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Outlines of Medical Diagnosis

1903

OUTLINES

OF

MEDICAL DIAGNOSIS.

Prepared for the use of Students

AT THE

HARVARD MEDICAL SCHOOL, BOSTON.

1903.

SECOND EDITION.

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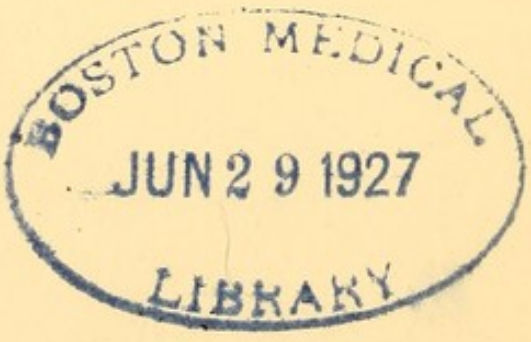

INDEX.

THE HISTORY.

NOTE the name of the patient, state (married or single), age, residence (town, street and number) and birthplace (malaria, hydatid, etc.), occupation (eye strain, writer's cramp, painter's colic, etc.) and the date on which he is seen.

The family history and personal history should be taken, and the progress of the present illness obtained in detail. If the patient is very ill, depend largely on the friends for data and obtain other necessary information during later visits. Avoid embarrassing questions in the presence of a third person.

As a rule, let the patient tell his story, simply guiding his narrative into profitable channels. Avoid leading questions. Do not be misled by his medical expressions. Lay diagnoses of meningitis, influenza, gastric catarrh, rheumatism and dysentery are untrustworthy and must not be allowed to interfere with a correct diagnosis on the part of the examiner. Note the difference between chilliness and a true chill. Sometimes the history obtained is incorrect because of the dulness of the patient, either natural or due to the disease. Here repeated questioning alone secures a satisfactory result.

Histories obtained from hospital patients are proverbially untrustworthy. Such persons are for the most part ignorant and unobservant. No matter what methods are employed to obtain the history, it is well to be sceptical about its accuracy, especially when the physical examination furnishes contradictory evidence. In children this is particularly important. Most children are unable to furnish information about themselves, and their histories must be obtained from the people in charge. Their symptoms are not likely to be accurately stated, perhaps from fear, embarrassment or misunderstanding.

General questions as to heredity are frequently unsatisfactory. Definite interrogations must be put, and where one is in doubt of the truthfulness of an answer, the desired information may be obtained in a roundabout way,—*e. g.*, patients will admit that parents have had "nerve trouble" or "brain trouble," although they might deny the presence of insanity. Family tendency to tuberculosis should be asked for, but it is of greater importance to know whether the patient has been in close relation, either at home or in the workshop, with a tuberculous individual.

Important diseases often are forgotten by patients in giving the personal history, therefore, it is well to ask specifically regarding the exanthemata, rheumatic fever, lung fever, St. Vitus' dance, jaundice, etc. Inquiries always should be made concerning the use of alcohol, tobacco, tea, coffee, the times and the methods of eating and sleeping. Indirect questions with regard to venereal diseases are often best. A patient will admit having had a "strain" or frequent or scalding urine, who will deny gonorrhea. On the other hand, inquiries about pregnancy and menstruation should be simple and straightforward.

Present Illness. The first question should always relate to the first symptom and the time of its occurrence. The sequence of subsequent symptoms should be carefully investigated. The patient's answers often suggest other subjects important in the differential diagnosis, and the doctor or student then can show the extent and accuracy of his medical knowledge by asking enough but not too much. Individual symptoms (*e. g.*, abdominal pain, etc.) should be analyzed according to their situation, mode of onset, frequency, duration, character and severity. The mere fact that a patient vomits or expectorates is of little value. It is important to note the quantity, color, presence of blood and mucus. Always consider the temperament of the patient and his customary use of language when statements are made dealing with pain, discomfort or fatigue.

It is desirable to include in the history a few general questions concerning the appetite, frequency of intestinal evacuations, ability to sleep and work (as an index of the sufferings), night sweats, loss of weight, progress of the disease, and also questions about the functions of the various systems not included in the patient's preliminary statement.

(*e.g.*)	**Digestive.**	Appetite, nausea, discomfort after eating, eructations, vomiting, defecation.
	Respiratory.	Cough, expectoration, pain in chest, dyspnoea.
	Circulatory.	Shortness of breath, palpitation, oedema.
	Nervous.	Headache, convulsion, paralysis.
	Urinary.	(*a*) Renal: headache, amount of urine, oedema.
		(*b*) Vesical: dysuria, retention, frequency of micturition.
	Menstrual.	Profuse, scanty, painful, irregular.

*General Examination of the Body.

General Observations. Nutrition of skin and muscles, size, weight, attitude, decubitus.

Skin, Mucous Membranes and Subcutaneous Tissue. Pale, flushed (hectic), cyanotic, pigmented (jaundiced, bronzed skin and buccal mucous membrane). Cold, hot, dry, moist, satiny (alcoholic), rough, desquamating; scars, eruptions (Koplik's sign), haemorrhages, oedema, emphysema, calluses, rheumatic nodules, tumors, hair (parasites, myxoedema).

Glands. Suboccipital, mastoid, parotid, submaxillary, superficial and deep cervical, supraclavicular, axillary, epitrochlear, inguinal; (bronchial, mediastinal, mesenteric).

