pharynx. The two sides are unsymmetrical. On the right side the ventral knob is smaller than the dorsal, while on the left they are about equal in size and placed on the same level.

In an embryo only slightly older the median thyroid is still **U**-shaped, though the right arm is still smaller than in the last and not so long as the one on the left side. The lateral rudiments show in this embryo the greatest lack of symmetry of any of those studied by Sudler (Fig. 5245). The right rudiment is still connected with the pharynx by a small hollow stalk, while on the left side this connection has entirely disappeared. On the right side the ventral knob touches the middle of the right arm of the median rudiment, but there is no histological continuity, whereas on the left side the ventral knob not only touches the median rudiment, but there is actual continuity. As in the embryo described before, the ventral knob on the right side is much smaller than the dorsal one, while on the left side they are of almost the same size.

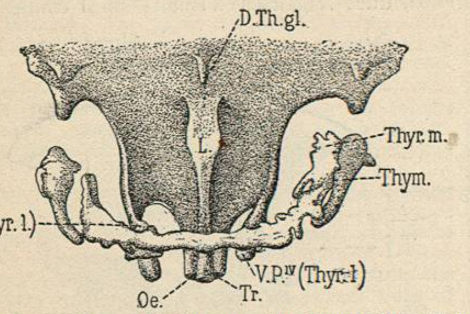

FIG. 5244.—Ventral View of the Pharynx of an Embryo Five Weeks Old (No. 109). (After Sudler.)

The median and lateral thyroid rudiments have united on both sides in an embryo of the sixth week, and all connection with the pharynx has disappeared. They still appear as distinct rudiments.

In a slightly older stage the lateral rudiments and the median have so completely united that all there is to show that they were once separate are a few prominent lobules at their point of union. The loop of the **U** has become smaller and the arms larger, and they have become lobulated, so approaching the condition of the adult gland.

In the last embryo studied, one of the seventh week, the shape is almost that of the adult thyroid. The two lateral lobes are pyriform and are connected by a small isthmus, which is attached to them at the smaller end.

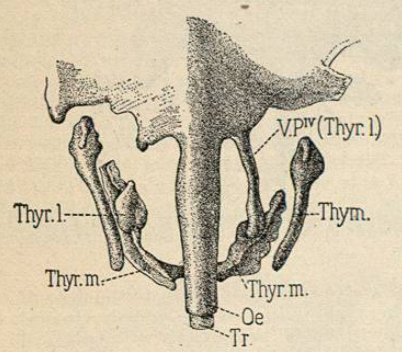

FIG. 5245.—Dorsal View of the Pharynx of an Embryo 13 mm. long (No. 175). (After Sudler.) The lateral thyroid on one side is attached to the pharynx and on the other is separated from it.

In the human embryo, as well as in the bird and some of the mammals, the pharynx develops more slowly on the right side than on the left, and the most striking example of this is in the thyroid. This may be due to the development of the heart and the bending of the head to the left.

From these different embryos Sudler draws the conclusion that "the thyroid arises in the human embryo from the union of a median rudiment situated at the point of junction of the tuberculum impar and the two dorsal rudiments of the tongue with a paired rudiment arising as a differentiation of a lining of the fourth visceral pouch."

Franklin P. Mall.

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TICK FEVER, OR SPOTTED FEVER.—A disease known by the latter of these two names is found in the States of Montana, Idaho, Nevada, Wyoming, and Oregon. As two other diseases (viz., typhus fever and cerebro-spinal meningitis) are already known as spotted fever, it would be well, as suggested by Anderson, to call the disease under discussion tick fever.

ETIOLOGY.—Tick fever or spotted fever is found in the mountainous districts in the above-named States at an elevation of over three thousand feet. It does not seem to be prevalent outside the latitude of 40° to 47° N. The disease is only found in persons whose occupation causes them to be exposed to the bite of the tick; such are lumbermen, ranchmen, and sheep-herders. Males in the prime of life are most liable to the disease; this would be expected from the occupations just mentioned. Beyond this, age and sex have no etiological significance. The disease is in all probability caused by a parasite.

The Parasite.—"Wilson and Chowning noticed ovoid intracorpuscular bodies in stained preparations of the blood from their earlier cases. They did not determine the character or significance of these bodies until they examined the fresh blood, when they found ovoid intracorpuscular bodies showing amœboid movements. These observations they confirmed in all the later cases which they examined. To Wilson and Chowning, then, belongs the credit of discovering a parasite which is very *probably* the cause of spotted (tick) fever." Anderson further says that in his studies upon the cause of this disease he "had the opportunity of examining the blood, both fresh and stained, in a number of cases. Two cases were in a hospital in Missoula, and daily examinations were made. In the fresh blood a few cells were found to contain parasites. Three forms were seen. The most common was a single ovoid body, refractile, situated within the cell, usually near its edge. When the slide is warmed this body possesses the power of projecting quite rapidly pseudopodia and of effecting a slight change of position. This form, which is apparently an early or young form, is about 1.5–2 μ in length, and 0.5–1 μ in width at its widest part. It closely resembles the earliest intracorpuscular parasites of æstivo-autumnal malaria.

