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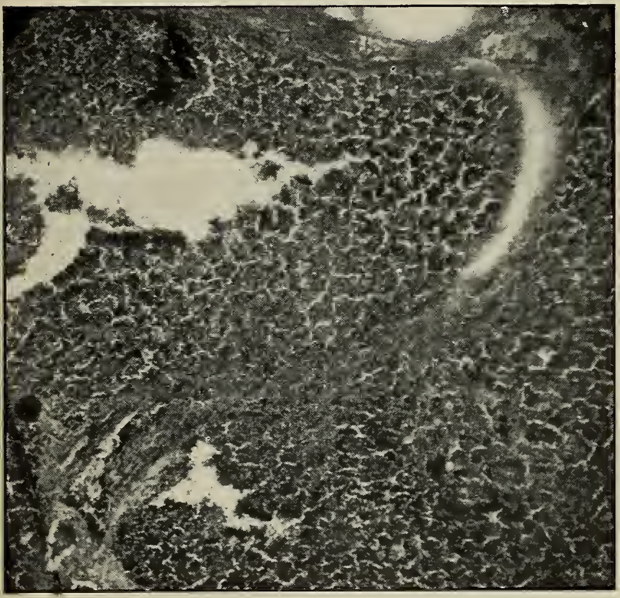

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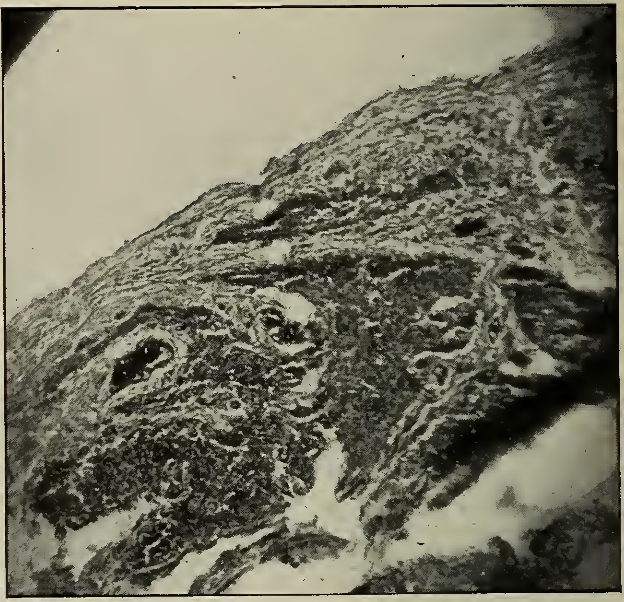

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The photomicrographs for this article were made in the scientific laboratory of Parke, Davis & Co.

No. 1. Section of normal thymus of rabbit.

No. 2. Section of thymus of rabbit after moderate irradiation with diminution of glandular cells.

No. 3. Section of thymus of rabbit after severe irradiation, with disappearance of glandular elements and excess of fibrous tissue.

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## X-RAY THERAPY OF ENLARGED THYMUS.

BY DR. SIDNEY LANGE, CINCINNATI.

It is the purpose of this paper to report four cases of enlarged thymus treated by X-rays, to make a plea for the consideration of enlarged thymus as a separate entity, apart from the so-called status lymphaticus of Paltauf, and by experiments upon young rabbits to demonstrate the action of the X-ray upon the thymus.

Case 1. E. L., male, aged 7 weeks, was referred for X-ray treatment because of cyanosis and inspiratory stridor. The diagnosis of enlarged thymus was based upon the presence of an abnormal area of dullness over the upper part of the sternum.

The family history strongly supported this diagnosis. A previous child which was normally delivered at full term developed, a few days after birth, a marked cyanosis which persisted without remission. At the age of three months it began to have attacks of suspended respiration, with extreme cyanosis, which attacks were relieved by raising and lowering arms above head. This child died suddenly in one of these attacks at the age of four months.

The present baby was delivered normally at full term, weight at birth, 6½ lbs. It was breast-fed. From birth it was noticed that the child's color was not good, appearing dusky and blue at times. When about two weeks old, he began to snuffle in respiration as though there were an obstruction in the nose. The respirations became wheezing in character and at times noisy. After crying, very rapid crowing inspirations would occur, and cyanosis very marked.

When presented for treatment child was seven weeks old, and weighed 8¼ lbs. Color was dusky, and at times decidedly blue, especially marked after crying. Mucous membranes were pale, hands and feet cold. The child was very restless, arms and legs jerking, and head and body constantly moving.

The respirations were accelerated and noisy. There was a snuffling in nose and wheezing in chest, alae nasi flared slightly in inspiration, and there was some retraction of the jugulum and intercostal spaces.

Chest examination revealed the above-mentioned area of dullness over the upper part of the sternum. Heart action was normal, although a diagnosis of congenital heart disease had been previously made.

Tonsils, liver and spleen were not enlarged, nor were any glands palpable.

Blood examination showed a white count of 12,000 with 60% small lymphocytes.

The skiagram which was made with difficulty because of great restlessness of child, showed a broadening of the upper mediastinal shadow.

X-ray exposures were given twice a week, the treatment extending over a period of two months, during which time fifteen exposures were made. The details of the technique need not be entered into here, save to say that all injury to the skin was avoided by using a leather and aluminum filter with a high tube.

The response was prompt. The dyspnoea and cyanosis rapidly improved, appearing only at infrequent intervals after crying and occasionally in morning on awakening. The restlessness disappeared, the child became quiet and playful.

Two and a half months after beginning treatment child appeared normal, except after a severe crying spell when slight duskiness would appear. The skiagram showed a decrease in the breadth of upper mediastinal shadow. When discharged from treatment, blood examination showed a white count of 9,500 with 35% small lymphocytes.

Case 2. Baby S. This case was reported in full by Dr. B. K. Rachford before the Association of American Physicians, May, 1910. It is from his notes that I make the following report:

The baby was delivered normally at full term, weight 6½ lbs. Breast-fed for one month, then weaned because of indigestion. When about a month old, mother noticed that the baby's feet were usually cold and often blue. At 5½ months had an afebrile attack of what was called "bronchitis," which lasted one month. Then a similar attack occurring at age of seven months with violent spasmodic cough and dyspnoea. This condition of cough and stridor continued three weeks when his adenoids were removed under chloroform anaesthesia in the hope of relieving his symptoms. Two days after the operation the symptom group recurred, now the stridor and dyspnoea interfered with his taking food. One month after the first operation a general and more radical operation was undertaken, for removal of tonsils and adenoids. A few days after this second operation, the symptoms reappeared and gradually increased until he was brought to Cincinnati two weeks later. In addition to the stridor and cyanosis there was a marked prostration. So urgent were the symptoms, that the child's father, who was a physician, prepared himself with tracheotomy instruments before leaving home as he feared a tracheotomy might be necessary on the train.

The physical examination as recorded by Dr. Rachford revealed an enlarged thymus by percussion. The child was pale, fat and flabby. Blood examination showed a chloranaemia and well marked lymphocytosis. Stridor was so constant and severe that the child could not take food. Attacks of paroxysmal cough and cyanosis coming on at short intervals threatened his life. Lymphatic glands were palpable and spleen slightly enlarged. Tuberculin skin test was negative.

X-ray treatments were begun at once over the upper mediastinum, exposures being made over front and back. Child at this time was 9½ months old.

Within 48 hours after the first treatment there was slight improvement. This improvement continued uninterruptedly over six weeks, during which 13 treatments were given.

Cough and stridor had practically disappeared and the thymus dullness decreased to normal bounds.

Satisfactory radiographs of this case could not be obtained as the child, because of the stridor, would not remain quiet for even half a second.

Two weeks after returning to his home in Kentucky the father reported that the child was apparently well; at intervals of about three months thereafter, the child had three slight attacks of cough and dyspnoea. Each time he was brought to Cincinnati promptly, and given one or two X-ray treatments which at once dissipated the symptoms. One year after beginning the treatment the father reported that child seemed perfectly well.

Case 3. Baby N. was delivered normally at full term. The child breast-fed for three weeks and was then given in addition three bottles of milk a day because of insufficiency of mother's supply. At birth a rattling in the throat was heard and a few weeks later a crowing inspiration began. The picture was a peculiar one. In addition to the usual accompaniment of an inspiratory dyspnoea the child presented a prominence of the upper sternum, and a peculiar asymmetry of the chest. The right side of the chest bulged out prominently and the left side appeared sunken, there was an area of abnormal dullness over the upper mediastinum extending to the right. The clinical picture, however, was that of a foreign body in the left bronchus interfering with aeration of the left lung. The possibility of the presence of such a foreign body and the advisability of a bronchoscopic examination was under consideration when an X-ray plate was made. It showed a broadening of the upper mediastinal shadow, and X-ray treatments were begun by way of trial. The asymmetry of the chest made the diagnosis of enlarged thymus appear somewhat doubtful. Furthermore, a blood examination of this child showed a practically normal blood picture for a child of this age. The tonsils, spleen and lymphatic glands did not appear enlarged.

At the beginning of X-ray treatment child was 3½ months old and weighed 12 lbs. The desperate condition of the child at this time was such that when the child was brought into the waiting room the crowing inspiration could be heard in the next room, although the door between the two rooms was closed. Ten treatments were given over a period of eight weeks. The improvement was prompt. The crowing subsided and nursing became less difficult. When discharged from treatment respiration was almost normal, stridor appearing only at intervals as after feeding or crying. Improvement continued during next two months, after which slight wheezing would occur at infrequent intervals, especially noticed early in morning. Child's development was progressive, gaining about one pound a month, and when last heard from was one year old and weighed 18 lbs. The mother reported that some wheezing still occurs at times, especially during sleep. A few more X-ray treatments would be probably advisable in this case, but as the symptoms are so slight and the child's development is progressive, the normal involution of the gland may be awaited.

Case 4. Baby B. aged seven months. There was nothing noteworthy in the previous history of the child. The present complaint began several months before beginning the X-ray treatment. The mother noticed that the child made a rattling noise in breathing, which noise was especially marked during nursing and immediately thereafter and when the child becomes excited. The child seemed nervous and restless. During the night the child would awake suddenly and would cry and seem to have difficulty in breathing. Upon examination the child appeared restless, although bright for its age. The skin and mucous membranes were pale. Tonsils, lymphatic glands and spleen were not enlarged. Blood examination showed a chloranaemia but no marked lymphocytosis. Inspiration was audible at all times and when the child became excited a peculiar rattle accompanied the inspiration. Percussion revealed a slight dullness over the upper mediastinum.

X-ray plate showed a broadening of the upper mediastinal shadow, especially to the left.

Seven X-ray treatments were given which improved the child so much that the mother considered the child cured and although further treatment was advised failed to bring the child in. The child began to gain steadily in weight, seemed cheerful and slept well.

Since 1858 (2) when the first exhaustive monograph upon the anatomy of the thymus gland appeared, the literature of this organ has been largely speculative, often contradictory. Not only is the physiology and pathology of the gland very uncertain, but even its anatomy, both gross and minute, is unsettled. That the gland is always present and relatively large at birth, and that it continues to increase up to puberty and then gradually involutes, seems to be the commonly accepted view.

The most recent work upon the histology of the thymus is by Pappenheimer (3). The thymus arises from the endodermal epithelium of the third branchial clefts and is therefore epithelial in origin. Histologically the thymus consists of large irregular reticular cells, with irregular prolongation forming a protoplasmic network in which the small thymus cells are scattered. These small thymus cells bear close resemblance to the small lymphocytes of the blood, but according to Pappenheimer can be differentiated from the small lymphocyte by the fact that the protoplasm of the small thymus cell is almost invisible, being never sharply circumscribed and frequently shows cellular connections with the reticulate epithelium. It is furthermore never intensely basiphilic. The thymus gland further differs from a lymph gland by the absence of a definite capsule, by the absence of a fibrous reticulum, and by the presence of such peculiarly differentiated structural elements as the mononuclear oxyphilic granular cells, the Hassall bodies and the myoid cells. The thymus histogenetically and histologically bears an uncertain relation if any to the lymph glands. While an enlarged thymus is usually accompanied by the condition known as status lymphaticus of Paltauf (4) either as a concomitant lesion, as a cause of the status lymphaticus as suggested by Hart (5), or as an effect, yet in many cases of pronounced status lymphaticus the thymus is only very slightly or not at all enlarged. The microscopic findings in the thymus are not distinctly abnormal in any case of status lymphaticus except possibly some indication of delayed involution. In two of the cases of enlarged thymus here reported there were no signs of status lymphaticus such as enlarged tonsils, lymph glands and spleen, nor was there any lymphocytosis in these two cases. Furthermore, it is well known that the thymus may enlarge in any chronic infection, and that it is regularly enlarged in Addison's disease, and in exophthalmic goitre. Enlargement of the thymus, therefore, may be considered as a separate entity apart from the status lymphaticus of Paltauf, although it is the usual accompaniment of the latter, and the profound influence of the X-ray upon thymic enlargement of whatever origin should be borne in mind. This action of the X-ray upon the thymus is analagous to its action upon the spermatogenic epithelium of the testicles, or if we accept the lymphatic origin of the thymus, is comparable to the destruction of lymphocytes in lymphatic enlargements or in leukaemia.

Many of the pathological reports of so-called thymus deaths are misleading, first, because the histology of the thymus is generally unfamiliar, and secondly, because the normal weight of the thymus at any given age is uncertain. The weight at birth according to Hochsinger (6) is 3.6 G., with a gradual increase until the tenth year, after which it decreases, and after puberty disappears altogether. Friedleben gives 14 G. as the weight at birth. The generally accepted weight for the new-born is from 13 to 15 G., although it varies from 7 to 25 G. It is generally conceded that it increases up to puberty or a little beyond, when it may reach 20-25 G., after which it undergoes involution. According to Zezas (7) any persistence of an appreciable amount of gland tissue after twenty years is abnormal, whereas Pappenheimer concludes that the thymus is functional more or less throughout life.

Hammer's (8) table gives 13 G. at birth, increasing to 37 G. at 15, down to 24 G. at 25 years, and then a gradual decrease to 6 G. at 70 years.