Glands may be small, large, hard, soft, fluctuating, adherent, or non-adherent, discrete or conglomerate.

Muscles. Atrophy, hypertrophy, resistance (firm, flabby), paralysis, spasm, tremor, fibrillation, contracture.

Bones and Joints. Redness, heat, tenderness, swelling, crepitus, mobility, epiphyses, deformity (spinal curves, bow-legs, arthritis deformans, Heberden's nodes), exostoses and tumors.

Arteries. Size, abnormal course, sclerosis, calcification, auscultation.

Veins. Size, varicosity, pulsation in neck either true (systolic or presystolic in time) or false (transmitted from the artery and therefore systolic in time).

Pulse. Rate (tachycardia, bradycardia), regularity, rhythm, tension (compressibility), volume, character of wave (dicrotic, water hammer or Corrigan's). Capillary pulse. Comparison of the heart's contractions with the radial pulse. Comparison of the radials.

Respiration. Frequency; painful, shallow, costal, diaphragmatic. Relation of inspiration to expiration. Dyspnoea (expiratory, inspiratory, Cheyne-Stokes).

Temperature. Mouth, axilla or rectum.

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*Physical examination is not dependent upon a knowledge of the patient's previous history and present sensations. It is a good exercise, therefore, for students to examine the patient before the history is taken. A complete, systematic and unbiased examination will thus be obtained.

HEAD.

Size, shape (rachitic, hydrocephalic, microcephalic, asymmetric), fontanelles, tender spots, craniotabes.

Facies. Placid, stupid, anxious, pinched, puffy, adenoid, alcoholic, hemiatrophic, myxoedematous, acromegalic, mask-like (paralysis agitans).

Eyes. Pupils (size, equality, shape, reflexes, Argyll-Robertson), ophthalmoplegia (strabismus, ptosis), nystagmus, conjunctivitis, exophthalmos; vision (condition of retina, hemianopsia, amaurosis). Oedema of lids (pertussis, Bright's disease).

Nose. Hypertrophies, external deformities, tumors, discharge, membrane (culture), ozæna, epistaxis, deviations of the septum, spurs, enlarged turbinates, new growths.

Lips. Color, hare-lip, ulcerations, herpes, fissures.

Breath. Foul, alcoholic, urinous; acetone, gas poisoning.

Tongue. Protrusion; pale, red, cyanotic, dry, moist, coated, fissured, smooth, rough, indented by teeth, ulcerated; geographical tongue, salivation, stomatitis, *leucoplakia buccalis*, mucous patches.

Gums. Color, spongy, hæmorrhagic (scurvy), lead line (lens), tumors, sordes.

Teeth. Carious, deformed (Hutchinson), number.

First dentition: 6–8 months, two lower incisors; 8–10 months, four upper incisors; 12–14 months, two lower incisors and four molars; 18–20 months, four canines; 28–32 months, four molars. Total, twenty.

Second dentition: 6 years, four molars; 7 years, four incisors; 8 years, four incisors; 9 years, four bicuspids; 10 years, four bicuspids; 11 years, four canines; 12 years, four molars; 17–25 years, four wisdom teeth. Total, thirty-two.

Pharynx. Tonsils, palate, adenoids, membrane (culture), eruptions, thrush, elongated or oedematous uvula, tonsillar and retropharyngeal abscess, pharyngeal and palatal reflexes and paralyses (tabes, diphtheria, bulbar).

Larynx. Voice changes from the normal, indicating the need of laryngoscopic examination.

Ear. Hearing, discharge, examination of canal (foreign bodies, wax, tympanum), mastoid tenderness, tophi, stigmata.

Neck. Torticollis, spinal curvature, venous fulness, pulsations, tracheal tug, parotid, thyroid and lymph glands, cysts, high spinal abscess.

CHEST.

Inspection. Size, shape (barrel chest, paralytic chest, rachitic chest), symmetry and comparative mobility, respiratory movements, Litten's phenomenon, intercostal spaces (flushing, retraction, Broadbent's sign), cardiac impulse, pulsations. Breasts: evidences of lactation, tumors.

Palpation. Tactile fremitus, cardiac impulse, pulsations, thrills, friction, tender points.

Percussion. Sense of resistance and elasticity. Variations from the normal pulmonary or cardiac boundaries.

Auscultation. Voice sounds, respiratory sounds, cardiac sounds, adventitious sounds.

HEART.

Inspection. Position of apex beat, pulsations.

Palpation. Apex impulse, thrill, friction (pulsation).

Percussion. Size and position of the heart.

Auscultation. Heart sounds: diminution, accentuation, rhythm, doubling. Murmurs: seat, time, character, transmission, relation to heart sounds. Examine in both erect and dorsal positions.

LUNGS.

Inspection. Rate and character of respiration.

Palpation. Tactile fremitus, friction râles.

Percussion. Pulmonary resonance, normal or modified. Respiratory percussion.

Auscultation. Respiratory murmur, voice sounds (spoken or whispered), adventitious sounds, râles, friction and succussion.

Cough. Dry, loose, hacking, constant, paroxysmal and painful.

ABDOMEN.

Inspection. Size, shape, thickness and tension of the abdominal wall, irregularities of outline due to tumors, umbilicus, striæ, superficial veins, herniæ, peristalsis, respiratory movements, pulsations.

