from 15 to 45 years, about, and its variations and deviations are important signs of disease.

Abnormality in menstruation is, principally, either **amenorrhœa, dysmenorrhœa,** or **menorrhagia.** The first, amenorrhœa, is either (1) non-appearance, (2) suppression, or (3) retention of the menses. The last of these (retention) is rare.

Suppression or irregularity of menstruation, apart from pregnancy, may result from uterine or ovarian disease, or from *constitutional* conditions affecting the uterus or ovaries functionally. The latter is the more common in general practice. The amenorrhœal woman is generally, though not always, *anæmic.*

Dysmenorrhœa (painful menstruation) may be either *obstructive*, *spasmodic*, or *neurotic.* The *first* may occur from congenital smallness of the orifice of the neck and mouth of the womb; or retroversion, anteversion, or obliquity of that organ; or pressure by a tumor; or occlusion of the os by inflammatory bands or adhesions of lymph. The diagnosis of such affections from *spasmodic* or *neurotic* dysmenorrhœa belongs to *obstetric* surgery or medicine. So does the consideration of *retention* of the menses.

Perspiration.—Changes affecting the secretion of the *skin* have been already alluded to, in connection with the signs of disease belonging to the tegument. Strong *odor* of the perspiration indicates vicarious excretion by the sweat-glands, and commonly accompanies insufficient action of the bowels. *Acidity* of the perspiration is sometimes dependent on the presence of an excess of *uric acid;* which, in gout, in the form of urate of sodium, is occasionally concreted palpably upon the surface of the body. *Sudoric* acid is said by Favre to take the place of uric acid, normally. The perspiration contains also chloride of sodium, urea, lactic acid, ammonia, etc. The *odor* of the perspiration is *peculiar* in small-pox, typhus, gout, albuminuria, etc.

SYMPTOMS CONNECTED WITH THE MOTOR APPARATUS.

The **decubitus,** or mode of lying down, of a patient, should be noticed. *Inability to rise* may depend upon *general debility*, *paralysis* of the extremities, rheumatic or gouty *inflammation* of the joints, etc., or *injuries*, such as fractures or dislocations.

Inability to lie down is most frequently the result of dyspnœa (orthopnœa)—the respiratory muscles having the freest scope in the erect position.

In *colic*, the patient generally prefers to lie upon the belly.

In *peritonitis*, the characteristic position is upon the back, with the *knees drawn up*, to relax the abdominal muscles.

Lying *upon one side* is often significant in disease. In the early stage of pleurisy, the patient prefers to lie upon the *healthy* side; when effusion has taken place, this is reversed. In irritative disorder of the liver, with enlargement, the patient will often lie most comfortably upon the right side. When the heart is enlarged or violent in its action, the sufferer *generally* cannot lie upon the left side. The exceptions are most frequent in cases of long duration.

In *aneurism of the aorta*, the *prone* or semi-prone position (as leaning forward over a bed) is sometimes preferred.

Muscular debility may be the result of acute disease, as fever, or of actual exhaustion and prostration. *Total want of exercise* will enfeeble the muscles; as, when a limb is long confined in splints on account of a fracture or other injury. Inability to walk steadily without constant guidance by sight, is among the symptoms of *locomotor ataxia.*

Spasm is of three kinds: *tonic*, *clonic*, and *choreic.*

Tonic spasm is *fixed rigidity;* such as *emprosthotonos* (arching of the body forwards), or *opisthotonos* (arching backwards), in *tetanus. Clonic* spasm is ordinary *convulsion; i. e., successive* contractions of the muscles at short intervals. *Choreic* spasm is a term suggested to indicate the jerking, irregular movement of the muscles, not controllable by the will, in cases of chorea.

Subsultus tendinum, or jerking of the tendons at the wrist, is one of the symptoms of low states of continued fever.

Paralysis will be alluded to presently.

SYMPTOMS CONNECTED WITH THE SENSORY APPARATUS.

Of these, the most important is **pain.** Pain may be—

Acute, *sharp*, *cutting*, as in pleurisy;
Shooting, *darting*, as in neuralgia;
Lancinating, in cancer;
Gnawing, *tearing*, in rheumatism;
Dull, *heavy*, *aching*, in pneumonia;
Griping, *twisting*, in dysentery;
Bearing down, in second stage of labor;

Pulsating, in the formation of an abscess;
Burning, *smarting*, in erysipelas;
Stinging, *nettling*, in urticaria;
Constant, or *intermittent;* fixed or wandering.

Tenderness *on pressure* is generally associated with *inflammation;* although some affections designated as neuralgic also present it—possibly from inflammation of the sheaths of the nerves. *Exhausted muscles* also have it, with pain (*myalgia* of Inman).