"Another form, not so common, was larger, being about 2–2.5 by 1–1.5 μ, larger at one end and showing in the larger end a dark granular spot; this was also amœboid.

"The third form noted was arranged in pairs, distinctly pyriform, with the smaller ends approaching, and in two cases a fine thread uniting the small ends was seen. Motion was not observed in this form, but the spot mentioned in the second form was seen.

"The parasites are never found in very large numbers, it being usually necessary to search several fields of the slide to find one. Sometimes they occur in groups, two or three infected cells being found in one field. In both fresh and stained preparations extracorpuscular bodies closely resembling the small single intracorpuscular form were seen. I was unable definitely to decide the character of these bodies, but am strongly inclined to think that they are the young form of the parasite which has not yet invaded the red cells.

"In the cases of spotted (tick) fever which I had the opportunity of examining I had no great difficulty in finding both in fresh and in stained preparations the bodies above described. Their constancy in the blood of persons suffering with spotted fever, their persistence for some time in the blood of these persons after recovery, their absence from the blood of persons suffering from other diseases and of healthy persons make it very probable that they are the cause of the disease, and that one more has been added to the rapidly growing list of diseases of man due to animal parasites." (Anderson: "Spotted Fever (Tick Fever) of the Rocky Mountains.")

Method of Infection.—"The life history of the organisms of malaria and Texas fever naturally suggested that some insect was concerned in the transmission of the disease. On investigation it was found that the ticks appeared in the valley about the last of February, but were inactive until the middle of March or 1st of April, the first cases of fever appearing about the last of March. The ticks begin to diminish greatly in number from about June 1st, and after the middle of July very few are seen; the cases of fever also begin to diminish about June 1st, the latest date on which the disease has been known to occur being July 20th.

"Mosquitoes do not appear in the valley until after the first cases of fever develop, and remain some time after the last cases appear. Bedbugs and other house insects, I think, were well excluded, by the fact that there has never been known an instance in which two cases occurred the same year in the same house.

"On a closer study of the cases of spotted (tick) fever it was always found that there was a history of tick bites about one week before the onset. In four cases there was a history of a single bite two, three, five, and seven days, respectively, before the initial symptoms. The usual time between the bite and the onset of the fever is about seven days. If the tick transmits the disease, it may be asked, Why do not more persons become infected, and why is the infection confined to the west bank of the Bitter Root River? I think this may be answered by the very obvious fact that the tick is unable to travel any great distance, unless carried on some person or object. Again, it is very unusual for a tick to bite a person and not be discovered in a short while, and the result is the death of the tick. If, as in Texas fever, the development of the parasite takes place in the female tick and the young ticks transmit the infection, the very small number of ticks which escape detection in persons explains the small number of infected ticks. Where do the female ticks get their infection? I examined a recovered case twenty-four days after discharge by the physician and had no trouble in finding the parasite in the fresh blood. This child had been out of doors for over two weeks, and if a female tick (ticks were quite numerous near the house) had bitten her and escaped destruction the parasites in the blood taken in by the tick would have undergone development, and the young ticks, when hatched out, would be ready to infect prospective victims.

"While the above facts and conclusions tend strongly to the belief that the ticks are necessary for the transmission of the disease, the actual fact cannot be proved scientifically until carefully controlled experiments are made on non-immune persons." (Anderson, *ut supra.*)

The tick in question is in all probability *Dermacentor reticulatus.*

MORBID ANATOMY.—Rigor mortis is intense, and appears early. The skin is jaundiced, has a mottled appearance, and the wounds caused by the tick bites may be present. Petechial spots, bright to dark purple in color, and from 1 to 3 cm. in diameter, are found, chiefly on the wrist, ankle, arm, and leg. The spleen, liver, and pancreas are much enlarged; the kidneys are also enlarged.