Palpation. Position, outline and mobility of liver, gall bladder, spleen, kidneys, stomach, bladder (and pancreas); tumors (see below), relation to inflated colon and stomach and to other organs. Tenderness: seat, superficial or deep; resist-

ance, friction, fluctuation wave (true and false), splashing, pulsation (aorta).

Percussion. Outline of organs, liver, gall bladder, spleen, stomach, bladder, uterus and tumors. Modifications due to distended intestines and free gas in the peritoneal cavity. Differentiation between ascites and cysts; condition of flanks, movable dulness, curve of dulness.

Auscultation. Arteries, foetal heart, placental bruit, splashing, gurgling.

Rectum. Piles, fissure, ulcer, abscess, fistula, pilonidal sinus, impacted fæces, stricture, prolapse, intussusception; uterus, tumors, relation to neighboring organs.

Genitals. Testes, epididymis, spermatic cord, varicocele, hydrocele, tumors; penis, glans, phimosis, ulcerations, urethra, character of the stream; discharge (urethritis, balanitis); prostate (vesiculae seminales); vagina, introitus (urethral caruncle), hymen, perineum, malformations; uterus; cervix, body; tubes, ovaries, tumors; discharge from urethra, vagina, uterus.

Extremities. Deformities, congenital and acquired. Conditions due to mal-nutrition and disease (clubbed fingers), oedema, flat-foot, tenderness (neuritis, trichinosis).

Spine. Curvatures, mobility, tender points, meningitis (spinal puncture), spina bifida.

Tumors. Location, shape, size, color, consistency, surface, tenderness, mobility (by respiration, by hand), dulness, pulsation, relation to organs.

NERVOUS SYSTEM.

1. **General Appearance.** Stigmata; asymmetry of head and face; ears; palate. General faulty development; nutrition.
2. **Mental Condition.** Intelligent, emotional (hysterical); special defects, psychoses; hallucinations; hypochondriasis, delirium, apathy, stupor.
3. **Motion.**
    1. Paresis or paralysis (flaccid or spastic), as related to lesions of: *a*, brain; *b*, cord; *c*, cranial or other peripheral nerves; *d*, functional disorder (hysteria). Cortex, monoplegia. Capsule, hemiplegia. Cord, paraplegia. Peripheral nerves, individual distributions.
    2. Gaits: spastic, ataxic.

3. Pupils: size, equality, outline, reaction to light and with accommodation; Argyll-Robertson pupil (syphilis, tabes, dementia-paralytica). Eye movements: strabismus, exophthalmos.
4. Reflexes: pupillary, knee jerk, ankle clonus, plantar (Babinski); Kernig's sign; wrist, elbow, abdominal, cremaster.
5. Ataxia (Romberg), localized and general convulsions, tremor, choreic and athetoid movements, fibrillation.
6. Electrical reactions: reaction of degeneration (R. D.) and partial R. D.

4. **Sensation.**
   1. Tactile, pain, temperature, position, delay, paresthesiae, dissociation.
   2. Distribution of disturbance: focal, segmental, peripheral, functional.
   3. Special senses: sight, hearing.
   4. Incontinence; retention; sexual power.

5. **Speech.** Aphasia, scanning (multiple sclerosis), monotone (paralysis agitans), nasal, bulbar.

6. **Trophic.** Nutrition of skin and joints, atrophy of muscles, perforating ulcer, vaso-motor.

X RAY EXAMINATION.

The Roentgen rays give valuable information in regard to the presence of foreign bodies, especially metallic; to the condition of fractures and dislocations, both recent and old; to aneurisms, especially of the aorta, and to many diseases of the bones and joints. Confirmatory evidence may be obtained in cases of calculi, conditions of the lungs and of the pleural cavity and regarding the position and size of the heart.

URINE.

Quantity in twenty-four hours. Color. Odor. Reaction. Specific Gravity. Sediment. Turbidity. Shreds.

Albumin. Heat — Boiling the upper half of the urine in a test-tube; turbidity due to phosphates disappears on adding dilute acetic acid. If a precipitate appears on heating and disappears on boiling, suspect albumose. Estimate the per cent of albumin by the nitric acid test.

Sugar. 1. Fehling's Test. Qualitative. Boil 10 c. c. of Fehling's solution in a test-tube. Add slowly 5 c. c. of urine and boil again. The presence of sugar is shown by the appearance of a red or yellowish precipitate. With a doubtful reaction, ferment the urine for twenty-four hours, with yeast, in a warm place, and repeat Fehling's test. If the doubtful reaction was due to glucose, the test will now be negative.

Fehling's Test. Quantitative. Dilute 10 c. c. of Fehling's solution with about 40 c. c. of water and boil in a flask to test the solution. Add slowly, by means of a burette, the urine diluted with water 1 : 10. After each addition, boil briskly. When the point is reached at which the blue color wholly disappears, the copper is reduced. 10 c. c. of Fehling's solution are reduced by 0.05 gram glucose, — which is, therefore, the amount of glucose in the urine used.

2. Fermentation Test. To 100 c. c. of urine add one-third of an yeast cake. Set in a warm place for twenty-four hours. If at the end of this time there is no reaction with Fehling's solution, take the specific gravity; otherwise, continue the fermentation till test is negative. Multiply the difference in specific gravity before and after fermentation by 0.23 to get the per cent.