With such a great normal variation in the weight of the thymus the clinical diagnosis of enlargement of the thymus unless there are definite pressure symptoms, may be uncertain. The normal thymus in children according to some recent work of Levison (9) cannot be percussed, nor does it cast a shadow upon the X-ray plate. But an enlarged thymus if it be enlarged laterally can be percussed, and gives definite skiagraphic evidence of its presence. Hochsinger has shown that this area of abnormal dullness and this abnormal X-ray shadow appears continuous with the upper border of the heart and is often mistaken for an upward enlargement of the heart boundaries. But for the production of pressure effects, it is chiefly the thickness of the gland that is of importance. In the new-born the distance between the sternum and the spine is not more than 2 cm., and a thymus which is enlarged antero-posteriorally and not laterally may evert serious pressure upon trachea or superior-cava without being evident to percussion or upon the radiograph. Denecke (10) reports such a case in which there was no thymic dullness. Yet, by a thymectomy, all the pressure symptoms were removed.

In all four cases here reported the symptoms were those of actual pressure upon air passages and blood vessels. This question of actual mechanical pressure by an enlarged thymus has been much discussed and doubted by some, notably Paltauf, because of the fact, that in many cases of "thymus deaths" the thymus, while enlarged, did not at autopsy seem to be compressing trachea or veins.

Drawing my conclusions from cases recorded in the literature, thymus deaths may be grouped under three headings. The first group includes those cases in which there are actual pressure symptoms appearing some time before death and the post-mortem reveals evidence of pressure upon the mediastinal contents. In the second group, the thymus while enlarged does not produce any prodromal pressure symptoms during life, and the post-mortem shows enlargement but no actual signs of pressure. The fatal issue in these cases is explained by a sudden swelling of the thymus, due to some exertion, as in crying, or due to some interference with the circulation as produced by certain positions of the patient, or as would occur in giving an anaesthetic. In these cases a vicious circle is established. In addition to the swollen thymus, the mediastinal veins become distended and the heart dilated which again react on the swollen thymus, the combination producing death.

In the third group, the deaths are extremely sudden without evidence of mediastinal pressure of any kind. Upon autopsy the thymus may or may not be enlarged. This group includes the true status lymphaticus of Paltauf, and the cause of death, according to Svehla's (11) theory and experiments, is "Hyperthymization."

However, the post-mortem state of the gland is not a criterion of its volume and relations during life, for vascular turgescence of the gland during life alters these relations. The swollen thymus presses upon veins which in turn become turgid and react on the thymus, thus greatly increasing the mediastinal pressure. The phenomenon was evidenced in Case 2 of this series. Placing the child on the abdomen with the head hanging low decreased the stridor, whereas, when the child was in the dorsal decubitus with head extended the pressure was increased. After Case 4 was discharged from treatment when the child slept with head thrown back, some stridor would appear.

Hedinger (12) in autopsies in 18 cases of "thymus deaths" in infants demonstrated pressure in the trachea in each case. Beneke (13) made similar observations and emphasized the fact that the simple throwing back of the head is often the direct cause of the sudden death. Rehn (14) by excising a small piece of the thymus and thus immediately relieving the symptoms, first proved by operative procedure that the thymus was exerting mechanical pressure. Jackson (15) by bronchoscopy demonstrated actual pressure upon the trachea in a case of enlarged thymus without any accompanying signs of status lymphaticus.

This increased mediastinal pressure is often exerted in asymmetric manner. It may interfere with the aeration of one or the other apex and produce misleading physical signs. Such anomalous physical signs were noted in several of the cases here reported. Oelsnitz (16) considers asymmetry of the chest especially characteristic of thymic enlargement, having observed it in six cases. Oelsnitz's observations served to dissipate the doubt in diagnosis in Case 3, which presented such marked asymmetry of the chest. Denecke (10) has reported a case in which a swelling of the superficial veins of the neck during crying was the only symptom of an enlarged thymus.

If, however, we put aside the pressure theory and accept Svehla's theory of hyperthymization in support of which he demonstrated that thymic extract injected into dogs produced full blood pressure, acceleration of pulse and death by suffocation, X-ray therapy may still be rationally employed, for with a decrease in the size of the thymus we may expect a diminution in the amount of secretion.

In this connection I may briefly mention a fifth case with marked constitutional symptoms but no marked pressure effects, the details of which are reported by Dr. Rachford.

The child, aged 16 months, was fat, flabby, anaemic and markedly lacking in physical development. Heart was dilated, pulse rapid, spleen, lymph-nodes and tonsils enlarged, and lymphocytosis marked. The thymus was enlarged upon percussion. The pressure symptoms were in the background and consisted in some shortness of breath, brought on by slight exertion. In twelve X-ray treatments, during six weeks, all of the above symptoms improved, lymph-nodes and spleen returned to normal. A severe anaemia persisted, which required appropriate treatment, for further details of which reference may be made to the original report. As in the other cases there was a slight recurrence of the symptoms, which have required a few more X-ray treatments.

In this case the enlarged lymphatic glands, spleen and the lymphocytosis returned to normal after the thymus was reduced by irradiation, although spleen and enlarged lymphatic glands received no X-ray exposures.

Over three years ago there was presented before the Cincinnati Academy of Medicine by Dr. Alfred Friedlander (1) the first case of enlargement of the thymus successfully treated by X-ray exposures. The patient was a child five weeks old, presenting inspiratory stridor, asthmatic attacks, cyanosis, enlarged spleen and lymphatic glands. Upon these symptoms together with an abnormal area of dullness over the upper part of the sternum extending laterally about 2 cm. to the right, a diagnosis of status lymphaticus and enlargement of the thymus was based. Nine X-ray treatments were given over a period of three weeks by the late Wm. H. Crane. The symptoms promptly subsided, and except for some pallor and slight cough the child developed normally. This plan of treatment was suggested by the classical experiments of Heinicke, who found that X-ray exposures had a profound influence upon the lymphoid tissues of young Guinea pigs, rabbits and dogs.

Since this original case, there is, aside from the five cases mentioned in this report, but one other case of X-ray treatment of enlargement of the thymus on record (a case by Myers quoted by Zezas), although various writers have referred to this method of treatment. By the operative method of removal of a portion of the thymus, many cases have been recorded. Zezas, up to Jan., 1910, collected 21 cases of so-called thymectomy from the literature with a mortality of 14%. By this operation but a small piece of the upper pole of the gland is removed, to relieve the urgent pressure.

In practically all of the operated cases on record the immediate result was an improvement in the urgent pressure symptoms, but not a complete relief of all the symptoms. The cure was later completed by the normal involution of the gland or by the relative decrease in the size of the gland, that is, the dimensions of the child's chest increase relatively more than the thymus and thus the pressure is removed.

The X-ray treatment is intended to accomplish similar results, except that the gland as a whole is decreased in size. The great advantage of the X-ray method is that it is free from danger.

Complete atrophy of the gland is not the desired result of X-ray therapy, and the treatments should not be pushed to that end. That the gland was merely reduced somewhat in size in the cases here reported is evidenced by the fact that there were in each case, slight recurrences of symptoms referable to an enlarged thymus, and by the fact that these symptoms could in one case be elicited after the X-ray treatment was completed by throwing the head backward, thus showing that the thymus was still of fair proportion. In another case, an X-ray plate made after stopping the treatment showed a decrease in size, but not a disappearance of the gland. As the experiments upon rabbits indicate, we can push the involution process as far as desired, and can avoid any possible after-effects as might arise from a complete atrophy of the gland. Our clinical experience of the slight recurrences and the experiments of Rudberg (18) upon rabbits show that a regeneration of a mild type follows the X-ray destruction, and this fact further guards against the production of complete atrophy of the gland.

Upon considering the tendency to recurrence after X-ray treatment in each case and noting the experiments of Rudberg showing rapid regeneration following irradition, it would seem that the X-ray exposures were given too conservatively in these cases. The vague fears of the mother as to the possible harmful effects of the ray, which fears are not infrequently shared by the physician often cause the X-ray operator to err on the side of conservatism and to treat too lightly and discontinue the treatment too soon.

Therefore, in view of the difficulty often encountered in the diagnosis of thymic enlargements, and in view of the prompt action and the harmlessness of a few X-ray exposures, Roentgen therapy may be rationally employed as a therapeutic test in obscure cases.

A failure of the X-ray treatment in a recent case has called attention to one disadvantage of this form of treatment. In X-ray therapy there is a latent period of 7 to 14 days between the time of giving the exposure and the time of the desired effects. The case referred to was that of a very young infant (8 or 10 days old) with urgent symptoms of thymic pressure as well as hyperthymization as evidenced by an extremely rapid heart action. This child died after receiving 4 treatments over a period of 6 days, well within the latent period for X-ray action. In such urgent cases where death appears to be a matter of a very few days thymectomy, followed perhaps by X-ray therapy, would seem to offer the best prospects.

To verify the above clinical results, the effect of the X-ray upon the thymus was studied experimentally, at the suggestion of Dr. Friedlander. For the experiments, young rabbits were selected, as it was found that they normally have a relatively large thymus. Brief reports of the first two series will be given.

Series one consisted of five rabbits seven weeks old, all of the same litter.

Rabbit No. 1, the first control (weight 825 Gms.) was killed at once and a large plump thymus was found weighing .55 Gms.

Rabbits 2, 3 and 4 were then subjected to X-ray exposures. A Walter 5 tube was used passing two milliamperes, target-skin distance—8 inches. Exposures of 15 minutes each were given three times a week. The rays were filtered through a lead and aluminum filter. All exposures were made over the ventral aspect of the thymus, the rest of the body was protected by a lead screen.

Rabbit No. 2 (weight 760 Gms.) was killed after receiving nine treatments over a period of 3½ weeks (body weight 840 Gms.). A small somewhat shriveled thymus was found, weighing .33 Gms.

Rabbit No. 3 (weight 680 Gms.) was killed after twelve treatments, over 4½ weeks (weight 675 Gms.). A very small thymus was found, weighing only .11 Gms.

Rabbit No. 4 (weight 790 Gms.) was killed after fifteen treatments, over 5½ weeks. Upon autopsy, the thymus had practically vanished. Some few small masses of what was apparently gland tissue and fat were found in the fascial covering of the great vessels. But so scant were these masses that no attempt was made to remove them for microscopic study.

Rabbit No. 5 (weight 755 Gms.) second control was then killed, and a large plump thymus weighing .44 Gms. was found.

Series No. 2 consisted of 5 rabbits, four weeks old, all of the same litter.

No. 1 (weight 275 Gms.)killed, as first control had a plump thymus, weighing .22 Gms.

Exposures upon Nos. 2, 3 and 4 were made as in the previous series, except that a Walter 4 tube was used, and the time of each exposure increased to 20 minutes. Twelve exposures over a period of three weeks were given.

The autopsy in each case revealed practical disappearance of the thymus. A few apparent gland remains and some fat masses could be seen in a thin connective tissue network. These remains were removed and prepared for microscopic study, which has not yet been completed, but it is likely that only a few traces of thymus gland tissue will be found. The weights of the tissue removed (consisting of fat, connective tissue and possibly some remains of the thymus) were respectively .020 Gms., .025 Gms., .01 Gm. The untreated control was then killed and a plump thymus was removed weighing .17 Gms.

The microscopic changes which were found in the atrophied glands of the first series were those of fibrosis.

The thymus of Rabbit No. 2, series 1, which was only partially atrophied, showed a great increase of the fibrous tissue separating the cell masses. Great bundles of it were seen penetrating the cells and apparently crowding them out.

In Rabbit No. 3, series 1, in which the thymus was very small and shriveled, only a few cell masses could be seen lying among dense bundles of connective tissue.

A study of the finer microscopic changes in the cells themselves will be given in a later report by Dr. Friedlander.

Interesting to note is the fact that thymus of the young rabbits of series 2 were more easily dissipated than those of the older rabbits of series 1.

Of great practical importance is the fact, that in neither series was there any alopecia produced by the X-ray exposures. In series 1, the hair over the exposed area was somewhat looser than over the rest of the body, but in series 2 no evidence of loosening of the hairs could be detected.

Note—Since writing this paper it was ascertained that Case 1 died six months after being discharged from treatment. Death was apparently due to a recurrence of the pressure symptoms. This again emphasizes the danger of recurrence of symptoms due to regeneration of the gland and the necessity of keeping the patients under observation for some time. As this patient was the first case treated, I was not aware of this possibility and did not instruct the mother regarding it.

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## BIBLIOGRAPHY.

(1.) Arch. Pediatrics, July, 1907.

(2.) Friedleben, Die Physiologie der Thymus, Frankfort, 1858.

(3.) Jour. of Med. Research, Feb., 1910.

(4.) Paltauf, Wien. Klin. Wchnschr., No. 46, 1889.

(5.) Hart, Muench. Med. Wchnschr., 1908.

(6.) Hochsinger, Stridor thymicus infantum, Vienn., 1904.

(7.) Zezas, Deut. Zeitschr. f Chirurgie, No. 12, 1910.

(8.) Hammer, Anatomisch Anzeiger, xxvii, 1905.

(9.) Levison, Jour. Am. Med. Ass., Sept. 17, 1910.

(10.) Denecke, Deut. Zeitschr. f Chirurgie, May, 1909, No. 6.

(11.) Svehla, Arch. f Exper. Path. u Med., 1900.

(12.) Hedinger, Jahrbuch f Kinderheilk, 1906, Bd. 63.

(13.) Beneke, Berl. Klin. Wchnschr., 1894, No. 9.

(14.) Rehn, Arch. f Klin. Chirurgie, 1906, Bd. 80.

(15.) Jackson, Jour. Am. Med. Assn., 1907.

(16.) Oelsnitz, Presse Medicale, Apr. 6, 1910, xviii, No. 28.

(17.) Hart and Nordman, Berl. Klin. Wchnschr, No. 18, 1910.

(18.) Rudberg, Arch. f Anat., 1907.