SYMPTOMS.—There is a period of incubation of about a week. The patient complains of nausea, general malaise, and a chill; this latter is followed by a fever which reaches its highest point about the tenth day, is characterized by evening rise and morning remissions, lasts about two weeks, and may be followed by subnormal temperature. In severe cases the morning remissions may be absent, and the fever remains high (from 104° to 106° F.). There are general pain and soreness, particularly during the first week, coated tongue with red edges, sordes, constipation, nausea which persists in severe cases, scanty urine with albumin and casts, and epistaxis. The liver and spleen may be enlarged. The pulse is high, and out of all proportion to the fever; the respiration is also increased. An examination of the blood shows: (1) the parasite described above; (2) a decrease in the percentage of hæmoglobin; (3) a decrease in the number of the red blood cells; (4) a slight leucocytosis, chiefly of the large mononuclears. Bronchitis is present during the second week; and in severe cases lobar pneumonia supervenes, with a grave prognosis.

"*The eruption* appears usually on the third day, first on the wrists and ankles, then on arms, legs, forehead, back, chest, and, last and least, on the abdomen. It is never very abundant on the abdomen, but the other portions of the body, in some cases, are literally covered by the eruption.

"At first the spots are of a bright red color, macular at all times, from a pin point to a split pea in size. At first they disappear readily on pressure and return quickly, but if the case is a severe one they soon become darker and in some cases are almost purple. From about the sixth to the tenth day of the disease they fail to disappear on pressure and are distinctly petechial in character. In favorable cases, about the fourteenth day, they begin to lose their petechial character and disappear slowly on pressure. In some cases the eruption consists of small, brownish spots, giving a turkey-egg appearance.

"As the fever declines the eruption begins to fade; but a slight return of fever or a free perspiration will cause it to show distinctly.

"When convalescence is well advanced desquamation begins and extends over the entire body. In very severe cases there may be gangrene of the fingers or toes, and still more frequently of the skin of the scrotum and penis. The skin is always jaundiced to a greater or less degree. This is usually first noticed in the conjunctivæ, the vessels of which are congested from the outset." (Anderson, *ut supra.*)

	Tick fever or spotted fever.	Typhoid fever.	Typhus fever.
Contagion	Non-contagious	Not contagious in the ordinary acceptation of the term.	Very contagious.
Geographical distribution.	From 40° to 47° N.	Universal	Almost universal.
Season	March to July	All the year; chiefly July to November.	Generally in the winter.
Eruption—			
Date of occurrence.	Third day	Second week	Third to fifth day.
Site of first appearance.	Wrists and ankles, arms and legs.	Abdomen and back.	Abdomen, flexor surfaces of forearms, and general, except on face.
Blood examination.	Shows parasite	Eberth's bacillus in cultures from blood. Widal reaction.	Negative.

Diagnosis.—This is made from: (1) The case occurring in the region known to be infected; (2) history of a tick bite; (3) the eruption appearing on the third day, and being seen first on the wrist and ankles; and (4) the presence of the parasite in the blood. The diseases from which it is to be differentiated are typhoid fever and typhus fever, particularly the latter. The preceding table will assist in making a diagnosis.

Prognosis.—This is unfavorable. Up to the present the death rate from tick fever has been seventy to ninety per cent. in Montana; but in Idaho and Nevada it is much lower. The disease varies in malignancy both in different localities and in different years in the same locality.

Treatment.—The treatment has so far been unsatisfactory; but in five cases, all treated by quinine, all recovered. Anderson suggests the bimuriate of quinine, 1 gm. (gr. xvi.) hypodermatically, q. 6. h.; or, by mouth, the sulphate of quinine in similar doses, q. 4. h. This drug should be given persistently from the commencement of the disease. The treatment is otherwise symptomatic, and includes cardiac stimulants, Dover's powder for the pains and soreness; tepid baths for the fever, and plenty of water to flush out the kidneys. The site of the tick bite should be cauterized with ninety-five-per-cent. carbolic acid.

R. J. E. Scott.

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Anderson, John F.: Spotted Fever (Tick Fever) of the Rocky Mountains. Bull. No. 14, Hyg. Lab., U. S. Pub. Health and Marine-Hospital Service, Washington, p. 50. From this pamphlet, which gives all that is known of spotted, or tick fever, the above article has been compiled.

TYPHOID FEVER, BACTERIOLOGY OF.—The bacillus of typhoid fever was discovered by Eberth in 1880, but not until four years later was it obtained in pure culture. This pure culture was isolated by Gaffky from the spleen and mesenteric lymph glands of patients dying from typhoid fever. In cover-slip preparations from pure cultures it stains well with any of the ordinary aniline dyes.