Acetone. To one-sixth of a test-tube of urine add a crystal of sodium nitro-prusside. Make strongly alkaline with NaOH. Shake. The addition of glacial acetic acid gives a purple color to the foam, if acetone is present.

Diacetic Acid. Add a strong aqueous solution of ferric chloride to 5 c. c. of urine. A Burgundy red color shows the presence of diacetic acid. If the reaction takes place after the urine has been previously boiled, it is not due to diacetic acid.

***β*-Oxybutyric Acid.** If the ferric chloride reaction is strongly positive, *β*-oxybutyric acid is probably present.

Urea. Amount in twenty-four hours. The per cent can be determined by Squibb's method, which is not trustworthy, however, in diabetes.

Bile. 1. Shake and look at the foam.

2. Iodine test. (Tr. iodine, 1; alcohol, 8.) Pour 1 c. c. on the top of the urine in a test-tube. A green ring at the border of the two fluids shows bile.

Diazo Reaction. To 5 c. c. sulphanilic acid solution add two drops of a 0.5 per cent solution of sodium nitrite. Add an equal part of urine. Shake and add 2 or 3 c. c. of ammonium hydrate. A carmine color, especially in the foam, shows the diazo reaction.

Chlorides. $AgNO_3$. 1:8. Add 1 drop of the solution to a few c. c. of urine in a glass into which a few drops of HNO_3 have previously been poured. Ag Cl is precipitated.

Importance of diminution of chlorides in extensive early pneumonia.

Sediment. Microscopic examination. Casts. Pus. Blood. Epithelial Cells. Crystals.

Tubercle Bacilli in Urine. 1. Make a cover glass preparation from the sediment, centrifugalized or collected in a conical glass. This should be spread thinly and dried, holding in the fingers over the flame of a Bunsen burner. Fix by passing three times through the flame while held with forceps.

2. Cover the preparation thoroughly with carbolic-fuchsin solution and steam over the flame during thirty seconds to one minute. Do not allow the staining solution to dry on the surface of the cover glass, but add more stain if necessary.

3. Wash in water.

4. Decolorize for twenty seconds in 20 per cent sulphuric acid.

5. Wash in water.

6. Wash for thirty seconds, or until no more color will come out, in 95 per cent alcohol. If specimen is still distinctly red, it may be returned for a few seconds to the acid, and then to the alcohol as before.

7. Wash in water.

8. Cover the preparation with Löffler's methylene-blue solution for thirty seconds.

9. Wash in water and mount.

Tubercle bacilli are bright red; nuclei and other bacteria are blue. (The washing with alcohol is designed to decolorize any smegma bacilli which may be present. These bacilli hold their color in the presence of acids, but not in the presence of alcohol).

STAIN FOR GONOCOCCI.

1. Smear a cover glass as thinly as possible with secretion of urinary sediment.

2. Cover for one minute with anilin oil gentian-violet (freshly made).

3. Wash in water.

4. Cover with IKI solution for thirty seconds.

5. Wash in 95 per cent alcohol until the blue color ceases to come out.

6. Wash in water.

7. Counterstain with dilute carbolic-fuchsin 1:8 without heat, or with saturated aqueous solution of Bismarck brown with heat to the steaming point.

8. Wash in water and mount.

Diplococci *within leucocytes*, which have been decolorized by Gram and have taken the counterstain of red or brown, are to be considered as gonococci.

BLOOD.

Examination of Fresh Blood. Size, shape and color of red blood corpuscles. Leucocytosis, Fibrin, Parasites (Malaria, Filaria).

Haemoglobin. Use Tallqvist's scale. This determines at once the presence or absence of anaemia.

$$\text{Color index} = \frac{\textit{Per cent Haemoglobin}}{\textit{Per cent Red Corpuscles}}, \quad \frac{100}{5{,}000{,}000} = 100\%.$$

Examination of Stained Specimen. Preparation of specimen. 1. Cleanse the cover glass with soap and water. Wipe dry.

2. Wash the edge of the ear with water, and thoroughly dry.

3. Quickly pierce the lower edge of the lobes of the ear with a clean surgical needle.

4. Wipe away the first few drops of blood.

5. Touch the centre of the cover glass, held by its edges, against the top of the drop of blood, avoiding the skin.

6. Drop this cover glass upon another clean cover glass. The blood should spread evenly between the two without any pressure.

7. Draw the cover slips apart, keeping their faces parallel. The blood films thus made should dry almost immediately, and are then ready to be stained.

Method of Staining. 1. Cover the specimen with five or six drops of Leishman's stain for one minute.

2. Add two or three times the quantity of water, and let this diluted stain remain for two minutes.

3. Wash in water until the preparation has a pinkish color.

4. Dry and mount.

By this method the presence of malarial organisms, leucocytosis, leukaemia, type of anaemia, abundance of blood plates, and the granular stippling of the red corpuscles may be determined.

Red Corpuscles. Variation in size and shape (poikilocytosis). Loss of color (acromia). Tendency toward a general increase or decrease in size.

Number of { Normoblasts / Megaloblasts } in one or more stained specimens.

White Corpuscles. Estimation of the number of white corpuscles.

Differential Count. Leucocytosis : — presence, kind.

Number of Basophiles (lymphocytes and large mononuclear).

Neutrophiles.