(19.) Anbertin & Bordet, Arch. des Maladies du Coeur, June 11, 1910, No. 6.

## DISCUSSION.

DR. HENRY K. PANCOAST, PHILADELPHIA.

The Society should feel grateful to Dr. Lange for this report on something new. This is a treatment which is undoubtedly of great value. Another reason why this report is a valuable one is that Dr. Lange not only gave us his results, but also an unbroken chain of reasoning for the existence of these results on anatomic and pathologic grounds, and later he will give us the microscopic report. That is the most important part of all in this work. If he has not already done so, he should note the effect of radiation on the thymus gland in different stages of treatment. In that way only can we prove what the effect of the ray is. The effect of radiation on a gland depends largely on its histology and in the case of the thymus that is a matter of doubt, as Dr. Lange mentioned. I think that I can see an explanation for the effect of the ray on the gland. If it consisted of epithelial tissue alone, I do not believe the effect from radiation would be as great as it is. The thymus is developed from the third branchial cleft as an epithelial organ primarily. Later, however, the gland is invaded by lymph tissue, which makes the treatment of this gland especially interesting to me because of my studies on the effect of radiation on the blood-forming organs. I have come to believe that the effect is largely due to the action of the rays on lymphoid structure. This is destroyed and to some extent there is also destruction of the epithelial tissue, leaving only the connective tissue. This being newly-formed lymphoid tissue in the infant suggests what we might find in an ordinary tymph gland.

This brings up another subject, which was suggested by Dr. Pfahler. If we are treating lymphoid structure which responds to X-ray treatment in an unusual way, as is the case in the lymphoid enlargements occurring in leukemia, there is a very rapid destruction of that lymphoid tissue, and we must be extremely careful of our dosage. We are treating infants and toxemia in infants is a very dangerous matter. Therefore be careful how you treat these cases. Prolonged or severe radiation may produce a toxemia which will prove overwhelming and terminate in death of the patient. If all we have heard is true, we have here a new and interesting field for X-ray work, especially if the effect of the ray on lymph tissue is what I believe it to be.

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DR. W. F. MANGES, PHILADELPHIA.

I have had a case of this kind to treat in the past year. The patient was a child, six or seven months old. The symptoms came on suddenly and were quite severe. There was great difficulty in breathing and at times respiration was spasmodic, particularly when the child was excited or was made to cry. It would become unconscious. Then the spasm would pass over and the child would breathe normally again. There was at all times a peculiar wheezing sound during respiration. A diagnosis of enlargement of the thymus was made by a prominent practitioner in the city of Philadelphia. He asked me what I thought could be done with the Roentgen ray and, basing an opinion on the fact that the ray reduced other enlarged glands, I told him that an improvement could possibly be obtained. I began the treatment by giving short exposures, placing the tube at some distance and using the filter. I was surprised at the result. The child soon began to sleep better and while it still had spasmodic attacks when crying, there was no wheezing. The child continued to improve. I treated it twice a week for about two months. The wheezing finally disappeared entirely and the spasmodic attacks were few and far between. Then, for fear that I might do too much, I stopped the treatments and waited. I did not see the child for three months. The mother told me it was beginning to wheeze again. I gave a few more treatments and have not heard from the patient again. This was last February. I am sure the child is well, because otherwise it would have returned to me.

DR. F. H. BAETJER, BALTIMORE.

Dr. Lange said he thought that in some cases the treatment might be used therapeutically. I have been interested in the thymus from a diagnostic standpoint. We have had several cases where it was difficult to tell whether it was a case of mediastinal growth or enlargement of the thymus. We found that when the thymus is large enough to be seen, if you will elevate the chin as much as you can, you will get a difference in the percussion note where the shadow appears on the plate.

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DR. D. R. BOWEN, ROME, N. Y.

I understood Dr. Taylor to say last evening that he would give us something on the measurement of the dose. I would like to know more about this, particularly because of a recent article by Schwartz, who used a mixture of a solution of corrosive sublimate and ammonium oxalate which, when exposed to the rays, becomes cloudy. He considered three of these units to be sufficient.

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DR. A. M. COLE, INDIANAPOLIS, IND.

Dr. Lange has given us a very excellent paper, and I want to commend his wisdom in treating these cases lightly. Some years ago a prominent nerve specialist treated a case of Hodgkins' disease with the Roentgen ray. He used a high tube and gave long exposures. The patient immediately developed severe toxic symptoms and died in a few days. The Doctor was frank enough to confess his trouble before the local medical society. The newspapers got hold of it and published it far and wide, greatly to the discredit of the Roentgen ray.

This is a very interesting subject, and what the effects of the Ray are upon these ductless glands I do not believe we as yet fully understand. I remember reading a book several years ago on the ductless glands and the writer made great claims for the effects of their secretion upon the general health. It was mostly theory, but nevertheless interesting.

No doubt the Ray has a certain stimulating effect upon the secretion of these glands and it may be due to this that we so often notice a tonic effect in using the Ray upon different diseases. I have noticed time and again when treating a carcinoma of the breast where the body generally is exposed that the patients will often say they feel better and stronger after a few exposures have been given. This may be the general effects of the Ray upon the ductless glands.

In this same line we may consider the effects of the Ray upon the opsonic index which Dr. Crane touched upon in a paper before this society two years ago. In my own mind I feel certain that the Ray has an effect upon the system generally that might be called tonic; and whether it is due to the effects upon the ductless glands, the opsonic index or what not, I am sure that we see it clinically.

This excellent paper of Dr. Lange's does demonstrate that the Ray will cause a partial atrophy of the Thymus gland and thereby will cure the train of symptoms associated with its enlargement. I consider this paper one of the most valuable contributions to Roentgen Therapy.

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DR. GEORGE C. JOHNSTON, PITTSBURG, PA.

I saw a child which presented a definite picture of enlargement of the thymus, but the history was peculiar in that the father of the child, a well-posted physician, said that the baby had been born with the croup, that the first cry it gave was a croupy cry. The history of most of these cases is that the thymus enlarges progressively after birth, the enlargement beginning shortly after birth, but I did not find any history of a child being born with a thymus gland sufficiently large to cause trouble. Therefore, I doubted the diagnosis. I lifted the chin as much as possible and pulled the thymus up above the shadow of the manubrium, but the plate did not show the picture we looked for. It is usually safe to diagnosticate an enlargement of the thymus if a shadow is visible on either side of the manubrium. This plate did not show that shadow, so that I was unable to make a diagnosis. There was a very faint shadow which seemed to be extensive and resembled a mediastinal growth, but it was too high up in the neck to be such a growth. The child grew progressively worse, so that an operation was necessary. Body temperature was never elevated. The operation was performed. The moment the surgeon had made the incision and began to dissect back to the side of the larynx, there was a gush of pus, about two ounces being evacuated. It was a case of congenital post-laryngeal abscess, which was quite new to me. The child made a rapid recovery.

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DR. LANGE (closing the discussion.)

Case 3 of my series was born with a crowing inspiration and, strange enough, this case presented the picture of a foreign body in the bronchus. We made a tentative diagnosis. One side of the chest was bulging; the other side was sunken. There was a prominence over the sternum. In looking up the literature, I found a report of a case by Oelsnitz, in the Presse Medicale. He says the thymus rarely enlarges symmetrically. It may extend down on one side or the other, and interfere with the symmetry of the chest. In three plates I made of this case there were such areas in the lung, which we could not explain. One man said he could get an area of dullness and we got a hazy shadow, showing that there must have been less air on one side than on the other. You must cast these things aside and regard them as symmetrical symptoms due to enlarged thymus. We called this a case of deficient aeration, but would not go so far as to call them cases of atelectasis.

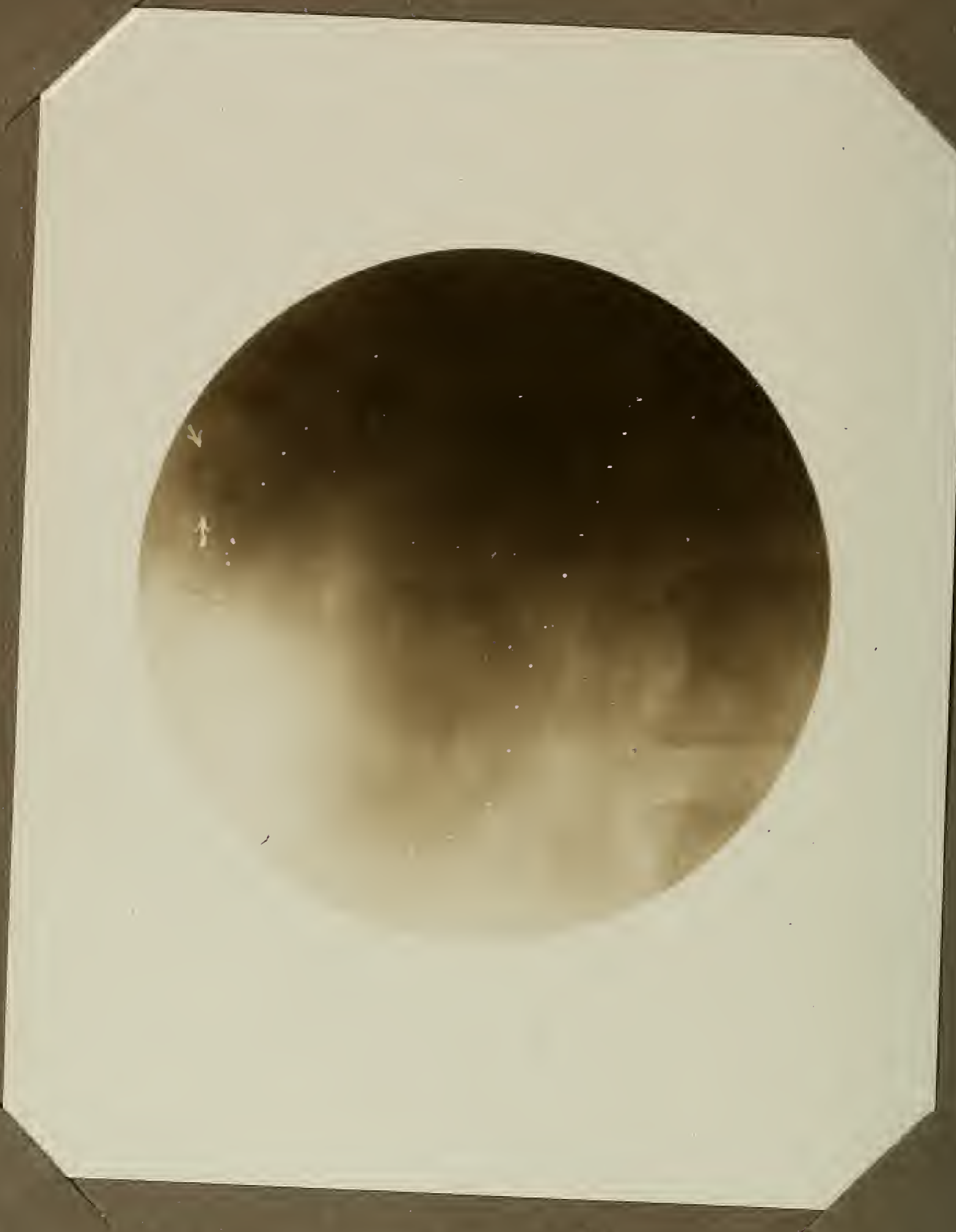
As to the histogenesis of the gland, that is exceedingly doubtful. The invasion of the lymphoid cells is very doubtful. Pappenheimer's theory is the correct one, that there is no such invasion of the lymph cells.

As to the frequency of these cases, I wrote to Dr. Pfahler some time ago and he wanted to know where I got all these cases. I have two additional cases at home now, under treatment. One child, six months old, weighed only eight pounds, and was still losing in weight. There was inspiratory stridor since birth. It has gained one pound in seven days under treatment, and the stridor is much improved. In the other case I have given only one treatment. I believe that the wards of general hospitals contain many such cases that are operated on for enlarged tonsils and adenoids. These cases are undoubtedly plentiful, but go unrecognized. Some of them succumb to the anaesthetic or die from intercurrent affection. There is a class of cases in which there is hyperthymization. There is an enlarged thymus, but there are no pressure symptoms. There are lymphocytosis, enlarged lymph glands, enlarged spleen and liver. The child has retarded mental and physical development. In one such case the treatment by means of the ray was very favorable. The child progressed wonderfully. There was decrease in the size of the gland, the internal secretion is diminished in amount, and the symptoms produced by the hyperthymization have abated.

After I finished my experiments on the rabbit, I found that Ebert and Bordet, in the Journal of Diseases of the Blood and Heart, recorded experiments on dogs and cats, in which this decrease in the size of the thymus was also reported.

As to the danger of these treatments and the production of toxemia, I have not seen any trace of it in my cases. I do not believe that there is anything to be feared from atrophy of the thymus. It has not been proven that atrophy of the gland will make any difference in the human economy, although in the cases reported the treatment has not been pushed to the point of producing atrophy. Removal of the thymus from dogs has caused obscure changes in the bone similar to rickets. One experimenter recently showed that such dogs will not live longer than a year, but so far as this applies to the human, it has not been shown that life is shortened or interfered with in any way by a reduction in the size, or a partial atrophy of the gland.

Regarding the diagnosis, I do not believe that you can make a diagnosis from the plate in every case. We did so in two cases. If the gland is enlarged antero-posteriorly, you cannot get any shadow, and with a child moving continuously, absolute immobility is out of the question. Therefore, we do not try to make a diagnosis from the plate alone, but depend largely on the clinical picture. If dullness extends to the right or left of the sternum, you can safely make a diagnosis of enlarged thymus. If not, then the ray will not help you at all.



GALLSTONE

PLATE BY DR. GEO. E. PFAHLER

# DETECTION OF GALLSTONES BY THE ROENTGEN RAY.

BY GEORGE E. PFAHLER, M. D., PHILADELPHIA, PA.