Sometimes pain is *relieved* by pressure; as in many cases of *colic* and *dysmenorrhœa*. This is a sign, usually, of the *absence* of inflammation.

Pain is *not always at the seat of disease*. Thus, in disease of the hip-joint (morbus coxarius), the pain is felt chiefly at the knee; in calculus of the bladder, at the glans penis; in ovarian disease, sometimes, along the limbs; in disorder of the liver, often, under the scapula; in dyspepsia, frequently, about the sternum; and in irritation of the uterus, at the top of the head.

Total **loss** of sensation, local or general, is called **anæsthesia**. **Hyperæsthesia** is *excessive* sensibility. **Acinesia** (a term seldom used) is loss of muscular power.

Paralysis of one side only, of the body, *e. g.*, the right arm and leg, is *hemiplegia*. Paralysis of both lower extremities, *paraplegia*. These terms are commonly applied either to loss of power, loss of sensibility, or the more usual combination of both. The cause of paralysis may be *local* (lesion of a *nerve*) or in the *spinal marrow*, or in the *brain*.

The **eye** affords many indications of disease. A prominent and turgid condition of both eyes occurs in acute ophthalmia, and in congestion of the brain. If *one eye* alone becomes prominent, local disease, *e. g.*, a tumor behind the orbit, may be suspected. The eyes are sunken, in phthisis, and in other wasting maladies. Sinking of *one* eye indicates local atrophic disease.

The **movements** of the eye should be noticed, especially in children. Rolling of the eyeballs from side to side is a common symptom of nervous restlessness or cerebral irritation in infants. *Squinting*, occurring as a symptom in disease, is of unfavorable import. Sometimes, however, *seeing double* occurs transiently, under sympathy of the brain with gastric irritation.

The **color** of the eyes varies in disease. In *conjunctivitis*, the bloodvessels are generally enlarged, and the membrane reddened. In *sclerotitis*, the enlarged vessels are seen *converging toward the margin of the cornea*. In *iritis*, discoloration, *irregularity*, and sometimes fixedness of the pupil occur.[1]

The cornea in old people occasionally exhibits the **arcus senilis**—a sign of fatty degeneration. It is an opacity around the circumference of the cornea.

The *lustre* of the eye is lessened generally in depressing acute diseases, and especially just before death.

The eyes are often remarkably bright during the progress of

[1] *Ophthalmoscopic* examination of the interior of the eye is found to be useful in the diagnosis not only of diseases of the eye, but in those of the brain.

phthisis. They have a *glare* in some cases of inflammation of the brain and of mania.

The **pupil** is generally *contracted* in—

Inflammation of the retina;
Inflammation of the brain;
Narcotism by opium, or the Calabar bean.

It is *dilated*, usually, in—

Apoplexy; Amaurosis;
Hydrocephalus; Cataract;
Narcotism by belladonna, stramonium, or prussic acid.

An *immovable* state of the pupil, or a *difference between the two eyes* under the same light, gives rise to suspicion of ophthalmic or cerebral disorder.

Photophobia is a dread of or shrinking from the light, such as occurs in ophthalmia, and in meningitis or cerebritis. Other symptoms connected with the eye are—

Photopsia, flashes of light passing before the eyes.
Muscæ volitantes, moving spots, or spectra.
Amblyopia, dimness of vision.
Diplopia, double vision.
Hemiopia, half-sight; *i. e.*, seeing but one-half of an object at a time.

Tinnitus aurium, or ringing in the ears, may attend *congestion of the brain; nervous debility;* or *quininization*. **Deafness** may proceed from *coryza* (a cold in the head); *wax* in the ears; *quininization; typhus* or *typhoid fever; disease of the ear; cerebral* softening.

Pain in the head (cephalalgia) may be especially alluded to as depending upon—

Neuralgia;
Rheumatism of the scalp;
Congestion of the brain;
Toxæmia (*e. g.*, by narcotics, alcohol, etc.);
Fever (remittent, yellow, typhoid, etc.);
Chronic disease of the brain;
Uterine irritation, etc.

The distinction between these different forms of headache is by no means always easily made out. As a general statement, it may be said that *neuralgic* headache is mostly on *one side* (hemicrania), and extends more or less to the *face;* it is usually accompanied, also, by sensitiveness of the scalp, and is *shooting* or *darting* in its character. *Rheumatism* of the head is attended by *stiffness of the muscles* which move the head from side to side. *Congestive*, *febrile*, and *toxæmic* headaches are accompanied by *heat* of the head, and are *throbbing* or *pulsating*. That of *uterine irritation* is on the *top* of the head. The pain of *chronic cerebral disease* (tumors, etc.) is commonly *constant* or *periodic in one spot*, and is attended by some functional disorder of the brain.