Oxyphiles (eosinophiles). Increased in trichinosis, some skin diseases and other conditions.

Myelocytes (neutrophilic, oxyphilic).

The plasmodia are stained blue, with small red nuclear dots, and are found in the red corpuscles, and collections of pigment in the white corpuscles.

Blood Plates. These appear with Leischman's stain as round or oval bodies stained purplish, showing a mesh-work. They are one-third of the size of the red blood corpuscles, and often are found in clumps. A plate lying upon a red blood corpuscle may be mistaken for a malarial parasite.

Blood Count. Red Corpuscles. Draw the blood into the blood counter up to the mark 0.5 and dilute with Gower's solution up to the mark 101. Mix thoroughly. Count the red corpuscles in twenty-five small squares at each of the four corners of the ruled field and multiply the total by 8000. Repeat the count and take the average. This gives the number of corpuscles in a cubic millimetre.

White Corpuscles. Draw the blood into the blood counter up to the mark 0.5 and dilute with 0.5 per cent acetic acid up to the mark 11. Mix thoroughly. Count the corpuscles on the ruled field. Clean the slide and count again. Multiply the sum of these two counts by 100. The product is the number of white corpuscles in a cubic millimetre.

Widal's Serum Reaction. Use a bouillon culture of the Bacillus Typhosus twelve to twenty-four hours old. Examinations by high power dry lens or oil immersion lens should show the bacilli in active motion and unclumped.

Collect three or four drops of the blood to be examined in a small test tube.

Mix nine drops of the typhoid culture and one drop of blood serum upon one end of a slide. Place four drops of bouillon culture on the other end of the slide and add one drop of the 1 : 10 dilution and mix. Cover both the 1 : 10 and the 1 : 50 dilutions with cover slips. Drops of equal size may be obtained by using a platinum loop.

The serum reaction is regarded as positive when there is

complete clumping of the bacilli and absolute cessation of motility. The time limit for the test is one hour, although the agglutination usually occurs within a few minutes. A reaction at 1 : 10 is strongly suggestive, while a reaction at 1 : 50 can be accepted as conclusive evidence of typhoid infection.

(If dried blood is employed for the test, it must first be extracted by a drop of water, which can then be used in place of one drop of serum.)

SPUTUM.

Origin. May be from mouth, nose, pharynx, larynx, lung (or stomach), one or more or all. Note source, whether hawked or coughed.

Quantity. The quantity expectorated in twenty-four hours may vary within wide limits, — small, as in beginning tuberculosis of the lungs, or large, as in chronic bronchitis.

Odor. Ordinarily there is no odor to sputum. Under certain circumstances, however, as in abscess or gangrene of the lung, the odor may be foetid and disagreeable.

Sputum for examination should be coughed up, not hawked. It is sometimes difficult to obtain, especially in the case of young children. It will then be found of service to insert a cotton stick into the pharynx. As a result of the irritation the sputum will be raised and can be wiped out upon the cotton before it is swallowed.

MACROSCOPIC EXAMINATION.

Inspection. Sputum may be, —

(*a*) Mucous: viscid.

(*b*) Purulent: seen in pure form only in perforation into the lungs or bronchi of foci of pus, such as abscess of the lung or empyaema.

(*c*) Muco-purulent: most common form and not characteristic of any particular condition.

(*d*) Serous: thin, often slightly red in color (blood) and frothy; pathognomonic of oedema of the lungs.

(*e*) Nummular: common in tuberculosis of the lungs.

(*f*) Hæmorrhagic: seen especially in phthisis, pneumonia, epistaxis, abscess of the lung, hæmorrhagic infarction, new growths and passive congestion.

(*g*) Tenacious as in pneumonia, — adheres to inverted cup.

Color may be —

(*a*) Rusty or orange-juice, pneumonia: prune-juice, pneumonia, cancer of the lung.

(*b*) Grass-green: pneumonia combined with jaundice.

(*c*) Black or gray from substances inhaled, as carbon, or colored by food, as chocolate, berries, wine or by tobacco.

(*d*) Reddish yellow: from rupture of abscess of the liver into the lung.

MICROSCOPIC EXAMINATION.

Important Constituents.

(*a*) Bacteria:

1. Tubercle bacillus. Influenza bacillus. Bacillus mucosus capsulatus. Acid-proof bacillus (in gangrene). Pneumococcus. Streptococcus.

2. Actinomyces granules.

(*b*) Elastic fibres: in all destructive processes of the lungs; phthisis, gangrene, abscess.

Unimportant Constituents.

(*a*) A few leucocytes.

(*b*) A few red blood corpuscles.

(*c*) Alveolar epithelial cells, often containing fat and carbon.

(*d*) Squamous and cylindrical cells.

(*e*) Various bacteria.

(*f*) Particles of food.

Tubercle Bacillus. By means of a small pair of forceps or a stiff platinum wire pick out from the sputum purulent or cheesy particles and smear the same on the cover glass.

1. The cover glass preparation should be spread thinly, dried, holding in the forceps, over the flame of a Bunsen burner and fixed by passing three times through the flame while held with cover glass forceps.

2. Cover the preparation thoroughly with carbolic-fuchsin solution and steam over the flame during thirty seconds to one minute. Do not allow the staining solution to dry on the surface of the cover glass, but add more stain if necessary.