The detection of gall-stones by means of the Roentgen-Ray involves many difficulties:—

1. Their density differs little from the surrounding bile, and with this shadow of the bile we must reckon the shadow cast by the liver, which is also more or less saturated with bile. If the biliary calculi are composed partially of calcium salts, they can be then more easily detected. Therefore, the greater the quantity of bile surrounding the gall-stones in the gall bladder or the liver, the greater will be this difficulty.

2. Biliary calculi occur more frequently in stout people. Therefore, one meets the same difficulties that are involved in examining stout people with renal calculi. The small shadow cast by the stone must be differentiated from the shadow cast by a great mass of soft tissues. In such cases, we are confronted not only with the density of a great mass of soft tissue, which in itself lessens the differentiation of our shadows, but we must contend with the secondary radiation from this mass of soft tissue which by its cross rays tends to obliterate the sharpness of differential shadows.

Therefore, the stouter the patient, the more difficult will be our task, though one must not conclude that the examination is impossible on this account. One of the cases in which the shadow of the calculus was shown the most clearly was a fairly stout woman.

3. On account of the faint differentiation of the shadow of a gall-stone, it is necessary to have the liver and gall bladder absolutely still.

4. It has been shown by a number of men that over exposure or under exposure, even when the stones are laid upon the plate, will nearly obliterate the shadow. A very high or a low vacuum will have the same effect. Therefore, the length of the exposure and the degree of vacuum must be correct.

5. One must differentiate the shadow of gall-stone from that cast by calcified costal cartilages, renal calculus, and fragments of bismuth, pills or other substances in the stomach or bowel.

I felt the importance of the diagnosis of gall-stones very early in my work, and while on duty in the Philadelphia Hospital in 1900 I conducted a series of experiments to determine this possibility. I took from the autopsy room a liver with the attached gall bladder containing gall stones and obtained a beautiful Roentgenogram, showing even the facets in the gall-stones. I took also a large variety of stones and placed them upon a plate, making the proper exposure and obtained beautiful shadows of each variety. I then used two cadavers and inserted the various gall-stones in the gall bladder, sewed up the wound and made an exposure each time. In each instance I obtained a shadow of the stone, but the shadow was only faintly differentiated from the surrounding tissues. At that time the length of exposure (with our small apparatus) was from three to eight minutes.

In the above experiments, I was dealing with an absolutely still body and I knew the stones were there. Therefore, I concluded that in the living subject, where one must contend with respiratory movement, and with the uncertainty of a stone, the rays would be of no value in diagnosis. I repeated these experiments at the Medico-Chirurgical Hospital in 1904 with the same conclusion.

Since the above date, we have gradually increased the power of our instruments so that exposures are made in as many seconds instead of minutes. We have learned how to keep our patients and apparatus still, how to eliminate in part the effects of secondary radiation, how to judge and regulate the vacuum of the tube, and the length of the exposure. In short, we have improved our technique so that today the detection of gall-stones becomes a possibility.

I have never published these investigations because they seemed entirely negative in value. I mention them now only to illustrate difficulties which at that time could not be overcome, but which at present we can master.

1. **Technique.**—The patient should be thoroughly purged. For this I prefer a bottle of citrate of Magnesia. If possible the stomach should be empty. Therefore, I prefer to give a purgative in the evening and make the examination the next morning before the patient has eaten breakfast. In this way one eliminates the confusing shadows due to gastro-intestinal contents. One also reduces somewhat the total bulk of substance through which the rays must pass.

2. **Position of the Patient.**—Having removed all clothing in the line of exposure, I place the patient upon the abdomen with the plate under the gall-bladder region. The arms are extended toward the head so that the patient is resting with the chest, elbows and face flat on the table. The upper part of the body is then bent strongly to the left (not rotated.) This opens the space between the lower ribs, and the crest of the ilium to the widest possible angle, through which the rays can best reach the gall bladder.

3. **Position of the Tube.**—The tube with the compression cylinder diaphragm (Albers-Schonberg) is set so that the rays will pass obliquely through the space between the last rib and the crest of the ilium toward the gall-bladder. By means of the diaphragm cylinder we eliminate many of the secondary rays which in the early days made this work impossible. At times a certain amount of compression can be added, which will lessen the total bulk of tissue, and lessen the distance of the tissue and the diaphragm from the plate.

4. **The Exposure** should be made as short as possible and must of necessity be made while the patient is holding the breath. A little time should be spent in training the patient in holding the breath absolutely still. The absolute time cannot be set, for it will depend upon the power of the apparatus, and upon the skill of the operator who must judge quickly at the time, according to the working of the tube.

5. **The Vacuum of the Tube** should be the same as is used in making kidney examinations, and should register No. 6 to 7 on the Benoist scale. For the purpose of localizing the region, I often attach to the skin a small fragment of lead by means of a narrow strip of adhesive plaster.

**Renal Calculus.** In one patient who had the symptoms of gall-bladder disease I found a stone in the upper part of the right kidney. This can be determined usually by using the usual technique for a kidney examination when the shadow of the stone will be more distinct and smaller.

**Calcareous** deposits in the costal cartilages are likely to occur in streaks, to be found on both sides, and not to be confined to the region of the gall-bladder. There is, of course, nothing to prevent the occurrence of both gallstone and calcifications in the costal cartilages in conjunction. In such instance the absolute differentiation is almost impossible. This is the condition in the last case I have examined, and in which an operation has not yet been performed.

The possibility of *artifacts* will occur to every experienced Roentgenologist, but this can be eliminated by a repetition of the examination.

## Results.

So far I have only had three cases in which my diagnosis was confirmed by operation. The other patients in which I found doubtful shadows of stones have not been operated upon.

Of the three positive cases, two were sent to me for stomach examinations. In both a preliminary plate was made before giving the bismuth meal. The stomachs were found normal, and this was confirmed by operation. So far, no case has been operated upon in which a stone was found that I did not find. But this must not be understood to mean that I believe that all stones can be shown. This would be far from the truth.

## Conclusions.

1. Gall-stones can only be shown when they are composed of a substance of greater density than the surrounding tissue. This will usually mean that they contain some calcium salts.

2. When conditions are favorable I believe that a certain proportion of calculi can be shown, but the positive diagnosis alone is valuable. If a calculus is not found it can by no means be interpreted as meaning that no stone is present.

3. I believe that only those Roentgenologists who have mastered a good technique for kidney examinations can hope to find gall-stones. Careless reports based upon insufficient evidence of imperfect plates will only bring discredit upon Roentgen diagnosis.

4. Too few examinations have been made and confirmed by operation to make statistics of the slightest value. Careful work by an expert Roentgenologist associated with a surgeon who has a large clinic of gall-stone disease would go far to establish the actual value of this means of diagnosis.

## DISCUSSION.

### DR. LEWIS GREGORY COLE OF NEW YORK CITY.

I have had three or four cases in which gall stones were distinctly shown. One of these was so distinct that I diagnosed it as kidney stone. In another case a well defined "X" was shown in exactly the region of the gall bladder, in several plates. I did not feel justified in making a diagnosis of gall stone on this, but it corresponds very accurately with the markings that are frequently shown in the centres of gall stones when radiographed outside of the body.

### DR. FEDOR HAENISCH, HAMBURG, GERMANY.

We ought to be very thankful to Dr. Pfahler for drawing attention to this sort of work again. You all know what an extremely difficult task it has been to use the X-ray for diagnostic purposes in gall-stones. In the past years it has been, so far as I know, a settled matter that you cannot diagnose gall-stones with the X-ray. Most of you have done the same as we have abroad. I have tried to devise a special apparatus to hold the plate, but did not succeed.

I had three positive cases which showed more or less indistinct shadows and which I thought might be gall-stones, as it subsequently proved to be.

The principal thing in the paper seems to be his alteration of the technic. I saw the Doctor make some of these examinations in his office, and it ought to make us all try again, but we must do this sort of work with a quick exposure. As the Doctor pointed out, it is impossible to get the gall-stones while the liver is in motion, but it might be possible that if we take up this work again according to his technic we may succeed in doing something. I did not expect to do anything more with it until I heard of his technic. But even with this new technic, while we may succeed in getting some of the gall-stones, we certainly cannot get them all, and we should not base a negative diagnosis on our work. We know that only a few gall-stones will show enough difference in density between the surrounding gall-bladder and liver to throw a shadow on the plate. It is a very small percentage that will do this. But it is an advantage to get even these few. A negative diagnosis is very unsatisfactory. You can remove gall-stones from the gall-bladder, place them on a plate, expose them to the ray, and yet fail to get any shadow, simply because these stones are of the same density as the chemical on the plate.

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DR. HENRY HULST, GRAND RAPIDS, MICH.

I wish to express my appreciation of Dr. Pfahler's work. It is a positive contribution to roentgenography, and it is simple but nevertheless it will prove to be a great thing. I would suggest that placing a marker over the spot where you expect to find a stone is not wise, because it might hide the shadow. If you want to indicate the region of the gall-bladder, why not use a lead diaphragm and have the patient lie on that? Not long ago one of the Mayos operated on a case of kidney stone which apparently was very well shown in the skiagram. The stone was not found, however. The patient was turned over on the back, the gall-bladder opened, and a stone was removed from it. I had the pleasure of diagnosing two such cases about seven or eight years ago. I made the plates with the five-seconds' exposure.

DR. A. M. COLE, INDIANAPOLIS, INDIANA.

What would be the objection to using a lower vacuum tube, but of sufficient vacuum to penetrate the tissues? I have not had an extended experience in this work, but I have heard of a method that someone is using in Chicago in which a very low tube and a long exposure is used, and very successful results have been claimed. It seems to me that if we use a tube of high vacuum, such as we would use for kidney-stones, the rays would be more liable to penetrate the gall-stones and show no shadow.

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DR. F. H. BAETJER, BALTIMORE, MD.

I would like to ask Dr. Pfahler how many cases he had and whether any of his patients were operated on in which a diagnosis of gall-stones was made, and how many negative skiagraphs were made in cases where an operation was done and stones were found?

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DR. H. E. POTTER, CHICAGO, ILLINOIS.

Most cases of gall-stone disease that are sent to us for examination are cases in which the diagnosis is somewhat obscure. There is right upper abdominal trouble, but the doctor is not sure whether it is due to gall-stones. In three cases which I examined during the last year I obtained shadows which might have been caused by stone in the kidney, in the common duct or in the gall-bladder, because these three structures occupy a space in the body which is easily covered by a silver dollar. Even stereoscopic radiographs do not help us in making a diagnosis. These three cases were operated and they were cases of stone in the kidney, with a complicating infection of the gall-bladder. I believe that the combination of right kidney-stone and gall-bladder disease is as commonly seen as are radiographs showing gall-stones.

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DR. CHARLES F. BOWEN, COLUMBUS, OHIO.

We might give the patient a large meal and an hour or two afterwards, when the gall-bladder has had an opportunity to empty itself of bile, we might get a picture of stone. If we take the picture with the patient in the upright position and the stomach full of food, it would pull the colon down out of the way.

DR. ALFRED L. GRAY, RICHMOND, VA.

I have not been very successful in my gall-stone work, and I used extra compression under the ribs on the right side. In addition to this extra pressure, I have attempted to squeeze the liver below the margin of the ribs, giving it a direction downward and forward more than is normal, thereby thinning out the liver as much as possible. Notwithstanding the fact that I have made what I consider to be very satisfactory radiographs, I have found fifty or sixty in which I was absolutely unable to show any stone on the plate and yet stones were found later at operation.

DR. J. RUDIS-JICINSKY, CEDAR RAPIDS, IOWA.

I have for years tried to find gall-stones and have failed many times. Now, I place my patient in such a position that I can use the compression diaphragm as much as possible, and so get good shadows. I now can make the diagnosis, especially when I use the film, pressing it firmly against the region of the gall-bladder. It seems to me that we can get better results in this way.

So far as shadow of a stone in the common duct being mistaken for stone in the gall-bladder is concerned, we ought to know our anatomy better than to make such a mistake. We know where we may expect to find a shadow of stone in the gall-bladder, and where would be the shadow of a stone in the kidney. Such mistakes should never happen.

DR. PERCY BROWN, BOSTON, MASS.

It seems to me that in these cases we cannot be too careful about securing proper catharsis for two reasons: First, because the shadow which we expect to portray will lie in close proximity to the hepatic flexure and therefore we must get the colon empty. Second, because so many of these patients are fat, phlegmatic females, with a tendency to sluggishness of the bowel. I should also like to have it said what each man's percentage of positive diagnoses was. Mine is about four per cent. A comparison of notes in this regard would be distinctly advantageous.

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DR. EDWARD H. SKINNER, KANSAS CITY, MO.

The diagnosis of gall-stones is very interesting to every roentgenologist, but the sooner we realize that we cannot get a shadow of a cholesterin stone, the better for us. There must be some calcareous material in the stone before it will throw a shadow. Therefore, it is necessary for us to remember that when there is no shadow on the plate there may still be a stone in the gall-bladder, and if the symptoms point to gall-stones we should not make a negative diagnosis. My personal experience is limited to about nine or ten cases in which I attempted to get a shadow. I saw a case with Dr. Beclere, in Paris, which was reported in the Bulletin of the Paris Society. He inflated the stomach with air when he made the skiagraph. The plate showed two shadows, one above and one below, seemingly in either end of the gall-bladder. Those two stones evidently were the only ones that contained calcareous material because between them was a mass of other stones, probably of the cholesterin variety.

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DR. FEDOR HAENISCH, HAMBURG, GERMANY.

I cannot agree with Dr. Rudis-Jicinsky that it is so easy to differentiate a gall-stone shadow from a kidney-stone shadow, even if we do know our anatomy. Kidneys are apt to wander about in the abdomen, and the liver may be slightly movable, so that the gall-bladder is not always in the same position where it is indicated on the anatomical atlas. An enlargement of the gall bladder or kidney is quite sufficient to push the stone down out of place, so that we must not let it go out that it is absolutely silly to make a mistake in these cases.

DR. LEWIS G. COLE, NEW YORK CITY.