Morphology.—The morphological characteristics of this organism are as follows: Its length varies from 1 to 4 μ, its diameter from 0.4 to 0.9 μ. The ends are always rounded. In cultures, and more especially in potato and old bouillon cultures, these organisms are often found grouped together in chains, sometimes as many as four or five in a chain. They are rapidly motile, this motility being due to the fact that they possess flagella, the number of which varies from eight to twenty. These flagella are attached to the bacillus at all points of its surface, that is, not only on the ends, as is the case in many bacteria, but also at its sides. For demonstrating these it is necessary to use a special method of staining. In my experience Loeffler's method has proved to be the best. Take two cover slips which have been thoroughly cleansed and are free from grease, and place on each one of these a drop of sterile water; then with a platinum needle touch the surface of an eighteen-hour agar culture of the bacillus, and draw the needle thus charged through first one drop and then the other; finally, cause the drop to spread out over a larger area and allow it to dry. By this method we obtain a good dilution in parts of the smears. There is no need to fix in the flame, as the mordant is a good fixative. The solutions required are as follows: First, a twenty-per-cent. aqueous solution of tannic acid; second, a saturated aqueous solution of ferrous sulphate (not to be heated); third, a saturated alcoholic solution of either fuchsin or gentian violet. Take of solution number one. ten parts; of number two, five parts; and of number three, one part. Let them stand for an hour and then filter; use at once. Flood the cover slip with this mordant (either of the first two solutions) for one minute, and then wash gently in distilled water; drain off the excess of water, and flood the slip with aniline fuchsin or aniline gentian violet, and warm carefully for one minute. Do not heat sufficiently to produce steam. Wash again in water and dry; then mount in Canada balsam. Another good method is that described by L. Smith in the *Journal of Medical Research*, vol. i., new series, p. 341. The dye which he uses is night blue; it gives a very beautiful picture, and is very easy to manage.

Cultural Characteristics.—The bacillus grows best at body temperature (37.5° C.), but it grows well at room temperature. Its thermal death point is 60° C., after an exposure for twenty minutes. According to Park the organism will live for five months when frozen, but not longer. It grows well on all media. In bouillon it forms a uniform cloud throughout the tube, and often will develop a heavy pellicle on the surface. On agar it produces a growth of a pearly white; on gelatin the growth is whitish and no liquefaction takes place; on potato the growth can hardly be seen at the end of forty-eight hours, but still older cultures may show a dirty-yellow growth. This organism grows well in milk without the production of acid from the lactose. There is, however, a slight primary production of acid. It does not coagulate the milk. In Dunham's solution it does not form indol. It does not cause any of the sugars to ferment with gas production. These last three cultural characteristics are used as a means of differentiating the typhoid bacillus from the colon and paracolon and the paratyphoid groups.

During the past few years there have been isolated from patients suffering from what seemed clinically to be a typhoid infection bacilli which did not answer culturally to the Bacillus typhosus, and did not agglutinate in serum which agglutinated this bacillus. The serum from the patient from which the organism had been isolated did not agglutinate the typhoid bacillus, but did agglutinate the isolated organism. These organisms when tested culturally behaved in some ways like the B. typhosus, while in other ways their behavior was like that of the Bacillus coli communis; hence they have been termed intermediates, and some bacteriologists have gone so far as to divide them into sub-groups. The organisms are often spoken of indiscriminately as para-typhoid or paracolon bacilli.

So many of these intermediates have been isolated that it will be impossible to discuss them all here. It might be stated, however, that the great majority of the cases suffering from infection with these intermediate organisms have run a very mild course, and they do not seem to be as pathogenic a group, on the whole, as that of the Bacillus typhosus.

The following short table will give a good idea of the position of this group:

	Bacillus typhosus.	Intermediates.	Colon bacillus.
1. Formation of indol in Dunham's solution in forty-eight hours.	Negative results.	Some positive results.	Positive results.
2. Coagulation of milk	Negative results.	Negative results.	Positive results.
3. Fermentation with production of gas in—			
(a) glucose bouillon	Negative results.	Positive results.	Positive results.
(b) lactose bouillon	Negative results.	No positive results.	Positive results.
(c) mannit bouillon	Negative results.	Some positive results.	Positive results.
4. Agglutination with specific serum—			
(a) typhoid serum	Positive results.	Negative results.	Negative results.
(b) intermediate serum	Negative results.	Positive results.	Negative results.
(c) colon serum	Negative results.	Negative result.	Positive results.

Of the intermediates which have thus far been isolated, the following are among the more important, historically as well as bacteriologically: Gaertner's, Cushing's, Gwyn's, Schottmüller's, Buxton's, and Libman's.