3. Wash in water.

4. Decolorize for twenty seconds in twenty per cent. sulphuric acid.

5. Wash in water.

6. Wash for thirty seconds or until no more color will come out, in 95 per cent alcohol. If specimen is still distinctly red, it may be returned for a few seconds to the acid and then to the alcohol as before.

7. Wash in water.

8. Cover the preparation with Löffler's methylene-blue solution for thirty seconds.

9. Wash in water and mount.

Tubercle bacilli are bright red, nuclei and other bacteria are blue. (The washing with alcohol is designed to decolorize any smegma bacilli which may be present. These bacilli hold their color in the presence of acids, but not in the presence of alcohol.)

Pneumococcus and Bacillus Mucosus Capsulatus. These may be recognized by their morphology and by their possession of a capsule. Special staining methods for capsules do not give constant results and are probably no more trustworthy than the simple staining with Löffler's methylene-blue solution. If the preparation be mounted in water instead of in balsam the capsules are often visible as hyaline zones about the bacteria.

Pneumococcus. The pneumococcus may, however, be recognized with a fair degree of certainty, even if its capsule is not demonstable. Probably the most satisfactory method is to stain by Gram. The pneumococcus will then be stained blue black with its more or less characteristic morphology well shown.

Gram's Method of Staining. 1. Smear the cover glass as thinly as possible.

2. Cover with anilin oil gentian-violet (freshly made) and heat to steaming point.

3. Wash in water.

4. Cover with IKI solution for thirty seconds.

5. Wash in 95 per cent alcohol until the blue color ceases to come out.

6. Counterstain with Bismarck brown for thirty seconds.

7. Wash in water and mount.

Bacillus Mucosus Capsulatus. The bacillus pneumoniae of Friedländer may be recognized in methylene-blue preparations by its large size and by its possession of a capsule. The ordinary staining methods, though they do not stain the capsule, often permit the presence of capsules to be recognized if the preparation be mounted in water instead of in balsam. Stain as follows: —

Smear the cover glass as thinly as possible.

2. Stain with Löffler's solution of methylene-blue with heat to the steaming point.

3. Wash in water and mount.

Influenza Bacillus. Influenza bacilli are the smallest bacteria found in the sputum. They are very small short rods. Their middle portions sometimes do not stain and thus appearances are presented suggestive of small diplococcus forms. They do not stain by Gram's method. For diagnosis they should be present in large numbers, both inside and outside of leucocytes.

Method of Examination for Influenza Bacilli. Make cover glass preparations from a purulent particle of the sputum, spreading it thinly. Stain with Löffler's solution of methylene blue, heating to the steaming point. Then wash in water and mount. When bacteria resembling influenza bacilli are present, stain a similar cover glass preparation by Gram's method and counterstain with Bismarck brown.

The influenza baccilli will appear faintly brown stained instead of stained blue black as in the case of the pneumococcus.

Elastic Fibres. 1. Heat equal parts of 10 per cent NaOH and sputum in the water bath till clear.

2. Centrifugalize or collect in a conical glass.

3. Examine sediment microscopically.

Gastric Contents.

Contents of Fasting Stomach is generally to be obtained in the morning. The stomach should be empty seven to eight hours after the last meal, and if food then is present, it is a sign of stasis. A few c. c. of fluid containing free HCl are of no consequence. They may be due to the irritation of the tube. Quantities of gastric contents above 50 c. c. indicate hypersecretion or stasis.

Test Breakfast (Ewald) consists of one slice of bread and a glass and a half of water. At the end of one hour not over 100 c. c. should remain in the stomach. Amounts of 150-300 c. c. imply motor insufficiency or hypersecretion. At the end of two hours the stomach should be empty.

In expressing the contents, do not dilute them with water.

Vomitus is to be examined in the same way as the above. Free HCl may be absent in the vomitus and yet be present after a test breakfast.

Quantity. See above. The quantity of vomitus alone may be so excessive as to indicate a dilatation of the stomach.

Color. Fresh blood is suggestive of ulcer; disintegrated blood (coffee grounds), of cancer. A few fine streaks of blood are of no significance. A green or yellow color may be due to bile. Avoid mistaking brown fragments of food for blood. If in doubt test for hæmin crystals.

Odor. The odors of butyric and acetic acids, of yeast and sarcinae, are characteristic of fermentation.

Mucus. In "catarrh of the stomach," mucus is so abundant that the contents can be poured in a lump from one beaker to another. Small amounts of mucus are also well shown in this way. Mucus requiring acetic acid for its demonstration is of no significance. Gastric mucus is mixed with food, and thus is distinguished from the glairy secretion of the mouth and oesophagus.

Food. See Contents of Fasting Stomach. In normal digestion, the bread is in fine particles; in Achylia Gastrica, the contents differs little from a mixture of bread and water.

Froth. When the contents separates into three layers, the lower consists of partially digested food, the middle of a rather thin liquid, while the upper is made up of froth due to gas liberated by the active fermentation, and contains mucus and

light fragments of food. The marked formation of these three layers is suggestive of dilatation of the stomach.

Reaction due to free HCl,
combined HCl (proteids),
acid salts.
organic acids (lactic, butyric, acetic).

Free HCl. Töpfer's Test. Add to a few c. c. of gastric contents one or two drops of Töpfer's solution. A carmine red color develops if a free mineral acid is present.