I had one case in which I was unable to show in the radiograph any indication of the stone. But in these plates there appeared very distinctly a small cross-shaped shadow in the region of the gall-bladder. I did not make a positive diagnosis of gall-stones, but said that there was something there which I could not account for. The patient was operated on and he had a gall-stone of the soft cholesterin type. The nucleus of that stone corresponded to the little cross shown in the plate.

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DR. H. E. ASHBURY, BALTIMORE, MD.

During the past winter I had occasion to ray gall-stones outside of the body. I made some artificial bile, as nearly of the same consistency as human bile as was possible. I also filled an artificial gall-bladder with bovine bile and suspended stones in it. This was placed on the plate and the gall-stones showed on the plate as dark spots. We placed these on a plate under the patient and they showed up as black spots. The stones we used were of about the size of a thumb. They contained calcareous material.

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DR. PFAHLER (closing).

As to using a soft tube, we must remember that rays must be of sufficient penetration to go through the body. Besides, the terms soft and hard mean nothing. I said that I used rays corresponding to six or seven Benoist. I cannot see how you can use a less strength and still have the rays go through the tissues. I cannot see the advantage of using a soft ray unless we make a long exposure, and then we are likely to burn the patient. The shorter the exposure, the better. We ought to try to make these exposures with the patient holding the breath.

As to the number of cases I have had, I think statistics are absolutely useless. Only those cases that are operated on are of value in this connection, because we cannot tell whether the unoperated cases are or are not positive. The number examined means nothing. I do not even count my cases. I have probably had forty or fifty, but that of itself is of no significance. People go through life with gall-stones that never manifest themselves. Therefore, the only cases that we should count are those that are operated on and where the roentgen diagnosis of stone is confirmed.

As to making the skiagraph after giving the patient a large meal, the thought is a good one, but it does not work out practically. Massaging the gall-bladder and expressing the bile might help.

Regarding the use of films, I cannot see that they are of any particular advantage, because the pressure of the body against the plate brings it as nearly as you can get it.

As to the experiments made by Dr. Ashbury, placing the stones under the body and then radiographing them, that does not bear any relation to the stones that are actually contained within the body. My experiments were made on the cadaver. I placed the stones into the gall-bladder so as to get exactly the same conditions as we get in the living subject.

# PHOTOGRAPHY OF THE FLUORESCENT SCREEN FOR ROENTGEN KINEMATOGRAPHY AND OTHER PURPOSES.*

BY E. W. CALDWELL, M. D., NEW YORK.

The idea of photographing the fluorescent screen is not new, and it is alleged that such photographs were successfully made by Dr. Levy of Berlin, and others, early in 1896. At this time the ordinary radiographic exposures were measured in minutes, and, if we consider that a much longer exposure is required for photographing a fluorescent screen with an ordinary camera than for making a direct X-ray exposure with the plate in contact with a fluorescent screen, it is easy to understand why this interesting experiment was not brought to practical use long ago.

In the "Electrical Engineer" of July 1, 1896, there appeared an illustration showing Bleyer's "Combined camera and sciascope" together with a primitive Crooke's tube and induction coil, arranged in a manner which shows the idea clearly enough, but justifies the suspicion that the experiment was not a brilliant success. I do not recall a single allusion to work in this direction that has appeared in print since X-rays became a factor in practical diagnosis.

There can be little doubt that the successful development of this idea, to a practical working basis, will be an important addition to Roentgen technique. For many years we have had to make our radiographs "life size," and to use photographic plates a little larger than the subject under examination. The expense of the large photographic plates used in examinations of the thorax and gastro intestinal tract is a very considerable item, and especially so, if we make the large number of plates which are frequently desirable in such examinations. If we can obtain the same results by making small photographs of a large fluorescent screen, the saving in photographic materials used for such examinations will

*A paper read before the Philadelphia Roentgen Society, March 24, 1911.

amount to several hundred dollars per day in this country alone.

Another advantage is the greater convenience of examining a large number of small plates grouped together, as compared with looking at a series of large plates, one at a time.

The facility with which these small plates or films may be filed or transported will appeal to every roentgenologist.

By far the most striking advantage of screen photography is that it makes actual Roentgenkinematography possible by the use of the ordinary moving picture camera fitted with a special lens.

Moving picture effects have already been obtained by copying on ordinary kinematographic film, series of radiographs made at long intervals, but representing consecutive phases of a recurring cycle such as, for example, the movements of the thorax during respiration. Rosenthal has succeeded in making as many as twenty radiographs of a stomach during a single cycle, and at intervals as short as one-quarter of a second. Kaestle, Rieder and Rosenthal, in their article* on Bioroentgenography of the internal organs, apply the term "Roentgen kinematography" to this last procedure, and criticise the use of the term by earlier experimenters to describe the moving picture effects obtained by patching together roentgenograms made at proper intervals, but during different cycles.

With full appreciation of the humor of the situation, I venture to point out that actual kinematography necessitates making these exposures with a minimum frequency which is determined by the time of the persistence of vision, and which is at the rate of at least ten per second.

The writer is not aware that any practical method of accomplishing this has yet been published. The question of the practical value of accomplishing this rather difficult feat has been discussed by various writers, many of whom are inclined to the view that it is of little importance. Nearly every one agrees that its chief use would be in the study

*Archives of the Roentgen Ray, June, 1910.

of movements in the gastro-intestinal tract and the organs of the thorax.

For these portions of the body plates or films of rather large size are used, and it will be obvious that the changing of these large plates at a rate of ten per second or faster, will be attended by serious mechanical difficulties. In addition to this the expense of plates or films of such size, and in sufficient number to give a continuous record, for even a few seconds, would be prohibitive. There is also the difficulty of copying these "full size" radiographs on the moving picture film in their proper order and position.

Such considerations as these led the writer, many months ago, to the conclusion that the brilliant work of Rosenthal, although an important step in advance, is still almost as far from actual practical Roentgenkinematography as the earlier attempts which he criticises. The very creditable repetition of Rosenthal's results by Dr. L. G. Cole, with apparatus furnished by Dr. Waite, has brought us no nearer to a practical solution of the problem.

Long ago it occurred to me, and probably also to many of my colleagues, that kinematographic photography of the fluorescent screen would eliminate the difficulties just mentioned. It therefore seemed logical to renew the attempts at photography of the screen, though it was obvious at the outset that many new difficulties would be encountered before this could be made practical.

Since 1896, however, our ordinary X-ray exposures have decreased from minutes to fractions of a second. We now have faster lenses and faster photographic plates, as well as better X-ray tubes and more powerful exciting apparatus. During the last year or two much better fluorescent screens have appeared; and the moving picture camera of today is a practical article of commerce. This rather remarkable record of progress does not bring us to a practical photography of the fluorescent screen for purposes of diagnosis.

The only screens in common use, which give fluorescence of sufficient actinic value are those containing calcium tungstate, but it is reasonable to hope that others may be developed, which will have greater actinic properties, though they may, perhaps, be less brilliant in the visible portion of the spectrum. This is a problem which seems to me worthy of the serious attention of the chemist.

The experiments to be described here were made with a Gehler folie which, as is well known, has phosphorescent as well as fluorescent properties, and gives off light for several minutes after cessation of the exciting X-ray. To determine whether the persistence of this illumination would interfere with making successful photographs of the screen in rapid succession, I attached a Gehler folie to a rotating disk and subjected it to X-rays which reached it through a very narrow radial slit in a sheet of lead. In a dark room these rays produce a brilliant narrow line of fluorescence on the screen, and it was found necessary to rotate the screen at an exceedingly high rate of speed in order to materially widen the brilliantly fluorescing portion. From this it was readily inferred that the phosphorescence which persisted, was much weaker than the fluorescence which subsided with the X-ray, and that no difficulty would be encountered from this source.

A few photographs were made of fluorescent screen shadows of the human body with an ordinary camera and a Cooke lens working at aperture of F4.5. As was expected, the exposures necessary were many times longer than would have sufficed for ordinary radiographs made with the same screen in contact with the plate. I was delighted, however, to find that these photographs were full of rich detail, and that, as I had hoped, the camera recorded much more than the eye could see on the fluorescent screen. This last mentioned fact convinces me that this method of examination of moving organs will be more accurate than direct fluoroscopy, which is now a generally recognized necessity.

The one thing lacking to make this work completely successful was greater speed. In order to obtain this there are several possible directions for improvement, in all of which a practical limit seems to be reached very soon.

In the first place, a screen of better actinic properties may be hoped for, but improvement in this direction seemed clearly beyond the experimental facilities of the writer. Improvement in speed of the photographic plate was not considered for the same reason. Much has already been done in this direction, and it will probably be very difficult to surpass the results obtained by Lumiere.

There remain to be considered the possibility of increasing the fluorescence of our present screen by obtaining more intense excitation by X-rays; and of obtaining lenses capable of very much greater speed than those in common use.

The amount that we may increase the power of the exciting X-rays is limited by the ability of the human body to stand such powerful radiation for a reasonable length of time without injury, and also by the fact that our best X-ray tubes would be destroyed in a very few seconds by the electrical excitation to which they are now subjected in rapid radiographic exposures.

Practically all of the powerful electrical appliances now used for exciting X-ray tubes give pulsating currents, the energy of which is not efficiently transformed into X-rays because during a portion of each impulse the current strength falls to a point where the rays have not sufficient penetration for radiographic work, although the deleterious effects upon the skin, and the heating of the X-ray tube continue.

Another disadvantage of the pulsating current is that the focus point on the target is more rapidly damaged by a series of very short and powerful impulses of current than by the samé amount of electrical energy expended in the tube by a current which is continuous. This has been pointed out by the writer at several meetings of the American Roentgen Society, and has been fully discussed by Wolter, Rosenthal, and others. It will be obvious therefore that excitation of the X-ray tube by a powerful continuous current will result in a gain in speed, and a reduction of the disadvantages incidental to continuous operation.

I have long waited in vain for some manufacturer to bring out a machine capable of delivering such currents, and several months ago, I began the construction of a device which now gives me practically uniform continuous current of from ten to more than two hundred milliamperes at a potential suitable for exciting X-ray tubes. This is accomplished by valve tube rectification of a polyphase current. The appar-

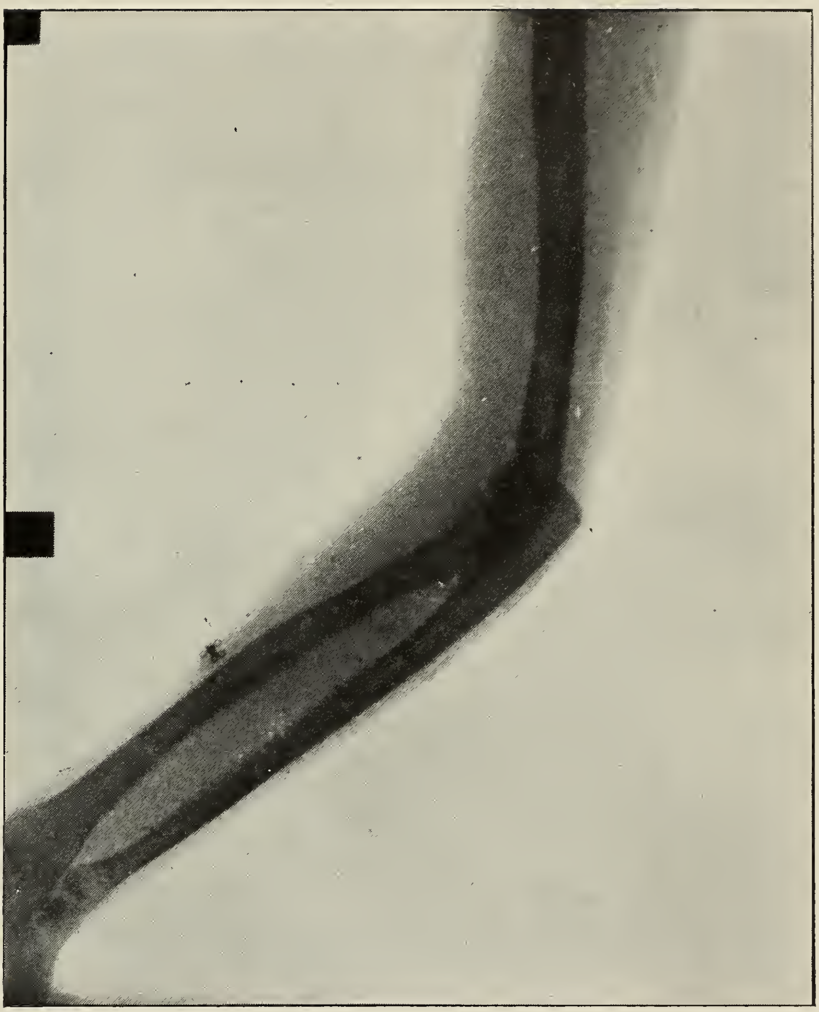


FIG. 1. Enlargement of photograph of the Gehler folie screen. Exposure one second.