Agglutination.—This phenomenon does not belong exclusively to the subject of this article, but I shall treat

of it fully for two reasons: first, because it was the study of this reaction with the B. typhosus that stimulated a great amount of research in regard to this phenomenon as an aid to diagnosis; secondly, because of the importance of this test and on account of the many errors to which it may lead unless it be fully understood. In 1884 Charrin and Roger, while working with the Bacillus pyocyaneus, observed the clumping of the bacilli, but they pushed their study of this phenomenon no further, and it was not till 1896 that it was again brought forward, this time by Gruber and Durham. These investigators immunized animals against various strains of bacteria, and they found that the serum of these animals had the property of clumping the bacteria when the bacteria were brought in contact with it; and, furthermore, they found that this action was fairly specific, that is, the serum from any animal which they had immunized would only clump the species of bacteria which had been used to bring about this immunization. They therefore advocated that this phenomenon be utilized for the purpose of differentiating species of bacteria. They did not, however, in their published work, suggest the use of serum taken from these patients as a means of determining what species of bacteria were causing the infection.

During this same year (1896) there was published a paper by Widal and Grünbaum in which they outlined a clinical test for typhoid fever based on the phenomenon of clumping. They were the first, therefore, to point out the value as a means of diagnosis, and the first also to devise a technique for carrying out the test. Since their paper was published this test has been used in all parts of the world, and legion are the papers that have been published on it.

The Technique.—The requisites are: 1. An actively motile culture of B. typhosus. This is best obtained by emulsifying a twenty-four hours' old agar culture in 10 c.c. of an 0.85 per cent. sodium-chloride solution; or by transferring from three to six loopfuls of a twenty-four-hour agar culture to a tube containing bouillon, shaking this thoroughly and incubating at 37° C. for an hour or two; or else one may transplant the typhoid bacilli from day to day into tubes of bouillon and let the growth proceed on the top of the thermostat. 2. The blood to be tested may either be in a dried condition or else it may be collected in capillary tubes and the serum obtained from these after coagulation. By the latter method we can measure our dilutions with almost perfect accuracy, a thing which it is impossible to do if we use a dried specimen. In the latter case it is necessary to dissolve out the substance representing the serum by letting the water used for the solvent completely surround the dried spot or stain. Then be careful not to move hastily or rub any of the clot loose. Only in this way is it possible to obtain a serum free from fibrin and blood corpuscles.

The mixture of the culture and serum may be observed in two ways: First, in the test tube; and, second, in the hanging drop. For the latter test are needed a microscope with a No. 3 or a No. 4 eyepiece, a one-sixth or one-seventh objective, hollow-ground slides, and absolutely clean cover slips (No. 1 or No. 2). Surround the hollow on the slide with vaseline or alboline, so that when the cover slip is placed over it its edges will be sealed, and thus evaporation will be prevented.

In the hanging-drop method, one drop of the fluid containing the bacteria, and one drop of the serum fluid are mixed on the cover slip and examined. In my experience the hanging-drop method is the most accurate if it be properly controlled. In the test tube the reaction is apparent to the naked eye, for when the organisms are clumped they collect at the bottom of the tube in a flocculent mass.

The clumping of the bacilli should take place in thirty minutes with a dilution of 1 to 20; if it takes more than thirty minutes or a dilution of less than 1 to 20, it should not be regarded in the light of a positive reaction, for it may then be due to a number of other factors which are too numerous to mention here. Some specimens of serum will not agglutinate in a dilution of 1 to 20, but will do so if the dilution be increased 1 to 50.

Instead of a clumping of the bacilli we may have what is known as a thread reaction; that is, the bacilli become arranged end to end, or, failing to separate completely as they multiply, they remain in the form of threads or chains.

The Distribution of the Typhoid Bacilli in the Body.—These organisms are found in the different tissues and fluids of the body as well as in the contents of the intestinal canal. We will consider these different localities in regular order, but in a very brief manner.

The Blood.—The typhoid bacilli are found with the greatest constancy in the blood. In the earlier examinations the search for these organisms in the blood gave very unsatisfactory results. At a later date, however, it was found that by the use of blood in bouillon highly diluted the presence of the bacilli could be demonstrated in the great majority of cases.

The Spleen.—Masses of the bacteria are found in the sinuses of the spleen, and splenic puncture has been recommended as a means of securing an early diagnosis. Such an exploratory puncture, however, is not free from danger to the patient, and the procedure is therefore not to be recommended.

The Rose Spots.—The bacilli may be obtained from these spots as early as on the seventh or eighth day apparently, in most instances, before the development, in the blood, of the substances which give rise to the Widal reaction (Hiss).

The Intestines and Their Contents.—It is here that the bacilli make their earliest appearance in the majority of cases. They are constantly found in Peyer's patches, and more particularly at the base of those which are ulcerated. They pass from these tissues doubtless by way of the lymphatics, and find lodgment in the mesenteric lymph nodes. Many of them are found in the phagocytic cells of the lymphatic system and also in the fixed phagocytic connective-tissue cells of the spleen. They are found also in large numbers in the fæces.