Günzburg's Reagent. Mix a drop of this reagent with a drop of the gastric contents in a porcelain dish or on a glass slide. Evaporate slowly over a water bath or free flame. A bright red color will appear if free HCl is present. After heating, a white paper may be held beneath the slide to bring out the color which may develop.

Congo red (paper) turns blue in the presence of 0.01 per cent free HCl.*

Combined HCl. A part of the HCl is always "combined" with proteids. Free HCl implies combined HCl. Combined HCl may be present, however, when free HCl is absent.

Acid Salts. Unimportant in clinical work.

Lactic Acid. Gastric contents should be examined at once, as lactic acid readily develops if they are left for some time in a warm place. Dilute a solution of $Fe_2 Cl_6$ to a very faint yellow color with water. Fill the concavities of two test-tubes with this solution, using one for comparison.

An intensification of the yellow color on addition of gastric contents suggests lactic acid with considerable certainty. A negative test rules out lactic acid.

When this test is positive, absolute proof is obtained by adding to 10 c. c. of the contents two drops of HCl, then boil to a syrup, and extract with ether. Dissolve the residue obtained upon evaporation of the ether in a little water and test for lactic acid as above.

Butyric and Acetic Acids. See "odor."

Quantitative Estimation of Free HCl and the Total Acidity.

Free HCl. To 10 c. c. unfiltered gastric contents add three to four drops of a solution of Töpfer's reagent. Titrate with a

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* Organic acids and acid salts also produce a somewhat similar reaction with Congo red (a purple or brown), but in solutions more concentrated than are ordinarily found in stomach contents. Congo red is therefore not *an absolute test* for small amounts of free HCl in gastric contents.

decinormal ($\frac{N}{10}$) NaOH solution until the disappearance of the carmine red color. This point represents the neutralization of the free HCl in the contents used. To estimate the quantity of free HCl multiply the number of c. c. of ($\frac{N}{10}$) NaOH used in this titration by 0.00365 (the quantity of HCl which is neutralized by 1 c. c. ($\frac{N}{10}$) NaOH). This gives the quantity of free HCl in grammes in the 10 c. c. gastric contents employed for analysis. From this the per cent of HCl can be reckoned. The normal quantitative values of free HCl vary between 0.07% and 0.18%, or 20–50 c. c. ($\frac{N}{10}$) NaOH per 100 c. c. gastric contents.

If extreme accuracy is desired, the titration may be repeated with another portion of gastric contents, using Günzburg's Reagent to determine the end point.

Total Acidity. To the same contents in which the free HCl has already been neutralized, add two or three drops of a one per cent solution of Phenol-phthalein. Continue the titration with the ($\frac{N}{10}$) NaOH solution until a permanent red color is obtained. This represents the neutralization of all the acid constituents of the contents (the free mineral and organic acids and the combined acid). By multiplying the number of c. c. of ($\frac{N}{10}$) NaOH used from the beginning of titration up to this point by 0.00365, the total acidity of the 10 c. c. gastric contents used is obtained in terms of grammes HCl. From this the per cent can be calculated. The normal quantitative values of total acidity vary between 0.15% and 0.30%, or 40–80 c. c. ($\frac{N}{10}$) NaOH per 100 c. c. gastric contents.

Fragments of Mucous Membrane are often found in Achylia Gastrica, occasionally in cancer.

Blood. The corpuscles soon disintegrate or are digested. In suspected cases use Teichmann's test. Evaporate slowly a few drops of gastric contents on a glass slide. Mix the residue intimately with one or two grains of salt. Add one or two drops of glacial acetic acid. Heat very gently nearly to dryness. When cool, examine microscopically, with high power dry lens, for haemin crystals. (Small brown colored rhombic crystals.)

Pus. The cell bodies are often digested, but the nuclei are easily recognized. Pus may be found in any gastric catarrh; often in the fasting stomachs of patients with ulcer and cancer.

Fungi and **Bacteria** are usually present in small amounts. In dilatation of the stomach they are abundant. The forms especially to be noted are yeast and sarcinae.

Intestinal Contents.

Quantity and Frequency. Dejections vary according to the habit and character of the food; weight is normally 120–250 g. In starvation they are reduced to a minimum. Stools may be numerous but without fæcal matter. In diarrhœa from the lower colon (dysentery) the stools are small and frequent; in that from the small intestine or upper colon — large, but infrequent.

Consistency and Form. The longer the stools remain in the rectum, the harder and dryer they become. Frothy stools are indicative of excessive intestinal putrefaction.

Reaction. Normally neutral, faintly acid or alkaline. The superficial reaction is often different from that of the central portion. Cholera and typhoid stools are alkaline. Carbohydrate and milk diets give an acid reaction.

Color. The normal brown color is due to hydrobilirubin (urobilin). Infants' stools are bright or golden yellow because of bilirubin; on standing they may soon change their color. Color varies with, —

1. Food—light with milk or bread; dark, with blackberries, red wine and exclusive meat diet; etc.; green with green vegetables.

2. Drugs — green, calomel; black, bismuth; black, iron, — though perhaps only on standing.

3. Blood. If originating in stomach 500 c. c. give tarry stools.

4. Bile — clay-colored from diminished secretion or obstruction to the flow of bile and also from unabsorbed fat. The green color of stools depending on bile is pathological.

The test for bile in the stools is complicated, and, except with experts, a negative result is of little value.