SYMPTOMS CONNECTED WITH THE PSYCHICAL APPARATUS.

The **expression of the countenance** is usually altered by disease, especially of an acute kind. The change from anxiety or distress to serenity is always a favorable prognostic, except where *gangrene* or *paralytic anæsthesia* accounts for it.

Great anxiety of expression is seen especially in organic disease of the heart, and in acute disorders of the abdominal viscera. In hypochondriasis, a *sad and desponding* expression prevails.

Terror is shown by the countenance in delirium tremens.

Rage, in hydrophobia, and sometimes in acute mania.

Insanity and *imbecility*, although not characterized by any *special* cast of countenance, yet modify its expression so as to enable the mental state to be detected by one accustomed to the observation of deranged persons.

The *facies Hippocratica* is the countenance of extreme exhaustion or of the moribund state.

Delirium is described as being either *active* or *passive*. Active delirium is present in cases of acute meningitis ; passive or low muttering delirium, in typhus fever, etc.

Coma presents itself in practice chiefly in five forms ; Alcoholic stupefaction ; Opium poisoning ; Apoplexy ; Typhus ; Fracture of the skull with compression of the brain.

Typhous stupor is generally easy of recognition ; the others may give some trouble in the diagnosis. Between narcotism by opium and dead-drunkenness we have the distinctions, that in opiate poisoning the pupil is almost always *firmly contracted*, and that the breath smells of alcohol (or aldehyde) in the intoxicated subject.

Loss of speech, without affection of the vocal apparatus, constitutes the disorder called *aphasia*.

Vertigo, or dizziness, is mostly symptomatic of disorder of the stomach, or of the liver (cholæmia) ; sometimes, of general debility ; rarely, of disease of the brain.

GENERAL VITAL CONDITION.

Lyons (Hospital Practice) remarks as follows: "The highest skill in physical diagnosis, and the most profound knowledge of pathological anatomy, will leave you but very imperfect and unsafe practitioners, incapable of clear judgment and self-reliance in difficult cases in which you have to rest on your own responsibility, if you do not from the first endeavor to master and acquire for yourselves that unwritten and indescribable knowledge which constitutes the consummate skill of the experienced medical man. It consists in a faculty of appreciating the vital state of your patient ; of forming a rapid but complete and accurate estimate of the nervous and muscular force which he possesses ; or, in general terms, of the powers of life which remain to him—his *viability*, so to speak, or the power which his system retains of resisting the morbid or fatal influences of injury or disease."

PHYSICAL DIAGNOSIS.

The *idea* of physical exploration for the purpose of diagnosis has been well defined by Piorry, in the word "**Organography:**" *i. e.*,

the determination of the actual and relative *position*, material *condition*, and functional *action* of the organs contained within the body. The methods in use for this purpose are modern, dating from Auenbrugger, of Vienna, the inventor of diagnostic percussion, in 1761, and Laennec, the great originator of auscultation,[1] about 1818.

The modes of examination of the chest, abdomen, etc., are—

Inspection ; Mensuration ; Palpation ; Succussion ; Spirometry ; Percussion ; Auscultation.

By **inspection**, we estimate, with the eye, the *form*, *size*, and *movements* of the chest, etc.

By **mensuration**, we obtain a more *accurate* knowledge, especially of *deviations* and *alterations* of size and form.

Palpation aids in the determination of the character of surfaces and of subjacent parts, and, in the chest, detects changes in the degree or extent of the *movements* of respiration and of the heart, and in the *vibrations* connected with the voice, cough, and breathing.

Succussion, or *shaking* the chest suddenly, is of use occasionally, in establishing the presence of *fluid* in the thoracic cavities.

Spirometry is the measurement of the capacity of the lungs for air.

By **percussion** we learn much of the physical condition of the lungs, heart, and abdominal viscera, through the variations of *resonance* and *resistance* when the walls of the thorax or abdomen are lightly struck.

Auscultation is equally important, but somewhat more difficult in its application, on account of the complexity of the signs afforded by it. It consists in directly *listening* to the sounds produced within the cavities of the body, by placing the ear, with or without the stethoscope, upon the surfaces thereof.

The **Regions** of the *Chest*, for the purpose of physical exploration, may be most conveniently divided into the following :—

Anterior.	*Posterior.*
Upper and lower sternal ;	Interscapular ;
Right and left clavicular ;	Dorsal ;
Right and left subclavian ;	Right and left acromial ;
Right and left mammary ;	Right and left scapular ;
Right and left infra-mammary.	Right and left infra-scapular.