The Liver.—In this organ there have been observed small areas of degeneration, which have been termed focal necroses. They are caused by the lodgment of the bacilli at these points, and as these organisms grow their toxin causes a degeneration of the cells surrounding them. According to some reports the bacilli have been found in the gall bladder many years after an attack of typhoid fever, and it is even believed by some writers that they furnish a nucleus for the formation of gall stones. Bile often causes an agglutination of the bacilli.

The Kidneys and the Urine.—The bacilli have been demonstrated in the kidneys, and they are found in the urine in about twenty-five per cent. of the cases, but not before the fourteenth or fifteenth day of the disease; in fact, they are not to be found in the urine in some cases until convalescence is established. According to most observers the bacilli may persist in the urine for days or even weeks. It is even claimed by some authorities that they continue to be present in the urine for a period of several months.

The Mouth and Throat.—The finding of typhoid bacilli by Besson in the tonsils of six out of ten patients investigated warrants the belief that they also exist in the mouth.

The Lungs.—In some rare cases in which there has been a pneumonic form of infection, the bacilli have been found in the lungs. Indeed, in those cases in which an overwhelming blood infection—in other words, a septicæmia—occurs, they will be found in all the tissues of the body.

As the infection is not symmetrically distributed in all cases, there can be no one method of securing an early diagnosis. Hence, if he wishes to make a sure bacteriological diagnosis, the bacteriologist must take time, and it often happens that the clinician can be fairly certain of his diagnosis before he hears from the laboratory. Nevertheless, a bacteriological diagnosis is most important as a means of corroborating the clinical diagnosis.

Animals infected with B. typhosus have developed only in rare instances a disease at all comparable to that in man. So far as practical serum therapy is concerned, it has ever, in this disease, shown negative results.

MEDIA USED AS AN AID TO THE ISOLATION OF THE BACILLUS TYPHOSUS.—Many different media have been devised for use in isolating this organism, but there are only four which have stood the test of time, and which, in the hands of the trained bacteriologist, are admitted to be more or less effective in isolating the typhoid bacilli. The simplest one is that devised by Hiss. For completing the differentiation, however, Hiss uses two different media. His first step is to plate out some of the suspected material in a medium the composition of which is as follows:

Hiss' Plating Medium.

	Gm.
Agar	15.
Gelatin	15.
Liebig's extract	5.
Sodium chloride	5.
Dextrose	10.
Distilled water	1,000.

The agar is first melted and then the rest of the ingredients are added. After the mixture has boiled for a few minutes, it is allowed to cool and is cleared with the white of two eggs. Then it should be boiled again and filtered through a thin layer of absorbent cotton. Before filtering see that the total amount of fluid is 1,000 c.c.; and, if it be found to be less than this amount, add enough hot distilled water to bring it up to that point.

I have found that this is one of the most important points in making up this plating medium. No acid or alkali need be added to the mixture.

In this plating medium the typhoid colonies form thready growths, while the colon colonies are round with smooth edges. The colonies showing threads are fished out and plated in Hiss' tube medium, which is composed as follows:

Hiss' Tube Medium.

	Gm.
Agar	5.
Gelatin	80.
Liebig's extract	5.
Sodium chloride	5.
Dextrose	10.
Distilled water	1,000.

This medium differs from the first, as will be observed, in having 10 gm. less of agar and 65 gm. more of gelatin. The mixture is also cleared with the white of two eggs and is corrected to 1.5 acid, phenolphthalein being the indicator.

In this tube medium the Bacillus typhosus clouds it throughout in twenty-four hours. B. coli generally shows growth and gas formation only along the line of puncture. This medium has given us many excellent results, and I prefer it to all the others.

Elsner's Method (*after Park*).—1st. Grate 0.5 kgm. of small potates to a fine pulp and add one litre of cold water; let it stand over night in a cool place.

2d. Wash thoroughly and strain through a fine cloth. This must be done while the mixture is cold.

3d. Boil the filtrates and filter again.

4th. Add ten per cent. of gelatin and boil until it is dissolved.

5th. Test the acidity and have it so that 3 c.c. of a decinormal sodium-hydrate solution will neutralize 10 c.c. of the medium, phenolphthalein being the indicator.

6th. Boil and clear with egg.

7th. Filter through cotton and then through paper.

8th. To the filtrate add one per cent. of potassium iodide. (Use a solution so made that 1 c.c. shall contain 1 gm. of the salt.)