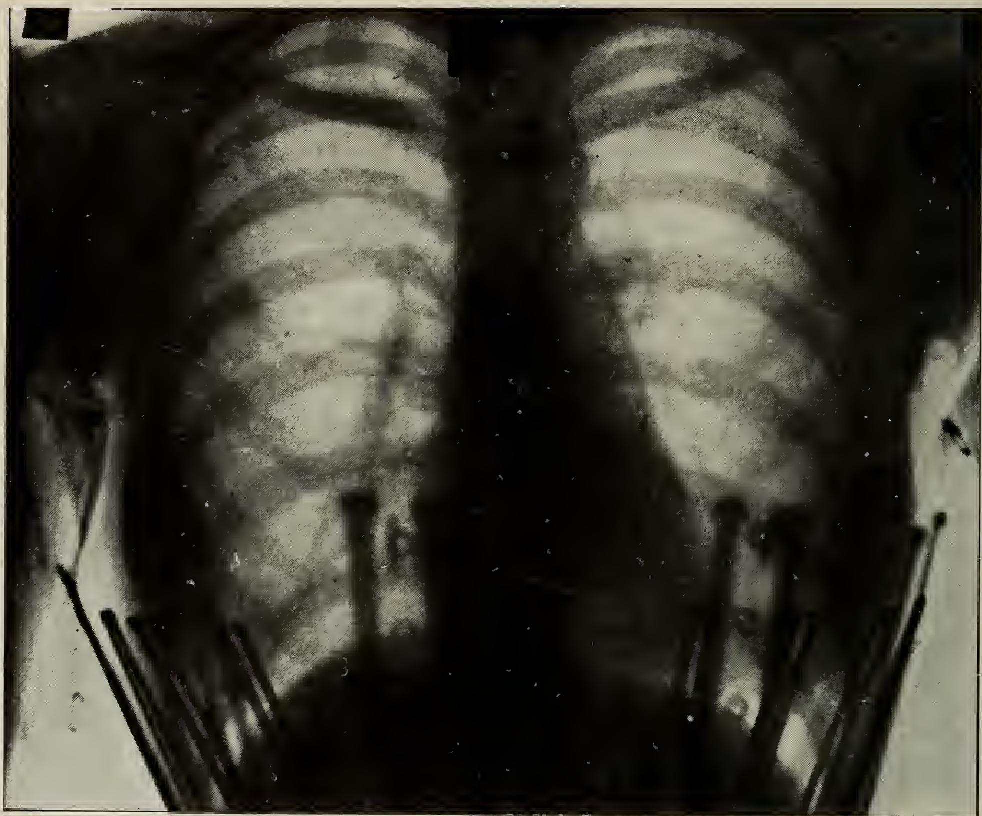


FIG. 2. Enlargement of photograph of Gehler folie screen.
Exposure four seconds.

atus will be more fully described in another publication. The performance of this apparatus demonstrates the entire feasibility of producing such currents, and the advantages that were expected from excitation of X-ray tubes in this way.

For kinematographic work, however, still more speed is necessary, and the most apparent method of obtaining it is by making lenses working at wider aperature than those in common use. Inquiry among many prominent lens makers developed the fact that the fastest lenses regularly made work at about F2, which is only about five times as fast as the fastest lenses used in hand cameras.

The photographs shown in the accompanying cuts, figures 1 and 2, were made with a lens working at F4.5 of a 14 x 17 Gehler folie excited by an X-ray tube taking about sixty milliamperes. The exposure for the thorax was about four seconds, and that for the arm about one second. In these plates the detail of the lung is quite as rich as in any good ordinary roentgenogram. In the plate of the arm there is a fair amount of bone detail, the different layers of soft tissue can be differentiated, and the silk sleeve with the hook and eye at the wrist are clearly discernible. With a lens working at F2, I have made equally good plates of lung and stomach in exposures of about one second. I have obtained a plate showing satisfactorily the outline of the heart with an exposure of about one-fifth of a second. These radiographs, or screen photographs, are a little more than an inch square, and would be too small to be readily reproduced, though they are somewhat more brilliant than the other plates shown.

For practical screen photography we need a lens ten or twenty times as fast as the one with which these exposures were made.

With a view to facilitating the design of a fast lens for this special purpose, I induced my friend, Dr. Ernest Blaker, to make a spectroscopic examination of the light from a Gehler folie, in the physical laboratory at Cornell University. As was expected, the light comes from only a comparatively narrow portion of the spectrum, and is most intense at about 5200qq. Some of the corrections necessary in lenses used for photography with heterogeneous rays, like daylight, will therefore be unnecessary.

Since the object we wish to photograph (the screen) is a plane, depth of definition is unnecessary, and one objection to wide aperture is thus removed.

I have at last found a reliable maker who has agreed to make a special lens having the speed which I have demonstrated to be sufficient for actual kinematography of the Gehler folie during periods of a few seconds, without undue risk to the patient or the X-ray tube.

My inquiries among photographic experts resulted in a premature publication of the general plan of this work. This has led me to bring my results before your society at this time, although I had expected to wait until I could report actual tests with the new lens.

From the results obtained in the experiments described above, I am encouraged to think that photography of the fluorescent screen is worthy of further serious study, and to hope that it may quite revolutionize our methods of X-ray examination of certain organs such as the heart, the stomach, and the intestines, at least.

We shall then have the Schutz-house equipped with a magazine or moving picture camera. While watching the fluorescent screen, from this vantage point, we may make a few dozen radio-photographs on a yard or two of film when anything interesting is shown, and thus obtain a record of the motion we desire to study.

# DESCRIPTION OF METHOD OF MEASURING FEMALE PELVIS.

BY W. F. MANGES, M. D , PHILADELPHIA.

Out of courtesy to Dr. E. P. Davis, Professor of Obstetrics at Jefferson Medical College, Philadelphia, and for sake of brevity the present communication will be merely technical.

A few Roentgenologists have in the past described methods of estimating the diameters of the pelvis.

Our worthy president, Dr. Pfahler, presented an article on this subject at the meeting in Niagara, fours years ago. His method is far more precise than any the obstetrician has made use of up to the present.

It is difficult to find further literature, and it would seem to be a subject of but little importance. We believe, however, that this deficiency is due more to lack of demand than to lack of value in the methods heretofore, and herein described. The importance of an accurate procedure can not be questioned, since pelvimetry is the foundation of modern obstetrical teaching.

In former radiographic pelvimetry, each patient had to assume a definite and similar position in relation to the plate regardless of contour, or thickness of the soft parts. The rays had to pass in a precise direction.

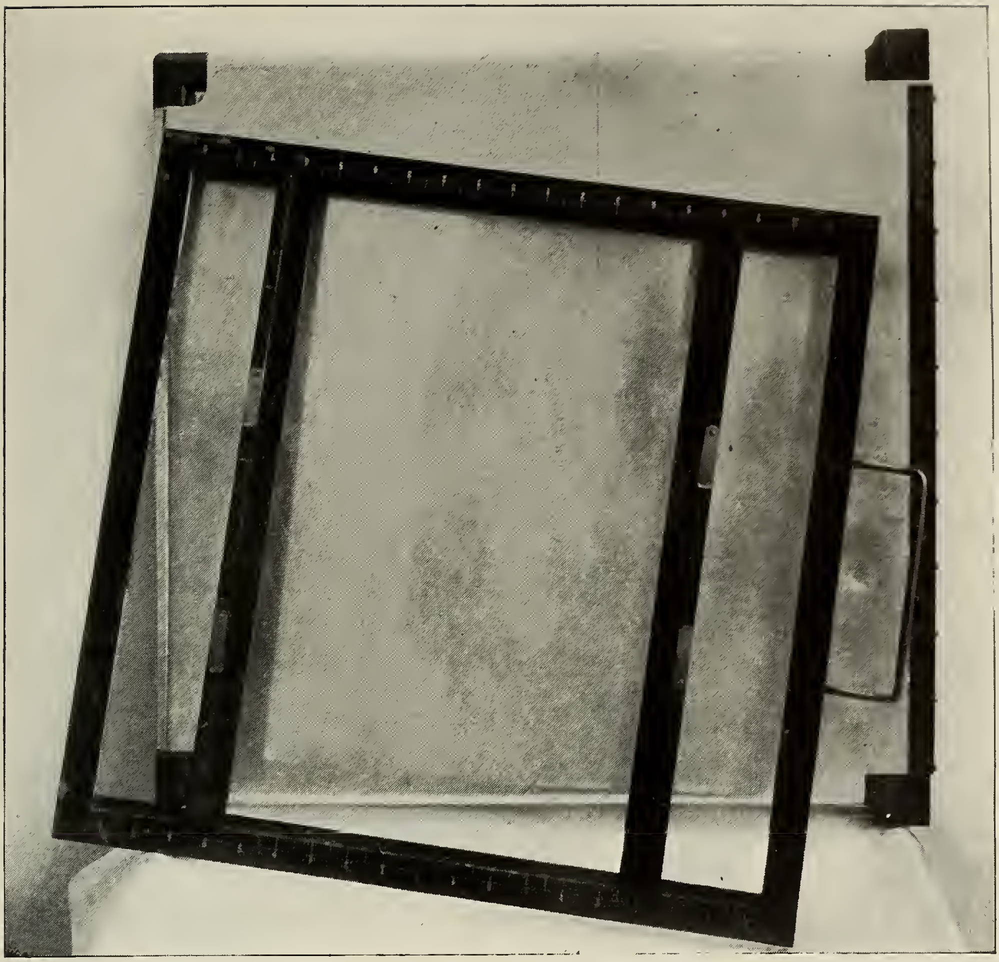
The method presented here involves two established Roentgenologic procedures, viz., Stereo-Roentgenography and localization by means of the MacKenzie-Davidson cross threads plan or some modification of it. No special apparatus beyond what is necessary for making stereoscopic negatives, and for plotting the cross thread scheme is required, the stereoscopic displacement of the tube serving for the displacement in localization. By the present plan no effort is made to have the plane of the pelvic inlet parallel with the sensitive plate. External contour of the pelvic region can be disregarded, and the rays may pass in any direction that will give a good stereoscopic view of the pelvis. The patient assumes the position of dorsal decubitus, which is comfortable and at the same time affords the best position for making stereo-negatives of the pelvis. We can in a general way tell whether we are dealing with a normally shaped pelvis, the simple flat type, or some contracted irregularity. We can tell which is the maximum diameter and which the minimum diameter, but from the stereoscopic view alone no eye is sufficiently trained to accurately measure the diameters without further aid.

We can, however, with pen or pencil mark on the negatives while viewing them on the stereoscope, certain definite points on the shadows of the inner surface of the pelvic brim, the tuberosities of the ischii, the spinus processes of the ischii, and the coccyx. These markings are made to correspond optically on the two negatives and, therefore, can be assumed to be the shadows of single foreign bodies at these points.

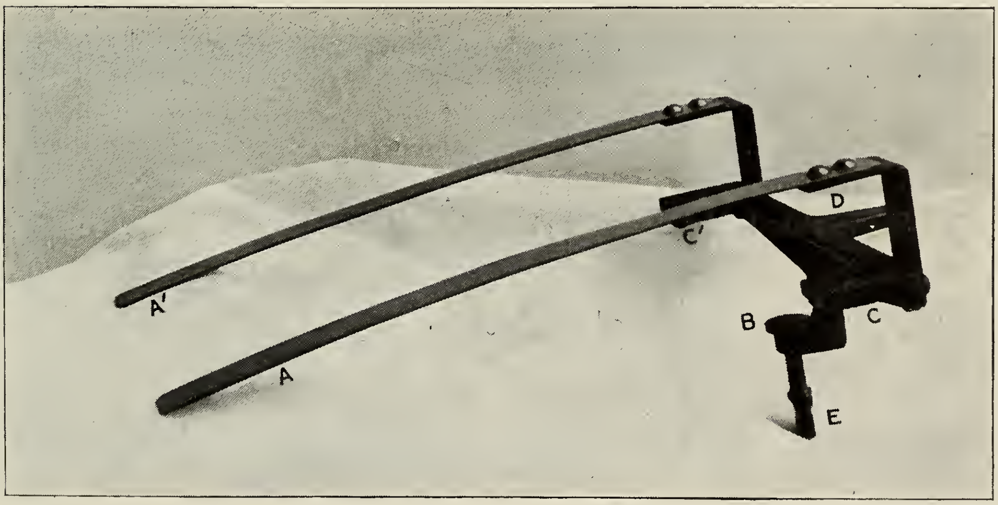
Now we need only localize these imaginary foreign bodies, and measure the distances between them to obtain the actual diameters of the pelvis.

For the purpose of plotting localization we make a tracing on plain white paper of the markings on the two negatives, numbering the tracings 1 and 2 respectively. The plate-holder, table clamp, tube carriage, and localizer are then put in position. The tracing is made to register with the table clamp.

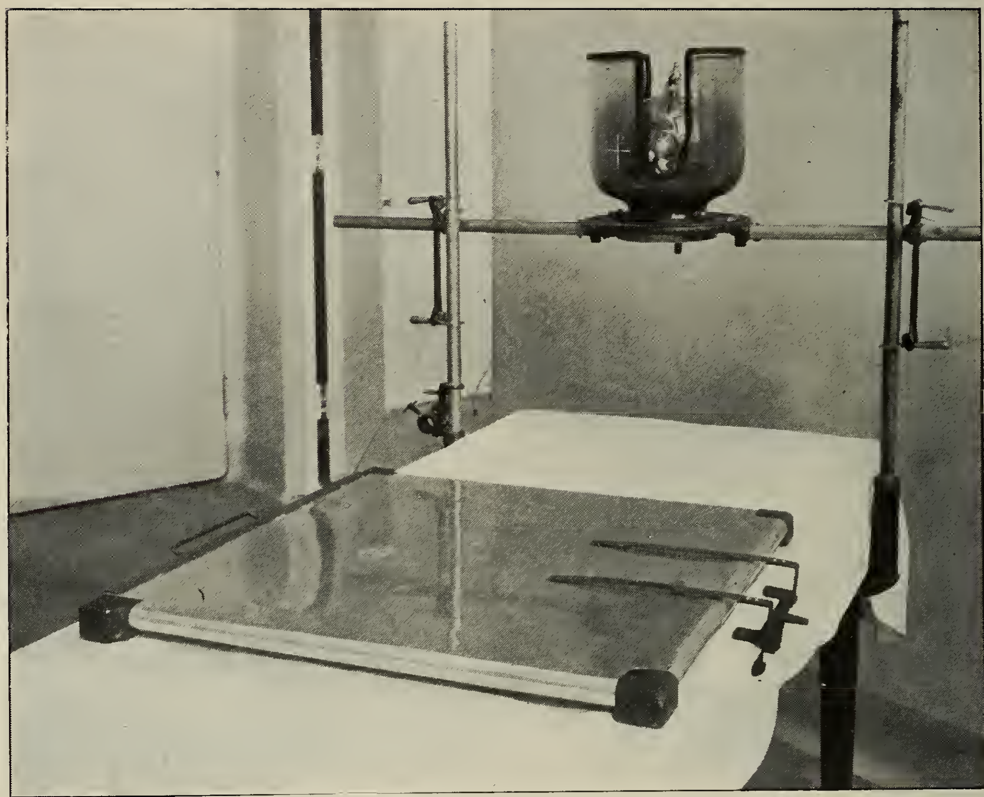
With the two threads occupying at one end the position formerly occupied by the focus point of the tube during the two exposures, the other ends are made to register on tracing one and tracing two of some point on the pelvic brim, e. g. the pubic junction. A metallic point may be adjusted to touch the crossing of the threads, and this represents the actual position of the inner surface of the pubic junction at the time of exposure. By adjusting the threads to tracing one and two of the promontory of the sacrum, we have its actual position at the crossing of the threads, when with a rule or tape we can measure the actual distance between the two points, the antero posterior diameter. In this manner any diameter can be measured. The question of danger to the fetus may be raised, but we think not fairly. Long exposures are uncalled for, since we have powerful generators, extremely sensitive plates and for the very cautious, intensifying screens.