Lateral.

Right and left axillary ;
Right and left lateral ;
Right and left lower lateral.

The most important peculiarities of these different regions, in the normal state, are connected with *percussion-resonance*. The clearest and fullest sound on percussion is given over the *subclavian* and *lateral* regions ; the dullest and smallest, over the *acromial*, the *right infra-mammary* (hepatic), and the *left mammary* or præcordial region.

[1] The idea of which, however, was known even to Hippocrates.

MENSURATION AND PALPATION.

For **mensuration,** various stethometers or chest-measurers have been devised ; but, with care and judgment, the common tape-measure will suffice.

The dimensions to be compared are the—

Circular: around the chest opposite the base of the ensiform cartilage. This averages thirty-three inches. The *right half* of the thorax is nearly always half an inch to an inch **larger** in circumference than the *left.*

Transverse: from the nipple to the middle of the sternum.

Vertical: from the clavicle to the lower margin of the ribs.

Antero-posterior: from the clavicle anteriorly to a corresponding point in the scapular region.

General expansion and local bulging of the chest, and general retraction and local depression, are the signs most frequently determined by inspection and mensuration.

General expansion or **local bulging** of the chest, usually upon one side only, may be caused by—

Pleuritic effusion;
Pneumothorax;
Emphysema of the lung ;
Aneurism, *cancer*, etc. ; or more rarely, by—
Hydrothorax ;
Pneumonia ;
Incipient tuberculization.

Retraction or **local depression** of the thoracic walls may result from—

Absorption of pleuritic effusion ;
Tuberculization ;
Pneumonia ;
Pleuro-pneumonia ;
Infiltrated cancer of the lung.

By **palpation,** we observe **diminution** of the **expansion** *and* **elevation** *of the* **ribs** *in breathing*, in—

Pleurisy;
Pneumonia;
Tuberculization;
Pneumothorax;
Emphysema ;
Intercostal rheumatism ;
Paralysis ;
Hydrothorax.

Increased expansion and elevation of the ribs in breathing occurs in—

Asthma ;
Croup ;
Spasm of the glottis ;
Foreign bodies in air-passages.

Increased vibration *of the walls of the chest* with the **voice** and **cough** is noticed in—

Tuberculization;
Pneumonia;
Pulmonary apoplexy ;
Dilatation of bronchi.

Diminished vocal and tussive vibration occurs in—

Pleuritic effusion ;
Pneumothorax;
Emphysema ;
Cancer of the lung.

Rhonchal vibration, occasionally, in bronchitis.

Rubbing, or to-and-fro vibration, in—

Pleurisy ;
Pericarditis.

Pulsatile vibration in—

Aneurism of aorta;
Cancer of lung or pleura ;
Pneumonia.

Fluctuation in—

Large pleuritic effusion.

Purring vibration (frémissement cataire) in—

Aneurism of aorta ;
Valvular heart disease ;
Anæmia.

SPIROMETRY.

For **Spirometry,** Hutchinson's, Pereira's, Coxeter's, and Mitchell's[1] spirometers have been used.

Hutchinson made elaborate investigations into the comparative breathing-power of individuals, by which he proposed to conclude upon their *vital capacity.* A man 5 feet 8 inches in height, and of 155 pounds weight, was found, on the average, to expire, after a full inspiration, 230 cubic inches.

For every inch of height above this, a definite increase in the quantity breathed was observed. The proportion was *less constant* with *weight* and with *age.* After fifty-five there was a decrease.

In the first stage of *consumption*, the average (for the adult of ordinary height) was found to be 154 cubic inches ; second stage, 131 ; late stage, 108, etc.

In practice, however, spirometry is not extensively used. It is of service in examinations for *life assurance.*

PERCUSSION.

Percussion is either *mediate* or *immediate.* In immediate percussion, we tap with the ends of the fingers at once upon the body ; in mediate percussion, a pleximeter (*stroke-measurer*) is used. The latter is almost universal ; but a difference exists as to the kind of pleximeter employed. Louis and Walshe have preferred one made of caoutchouc ; Piorry and Skoda, one of ivory ; Wünderlich, an ivory disk, upon which to strike with a small steel hammer, the head of which is covered with caoutchouc.

A majority of practitioners, however, are satisfied (with good reason) with the use of the *middle finger of the left hand* as a pleximeter. (Percuss by movement of the hand on the *wrist;* not by

[1] Consisting of a small *gas-meter*, with a mouth-piece.