Odor. Of importance in infants. Normally slightly sour. Foul in albuminous decomposition. Sour in acid fermentation. Very foul in severe disease of colon. Odorless in cholera infantum.

Mucus, in large quantities, is always pathological and means catarrh of the colon, except in cases of colica mucosa in which there is a nervous hypersecretion of mucus. It may occur, —

1. Intimately mixed with the stool (coming from the small intestine).

2. As a thick coating to the fæces (large intestine).
3. Forming the whole stool (large intestine).

Blood. The higher in the intestine the origin the more the blood is changed in color. Tarry stools occur in gastric or intestinal hemorrhages. Confirm by Teichmann's test, page 23, not confounding hæmin crystals with bismuth crystals.

Pus. Large amounts come from abscesses communicating with the intestine. Small amounts may come from abscesses, ulcers or catarrh. The pus corpuscles soon disintegrate and are seen with difficulty.

Tubercle Bacilli. Dilute the stool with ten volumes of water in a wide mouthed bottle of 200 C. C. capacity. Mix thoroughly. Let it stand for twenty-four hours. The narrow layer between the thin liquid and the more solid sediment contains the bacilli. Remove this with a pipette. Spread on cover glasses. Evaporate slowly to dryness and then proceed according to the method described for staining tubercle bacilli in sputum.

Undigested Food. Muscle fibres are seen in every stool, but their striæ are poorly marked and the ends are rounded; elastic fibres come from a meat diet. Starch is never seen in normal stools and seldom in diarrhœa. Fat appears as oil, grease, fat drops or crystals. Curds are frequently seen in infants' stools and are an indication of imperfect digestion.

Intestinal Parasites. Amœba Coli. Round worms. Pin worms. Tape worms:—beef (Tænia mediocanellata or saginata. This worm has a pigmented head); pork (Tænia Solium. This worm has hooklets about the head.); fish (Bothriocephalus latus). Eggs of intestinal parasites may be seen.

Crystals. Not of importance.

Foreign Bodies.

Apparatus and Chemical Reagents.

Stethoscope.
Microscope with oil immersion.
Centrifugal Machine.
Blood Counter.
Tallqvist's Hæmoglobin Scale.
Blood-Oven.
Cover glasses and slides.
Forceps.
Burette.
Graduate.
Specific Gravity Bulb.
Squibb's Urea Apparatus.
Test Tubes.
Red and blue litmus.
Congo paper.

Nitric Acid — conc.
Sulphuric Acid — conc.
Glacial Acetic Acid.
Dilute Acetic Acid 0.5%.
Sodium Nitrite 0.5%.
Ammonium Hydrate.
Sodium Hydrate, Decinormal Solution.
Sodium Hydrate.
Sodium Nitro-prusside.
Ferric Chloride (strong aqueous solution).
Iodine Solution (Tr. Iodine, 1; Alcohol, 8).
Silver Nitrate Solution 1 : 8.

Fehling's Solution. Dissolve 34.64g. pure $CuSO_4$ in water and make up to 500 c. c. Dissolve 173 g. Rochelle Salts and 60 g. Sodium Hydrate each in 200 c. c. water and mix, and then make up also to 500 c. c. 5 c. c. of each sol. are used for the test.

Sulphanilic Acid. Solution for Diazo reaction. Make a saturated solution of sulphanilic acid in a solution of hydrochloric acid 50 : 1000.

Bromine Solution for Urea: Bromine, 30 g.; Sodium Bromide, 30 g.; Water, 240 c. c.

Sodium Hydrate Solution for Urea: NaOH, 100.0 g.; Water, 250 c. c.

IKI Solution: Iodine, 1 g.; Potassium Iodide, 2 g.; Water, 300 c. c.

Bismarck brown (saturated aqueous solution).

Alcohol 95%.

Gower's Solution: Sodii Sulphatis, gr. 112; Acid. Acetici, ʒ v.; Aquae, ℥ iv.

Leishman's Stain. To 100 c. c. of 0.5% aqueous solution of Sodium Bicarbonate add 1% of Methylene-blue. Steam in an Arnold sterilizer for one hour. When cold, stir into the unfiltered mixture 500 c. c. of a 1% aqueous solution of Eosin. Filter and dry the precipitate without washing. Make a saturated solution of this precipitate in absolute methylic alcohol. Filter and add 25% of absolute methylic alcohol.

Löffler's Methylene-blue.

Carbolic-fuchsin: Carbolic acid crystals, 5; Fuchsin. Sat. alcoholic sol., 10; Water, 100.

Methylene-blue (saturated aqueous solution).

Anilin oil gentian-violet solution. To 13 c. c. saturated alcoholic solution of gentian-violet add 84 c. c. anilin water. Anilin water is made by shaking together 5 parts of anilin with 95 parts of water. Filter the resulting milky fluid. It should come through perfectly clear. Discard after one week.

Günzburg's Reagent. Phloroglucin, 2 g.; Vanillin, 1 g.: Alcohol, 30 g.

Töpfer's Reagent. Dimethyl-amido-azo-benzol 0.5 per cent alcoholic solution.

Phenolphthalein. 1.0 per cent alcoholic solution.

Tincture Iodine.

Ether.

The above reagents and apparatus can be obtained at the Harvard Co-operative Society's Store, 707 Boylston Street, Boston.