9th. Decant into tubes and sterilize.

The incubator for this medium must be kept at from 22° to 24° C.

The plates must be thoroughly cooled before placing in the incubator, as otherwise the difference between B. typhosus and B. coli would not be observed.

The colon colonies are the first to develop. They are rough and granular, and have a greenish-brown color; later, the typhoid colonies develop and are small, white, and gleaming, and can best be described as being dew-drop-like in appearance, although occasionally somewhat granular. This is apt to cause some confusion in the mind of the beginner, but one who is familiar with the use of this medium is very little likely to make a mistake. The potassium iodide prevents nearly all other organisms from developing in this medium.

This plating medium, used in conjunction with Hiss' tube medium, gives us a very satisfactory differential method.

The Capaldi plating medium and that formulated by von Drigalski and Conradi have in my hands furnished such variable results that I scarcely think it necessary to describe them here. The latter is a very complicated medium, by no means easy to prepare.

Distribution of the Bacilli Outside the Body.—The Bacillus typhosus may remain in contaminated soil for from two to three months, and in water for nearly the same length of time. On the other hand, if either the soil or the water contains enough organic matter for the support of the organism, it may remain there indefinitely.

The past few years have witnessed no change in our ideas regarding the transmission of typhoid fever. In fact, the theories of that time have merely been strengthened, and all are now agreed that in the vast majority of cases it is through the alimentary tract that the infection gains entrance to our system. In a few rare instances it is believed that the infection has been brought about by the inhalation of the Bacillus typhosus into the lungs.

There still remain to be considered the different methods by which this organism can gain entrance to the intestines. First, we may have a direct infection, that is, from a person suffering from the disease to one who has come in contact with the patient. When infection occurs in this manner some infected material must pass, through carelessness, to the alimentary canal of the individual contracting the disease; for, if perfect cleanliness and caution are observed, this form of infection need never occur.

Unless the excreta of the patient be thoroughly disinfected they will pollute the soil, and the infective organisms which they contain will remain quiescent until they are washed into some water supply, from which they gain entrance into some other human being. This may happen in any of the following ways: directly, as in drinking water or in ice, or in milk to which contaminated water has been added, either for purposes of dilution or in cleansing the receptacle. In milk the bacilli will multiply rapidly, unless the milk be kept constantly iced. If there be a large source of pollution, from which the polluted material drains into a river or creek, the submerged banks of which are used for the fattening of oysters, these will take in the bacilli and will furnish them, if decomposition should begin to develop in the host, with a soil most favorable for their rapid multiplication. It is under these circumstances that oysters may serve as the source of typhoid infection among those who eat them in an uncooked state. (At some later date the author proposes to publish the experiments which he has made in this special field.)

If the excreta be thrown into sinks and privies where flies congregate in large numbers, these insects will transfer the infected material to the house—*i.e.*, they will deposit it upon any food, cooked or uncooked, to which they may gain access. This is probably a frequent mode of spreading typhoid infection among the different members of a family after one of their number has been taken ill with the disease. Nothing short of the most thorough disinfection will prevent such a spreading of typhoid fever.

Raw vegetables may serve as carriers of the disease

provided they have been watered with infected material or have been washed in infected water, in preparation for their appearance on the table.

Ice cream, when manufactured of milk or cream which contains typhoid bacilli, and which has not been cooked, may serve to communicate the disease.

Major Firth, of the English Army Medical Corps, has recently shown that clothing which has been soiled by the excreta of a patient suffering with this disease may retain the virulent typhoid bacilli at the end of eighty-four days. Consequently soiled clothing, unless disinfected, may be a means of spreading the disease. The same authority has also shown that the bacilli may remain fully virulent in the soil for eighty-five days, and we know from other observations that it can remain so for much longer periods. Major Firth also claims that they may retain their virulence for twenty-five days after having been dried and blown about as dust. If this be so, it is certainly a matter of great importance, for it shows that the typhoid bacillus is a much more resistant organism than we have given it credit for being. This observation, however, must first be confirmed by other authorities before we can accept it as a fact.

To sum up, then, we find that there are three great roads by which infection reaches human beings. These are, first, personal contamination from person to person; second, contamination of water supply and therefore of milk and food; and third, the spread of the bacilli by household insects such as flies, cockroaches, etc.

From this it will be seen that the great weapons for combating the spread of this disease are, first, thorough disinfection of all excreta from the patient; and at this point I wish to emphasize the fact that it is of the greatest importance to disinfect and to handle carefully the urine of these patients. Our second weapon is the thorough sanitary supervision of our water supplies so that our water-sheds may escape contamination.