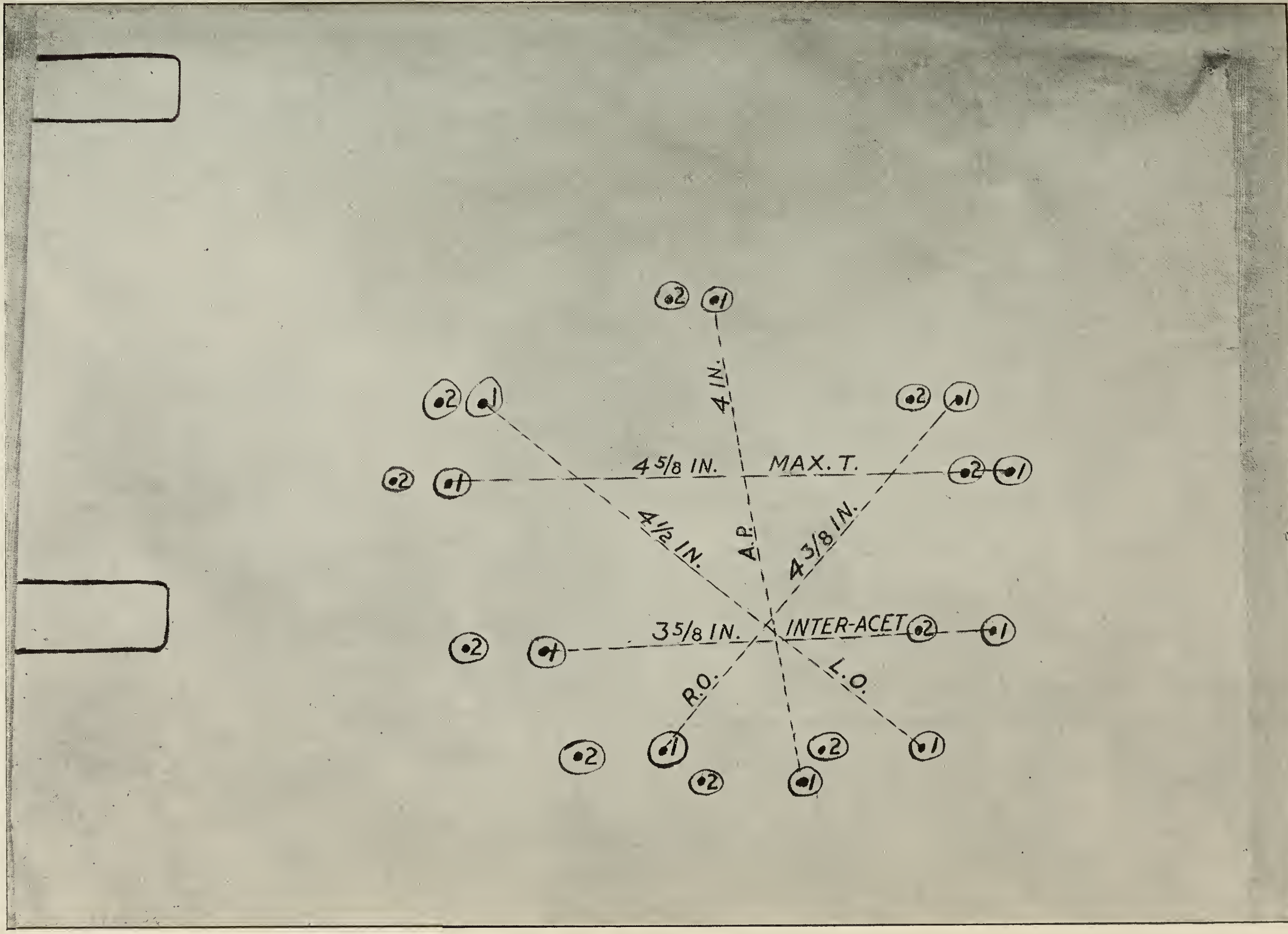
1. Plate Holder. Slide removed and set for 10x12 plates.



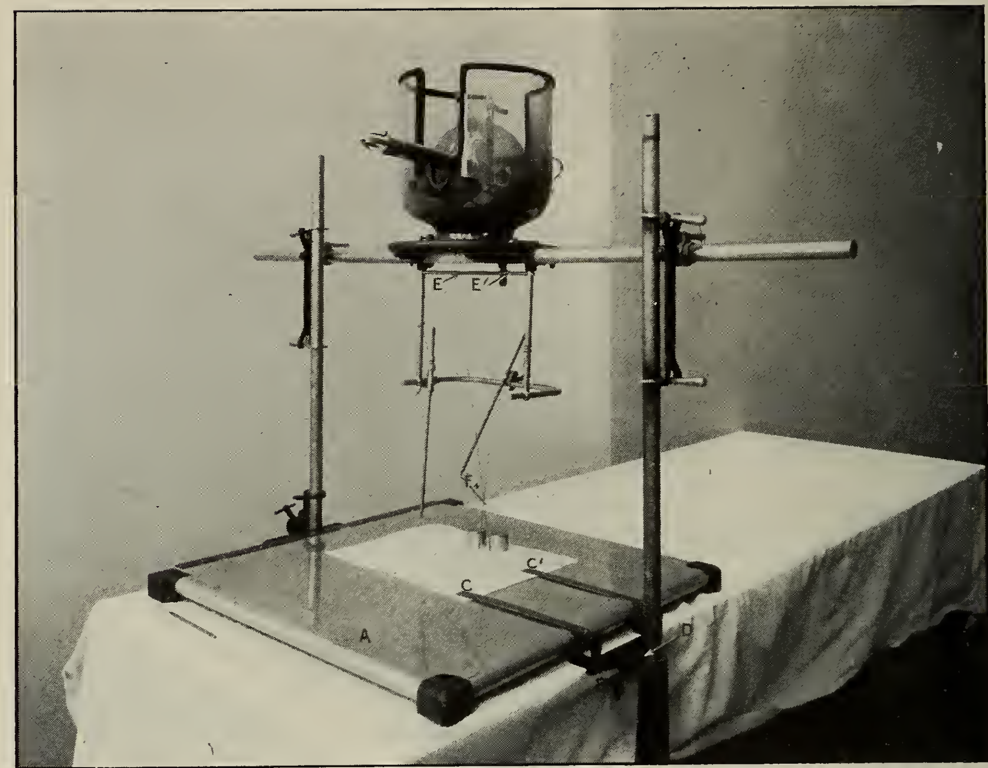

2. Table Clamp. A and $A^1$, metallic arms which project over plate holder and shadows of which are shown on skias. C and $C^1$, rest on top of table with B on under surface, clamped by thumb screw E. D projecting externally determines the position of the tube carriage.



3. Shows plate holder and table clamp applied, and ready to receive patient.

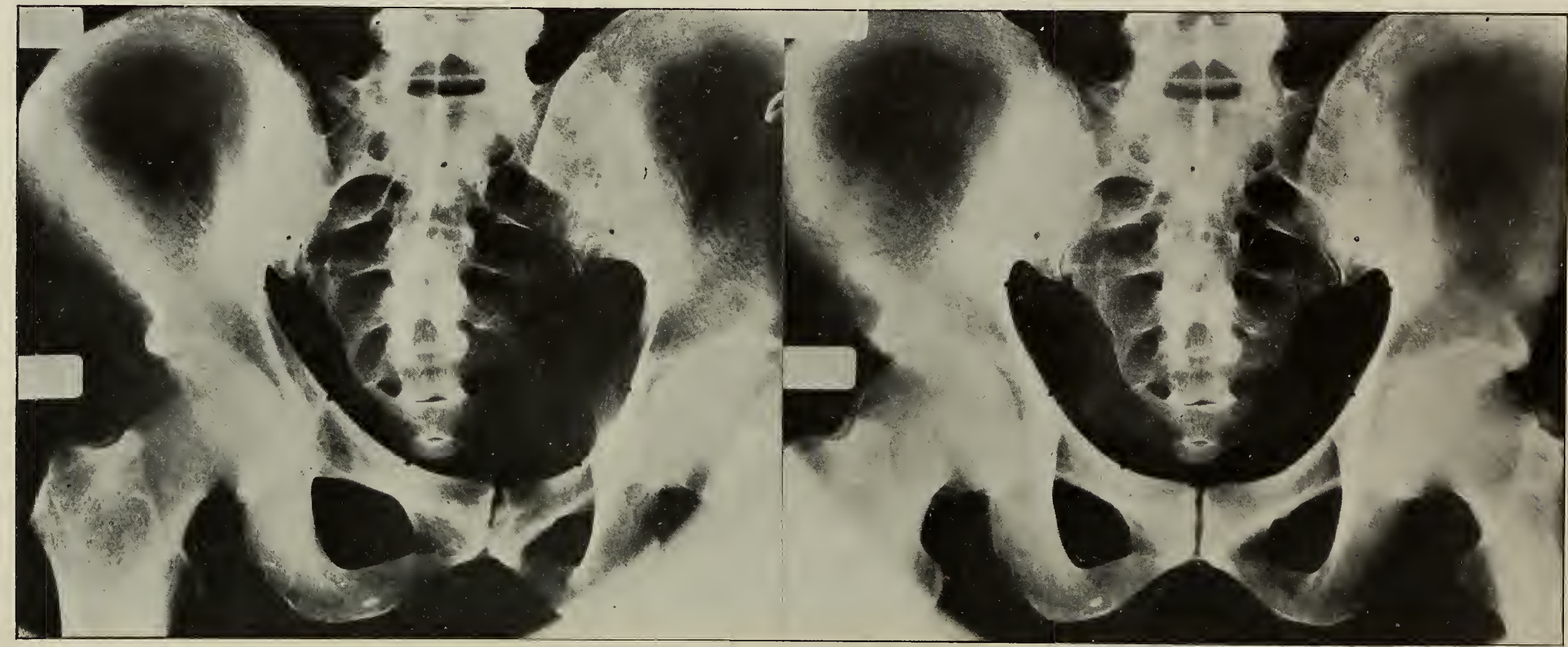



4. Shows tracings from negatives. Those marked 1 inside the rings are tracings from one plate, those marked 2 inside the rings are tracings from the other plate: e.g. 1P and 2P are tracings of the pubes, the most anterior point of the pelvic brim. A. P.=Antero posterior diameter; L. O.=left oblique; R. O.=right oblique; Max. T.=Maximum transverse; and Inter-Acet.=the transverse




5. Shows plate holder, A; table clamp, B; tracing registering with metallic arms at C and $C^1$; tube carriage resting against external arm of table clamp (its position at time of exposures) at D; localizer in position so that E and $E^1$ occupy the positions formerly occupied by the focus point of the tube at the two exposures; the other ends of the threads point to tracing 1 and 2 of the pubes; the crossing of the threads represents actual position of inner surface of pubes. The point of rod F was adjusted at the crossing of the threads when the ends of the threads were placed on tracings 1 and 2 of the promontory of the sacrum. Measuring with a rule between this point and crossing of threads as shown on picture by line H, represents actual distance between pubes and promontory of sacrum.

6. Markings on pelvic brim.



7. Stereoscopic view of the pelvis after being marked.

Furthermore, it would require but few generations to educate prospective mothers to resort to such a measure at some preconceptive time.

We would conclude then, that accurate pelvimetry is very much to be desired; that in the method here described we have accuracy; and that with modern equipment, and proper technique the process is free from danger.

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## DISCUSSION.

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DR. GEORGE H. STOVER, DENVER, COLORADO.

I regard the stereoradiogram as the only correct way of measuring, and I am glad that Dr. Manges has emphasized that fact in his paper.

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DR. GEORGE C. JOHNSTON, PITTSBURG, PA.

I think that this method of measurement is not only decidedly new, but very ingenious and exceedingly valuable.

# FURTHER CONTRIBUTIONS ON THE X-RAY TREATMENT OF LEUKEMIA.

BY HENRY K. PANCOAST, M. D., PHILADELPHIA.

Two thoughts that are apt to arise in the minds of medical men, when, for any reason, the subject of Roentgen therapy in leukemia is brought to their attention, are worthy of our consideration. The first of these is the fact that radiation has usually been found to exert a most profound, striking, and unusual influence upon the important manifestations of this invariably fatal disease. The effect of this influence has usually appeared to be most favorable, at least at first, and at one time it reflected much credit upon x-ray therapy. The second thought which now immediately follows, however, is the fact that, while the x-ray may be the most satisfactory or successful therapeutic agent yet discovered for combating this disease, the gratifying effects primarily produced have been but temporary, and the treatment has invariably failed to prevent the usual fatal termination. Hence any glory reflected in the first thought is lost to us when the second thought becomes uppermost. Furthermore, the latter may lead to reflections upon the apparent limitations of x-ray therapy in this and in other lines, and which may or may not exist in reality. There will always be a tendency among outsiders to draw their own conclusions as to the limitations of Roentgen therapy, unless we, as x-ray therapists, prove our own limitations conclusively by thorough investigations along all lines, and leave ourselves open to no criticism, especially for the reason that advantage rarely fails to be taken of any opportunity for criticism in connection with this branch of Roentgenology.