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VISION, DISORDERS OF: CHROMATOPSIA (*Colored Vision*).—Chromatopsia is a modification of the visual sensation, as a result of which all objects appear of a certain color (red, purple, blue, yellow, green, white), without any effect upon the acuteness of vision or any visible changes in the fundus.

Erythropsia (*Red Vision*), the most common variety, is not infrequent after cataract extraction, occurring in three to five per cent. of cases (Becker), and after exposure to intense light, for example, sunlit snow fields especially in high regions, brilliant electric light, flashes of lightning, and observation of the sun. This visual disturbance becomes more marked when the illumination is suddenly diminished, as after going from the open into a house. After cataract extraction there is less frequently purple or *blue vision* (*kyanopsia*), or the patient complains of objects appearing of a glaring white. The phenomenon generally appears shortly after the operation, or after some days or weeks; it lasts a variable number of hours, days, weeks, or months; it may be constant or intermittent; it generally disappears in the course of a few days or weeks. No treatment is called for beyond the wearing of smoke-tinted glasses; potassic bromide has been recommended in these cases.

Independently of cataract extraction, the occurrence of colored vision is favored by dilatation of the pupil, congenital coloboma of the iris, iridectomy, by excitement of any sort, and by elevation of body-temperature. Red vision is an occasional symptom of optic-nerve atrophy, glaucoma, nyctalopia, migraine, hysteria, hystero-traumatic amblyopia, and amaurosis, exhausting diseases, and severe fevers; it sometimes occurs with intra-ocular hemorrhage; it may be part of the epileptic aura; it is said to be caused by coffee in rare instances. Blue vision is occasionally complained of by patients suffering from retinitis albuminurica and detachment of the retina, and may also follow the use of cannabis indica. *Green vision* (*chloropsia*) is a rare symptom of detachment of the retina, optic-nerve atrophy, and aphakia as the result of cataract extraction. Blind eyes occasionally are conscious of colored lights, probably due to irritation of the visual centres.

It seems probable that chromotopsia may be due either to central irritation or to local causes. No entirely satisfactory explanation of the phenomenon has yet been offered. Fuchs attributes red vision to the action of strong light on the visual purple and its slow regeneration under less intense light; but the absence of visual purple at the macula upsets this theory. Snellen believes it to be due to the coloring of white light by its passage through the translucent and vascular lids and choroid, and the subsequent diffusion of this reddish light over the retina. After the extraction of cataract, upon exposure to bright light, the lids are partly closed; there is thus a small central pupillary opening for white light, while the periphery of the retina is flooded with red light which has come through the lids. When the intensity of the illumination is reduced, the red perception of the periphery changes to a complementary green as a result of fatigue, while central vision appears red by contrast. The blue vision after cataract extraction is attributed by Burnett to fatigue of the retina as a result of long-continued exposure to light rendered yellow by passage through amber-colored cataracts, giving blue as a residual sensation in white light.

Toxic Chromatopsia.—Colored vision, usually yellow (*xanthopsia*), is one of the symptoms of the poisonous effects of certain drugs, of which santonin is the most common example; this agent may, however, produce green vision, or rarely red or blue vision. Other drugs which may produce chromatopsia are amyl nitrite, picric acid, chromic acid (as a result of local applications), osmic acid, digitalis, carbonic oxide, and tobacco. Xanthopsia also occurs as an early symptom of catarrhal jaundice, being due probably to the discoloration of the dioptric media and the structures of the eyeball by bile pigment. Yellow vision is also seen after dazzling from electric light, and occasionally accompanies nyctalopia.

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WOLFFIAN BODY, PATHOLOGY OF.—In mammalian embryos the mesonephros or Wolffian body is a rather pyriform body symmetrically placed in the abdominal cavity. In very young embryos it is, next to the liver, the largest abdominal organ. It was first observed by Wolff in 1759. The exact origin of the Wolffian body is not yet determined; some authors hold that it is ectodermal, others that it is mesodermal, while others still ascribe to it both an ectodermal and a mesodermal origin. It is developed from the pronephric or Wolffian duct and from the mesonephric cords. The origin of the latter has not yet been wholly worked out in the case of the human body. In the lower mammals they arise through aggregations of the cells of the Wolffian ridge into solid cords which at first are not connected with the Wolffian duct or the cœlomic epithelium. These cords acquire a lumen and connect at one end with the duct, while at the other end there is a condensation of the mesoderm, forming the glomeruli, into which vessels from the aorta penetrate. The tubules increase in length rapidly and in the human embryo assume an **S**-shape. Secondary and tertiary tubules develop in connection with each of the primary ones, but the mode and origin of these have not yet been determined, some writers hold-