Let us regard this one instance from the standpoint of an outsider, and consider whether, as a collective body, we have given this particular disease all of the attention it should have received from us, and have done our part in the investigation of both the disease itself and the effects of radiation upon its lesions, especially when its treatment has, for the most part, been left solely in our hands.

It has been three years since the treatment of leukemia has been discussed by this Society, and that is too long a period to allow such an important subject to lie dormant. The essential object of this paper is to promote discussion upon this topic, and for two purposes, the first of which is to prevent a lack of interest and to awaken a spirit of concerted action toward further investigations. The second purpose is a selfish motive to learn something new from the work and the experience of others. A secondary object is the presentation of a few personal observations of little actual importance made in connection with the method of treatment suggested three years ago in a paper written conjointly with Dr. Stengel.

We had then adopted and have since continued to employ this method, for reasons which may be briefly enumerated as follows:

(1) If we accept the present views concerning the pathology of leukemia, and regard it as of the nature of a malignant disease, with the primary foci in the bone marrow, and the lymphatic enlargements as representing secondary metastatic foci, it would seem more rational to direct the treatment primarily to the bone marrow, with a view of inhibiting further abnormal cell proliferation more directly than is possible by the exposure of the secondary enlargements, which brings about the same effect in an indirect manner through the production of leukolytic substances.

(2) The direct exposure of the bone marrow seems likely to produce a **more powerful,** and does produce a **more lasting,** inhibitory effect than these leukolytic substances.

(3) This direct inhibitory effect tends to prevent or limit further metastasis, so that we are able to leave the exposure of the enlargements until a time when it is comparatively safe to expose these large collections of peculiarly vulnerable cells to direct radiation. Hence the dangerous, and frequently fatal, toxemia so apt to result from the early radiation of the spleen and other enlargements may be entirely avoided.

(4) An early symptomatic cure, which is always likely to mislead, is avoided, and the treatment is less apt to be stopped too soon.

(5) The wider distribution of the exposures is less conducive to burns. The skin should be carefully watched, where adjacent areas overlap, however.

(6) The results so far obtained are regarded as additional evidence of the superiority of this method.

TECHNIC.—Omitting all details that have been previously presented, the treatment has been carried out along the following lines:

(1) The applications are made primarily over the bones of practically the entire skeleton.

(2) Each area is exposed regularly and systematically, and it has seemed advisable, for several reasons, to give each area at least three successive exposures during each series.

(3) Exactness in dosage is essential, especially during the early period of the treatment, when toxemia is readily induced. On the other hand, it is advisable to administer the largest dosage possible without producing the least toxic manifestations.

(4) **Frequency.** Except in cases with severe toxemia, daily exposures are advocated, because of the lapse of time between the exposures of the different regions, and because we are dealing with a wide-spread disease of a malignant character. Two areas may be exposed at one time later on, but this is not advocated at first.

(5) Toxic reactions are harmful, and should always be avoided. Toxemia is an indication for decreased dosage, and not for lessened frequency or cessation of treatment. The difference of a very few milliampere-minutes may be sufficient to induce a toxemia, and even an albumenuria.

(6) Direct exposure of the spleen, or of regions containing enlarged glands, should be avoided early, first, because of the dangers from toxemia; and secondly, because the rapid decrease in leukocytosis that follows is apt to be misleading. The secondary enlargements must be exposed at some time,

of course, but not until a safe period, when they have perhaps decreased somewhat in size, as they are very apt to do without direct exposure; when the leukocytosis has decreased materially; and the improvement in the general condition renders the increased liberation of waste tissue products more readily borne.

(7) Any prolonged periods of rest from treatment are to be avoided, and there should be no let up while there is still any likelihood of good being accomplished.

(8) The duration of the treatment has a most important bearing upon the prognosis in favorable cases. Past experience has shown that in every case which has responded favorably, a normal leukocyte count, a reduction of the spleen to normal size, the disappearance of glandular enlargements in lymphatic cases, and a return of the general health to a normal standard—or in other words, a symptomatic cure,—have not in any instance been sufficient to prevent a relapse and ultimate death. Why, then, should we be satisfied to stop at that point? We must certainly treat this as a malignant condition in which recurrence is certain unless every vestige of the disease is eradicated, and we can surely often go farther than a symptomatic cure by keeping up the treatment vigorously until no vestige remains, by not stopping until the differential count shows normal ratios, without which permanent cures need never be expected. We can do even more than this, moreover, by carefully watching the differential count after it has become normal, and starting treatment again at the first indication of any decided tendency toward a reversion to abnormal ratios, which may be taken as a harbinger of a relapse. Experience has shown, in connection with at least one case, that one or perhaps two series of applications over the body at such a time will prevent a relapse, for a time at least. When we have been able to carry the treatment of a favorable case to such a point, which we are, unfortunately, not often able to do, we must acknowledge that we have reached the limit of our present knowledge as to what to do further. A drop in the leukocytosis to a normal or even subnormal count before the enlargements have entirely subsided and the differential ratios have become normal, is a phenom-

enon that is occasionally observed, but one should not hesitate to continue the treatment under such circumstances as long as other indications for its continuance exist.

(9) **The use of arsenic** in connection with x-ray treatment is a question that should be given more careful consideration. Ordinarily there is no objection to the use of this drug in **small tonic** doses during the later periods of the treatment, provided it shows no tendency to disturb the digestive functions in any way. On the other hand, the administration of any form of arsenic in the large doses ordinarily employed in the treatment of this particular disease should be discountenanced, and especially during the early part of the treatment by radiation, and large doses should never be employed in connection with x-ray treatment without due consideration being given to the double destructive effect of these two agents. The effect of large doses of arsenic upon the leukemic cells is much the same as that of direct radiation of the secondary enlargements,—cellular destruction and the production of leukolytic substances, with their inhibitory effects, and also the liberation of toxic products. The toxins so produced, added to those resulting from the x-ray applications, may be sufficient to induce a dangerous toxemia. Furthermore, this effect of the arsenic may make it difficult to properly adjust the x-ray dosage, and it may also lower the leukocytosis too rapidly and render difficult the determination of the effect of the x-ray treatment upon the disease. Moreover, the disturbances of digestion likely to result from large doses of this drug may seriously interfere with the proper elimination of the waste tissue products. Its greatest value, aside from that as a tonic, is in connection with those cases which will progress to a certain stage and then remain practically stationary, radiation apparently being unable to bring about any further improvement. Here moderate doses of arsenic will sometimes materially assist the x-ray toward further improvement in the condition. Also in connection with cases in which, for certain reasons, the x-ray treatment has to be discontinued at too early a period, arsenic is always advisable as a means of retarding the certain relapse and delaying the fatal termination for a time. Such a patient should be ad-

vised to get x-ray treatment whenever it may be possible, even if only once or twice a month.

(10) Cases suffering from acute forms of the disease or acute relapses should not be treated by radiation.

**The Prognosis.**—The fact that several of our patients have been either physicians, or intelligent lay individuals who have taken such an interest in this rather unusual disease as to study all the literature concerning it that they could obtain, has induced us to be rather guarded in our statements concerning the ultimate prognosis in leukemia, at least when such statements are offered for publication. We all know what the ultimate result of x-ray treatment has been in the past, but it is our earnest hope that we, as x-ray therapeutists, may in the near future have some grounds for promising a far more favorable outcome.

The most favorable result is of course a cure, but we have yet to determine exactly what this term implies in connection with leukemia. So far as we can reasonably assume, a permanent cure implies, in addition to a symptomatic cure, at least an elimination of the cause of abnormal cell proliferation by the bone marrow. The nearest we can come to the cause of the disease, is, perhaps, to say that there is in it, and probably also in polycythemia, either a lack of some controlling influence which regulates normal cell proliferation at such a rate as to maintain the normal ratio between the reds and whites, or there is present some active factor which inhibits or otherwise disturbs this controlling influence. So far as we can reasonably assume in regard to the effect of radiation, the x-ray must either act as a temporary substitute for some controlling influence which is lacking, or must restore some faulty process to normal, on the one hand, or on the other, it must destroy some unknown definite etiologic factor. At any rate, the future prognosis will depend upon what effect radiation can be made to exert upon the cause of the disease.

We do know that so far we have been unable to do more than inhibit the etiologic factor, for so far we have failed to obtain ultimate or permanent cures in our favorable cases.

This may be because we do not continue the treatment long enough to eradicate the disease, as in cases of malignant growths that recur. Otherwise, x-ray treatment would seem to be no more than a palliative measure which affords a prolongation of life for a variable period through inhibition of abnormal cell proliferation.

Regarding the treatment as merely a palliative measure, our experience has proved that the bone treatment offers a longer expectation of life in favorable cases than does the older method; is attended by fewer dangers, and that death is apt to be rather more sudden when it does come, but the patients appear to maintain a fairly good general condition until a short time before death. The general condition usually improves from the start, the patient often being able to resume his usual work very soon, and to continue it for a considerable time. One reason for this, no doubt, is the fact that the early toxemia of the direct splenic and glandular exposures is avoided. The leukocytosis decreases much less rapidly, but this is regarded more as an advantage than a disadvantage. At least twice the length of time, or twice the number of treatments, are required in order to obtain a so-called symptomatic cure, but even this is looked upon as an advantage.



These comparisons are based upon the observations made in connection with the treatment of 20 cases by the method herein advocated. As only 5 other cases were treated by the older method prior to the adoption of the present one, we have included these with the average general results obtained under the older method in making our comparisons.

4238 Pine Street.

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## DISCUSSION.

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MR. H. W. DACHTLER, TOLEDO.

I have treated two cases by this method since Dr. Pancoast published his original paper, and have one patient now under treatment. I was wondering how long these cases will go without a recurrence. One patient went two and a half years without any treatment. The patient disappeared from observation about six months ago. The other patient is not feeling very well, but has not yet returned because of a recurrence.

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DR. ROLAND HAMMOND, PROVIDENCE, R. I.

I spent a little while with Dr. Warthin at Ann Arbor recently. He showed me some slides of kidneys removed from cases of leukemia which had been treated by the Roentgen ray. They showed areas of calcification. He was very pessimistic about the value of the treatment and seemed inclined to consider it of no use, in fact harmful. We ought to settle that point and set him right, if he is wrong.

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DR. J. RUDIS-JICINSKY, CEDAR RAPIDS, IOWA.

It is quite probable that the slides Dr. Hammond saw were made from specimens removed from a case of leukemia, but it is also possible that some other condition was combined with the leukemia which would account for the appearance of the kidneys. If the Roentgen ray gives these patients any relief, even for a time only, it is well worth using. I had one such case and the patient came back after three or four years with a recurrence.

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DR. PANCOAST (closing the discussion).

Pseudo-leukemia and leukemia should not be confused. They are two entirely separate diseases pathologically as well as clinically. From the therapeutic side, so far as the Roentgen ray is concerned, there is every difference between the two. I am trying to regard leukemia in the light of a malignant disease. Pseudo-leukemia I regard as a sarcoma in my treatment, and I expect a recurrence, yet I treat it as a local disease and not as a general disease, as I do leukemia.

As to Mr. Dachtler's remarks, the particular point I wish to bring out is that we should not wait for the relapse, although it does always occur. Why wait for it? Why wait for the return of symptoms when you can get an earlier sign? Why not watch the differential count? Make a blood count at least once a month for a while anyway. As soon as you see any change in the differential ratio, begin the treatment at once. Do not wait until the patient is nearly dead. You do not do that in any malignant case. Why not treat a case of leukemia on the first suspicion of recurrence, and that is a change in the differential count? That is the important point I wish to emphasize in my paper.

As to what Dr. Warthin told Dr. Hammond, that is an old story. The changes in the kidneys were not due to the effect of the Roentgen ray. They were due entirely to the effect of the toxins liberated by direct exposure of the spleen and lymph glands. By the elimination of these toxins the kidneys were damaged. That is one of the main objects of the bone treatment of leukemia, to avoid that toxemia so that normal kidneys will not be influenced in any way.

# THE ROENTGEN TREATMENT OF CARCINOMA OF THE BREAST.

BY RUSSELL H. BOGGS, M. D., PITTSBURG, PA.

Roentgen treatment is given both as a palliative measure and as a curative agent. Although the Roentgen Rays have been used extensively, Roentgenologists differ considerably in regard to the value of the treatment. This is not only due to different degrees of malignancy, in different classes of cases, but also to variations in technique.

Some have given small daily doses with the tube placed close to the surface of the skin, while others have given only few massive doses, with the tube at from twelve to fifteen inches from the surface. Since the technique varies from a few to fifty or more treatments, the physiological action on the tissue will vary from an almost imperceptible dermatitis, without any tanning, to an inflammation of the second or third degree, followed by a sclerosis of the adjacent lymphatic glands. Then it would be natural to expect that various Roentgenologists place the value of the Roentgen Ray in the treatment of carcinoma of the breast at a different level.

In some localities, Roentgenologists were governed or rather were compelled to treat the cases according to the directions of the surgeons who referred the patients. Of course, this did not give the Roentgenologists a fair chance. This is particularly true in large hospitals where the cases have been treated by young Roentgenologists. One Roentgenologist complained that his patients, who were referred by the staff surgeons, told him the time of exposure and the amount of treatments to give in each case. The patients were instructed that they could leave the city as soon as this number of treatments was given. He further states that he realized that in many of the cases no therapeutic effect had been obtained, and for this reason he disliked this particular branch of Roentgenology. It would be as rational for the surgeon to prescribe a definite dosage for his anaesthetist.

Such will not be the case in the future, as both surgeons and physicians recognize Roentgenology as a definite specialty.

In taking up the treatment of carcinoma of the breast it seems advisable to divide the subject into inoperable and recurrent cases and ante-operative and post-operative treatment.

The Rays are the only therapeutic method in inoperable cases that will cause cessation of pain and hemorrhages, disappearance of offensive odors, arrest of invading progress and improvement in the general health of the patient. In a certain percentage of cases the mass is reduced to such an extent that it will become operable. It seems, in the past, that many of these cases which have improved so much were operated upon too early, before the disease had sufficiently localized. When a patient presents herself with the symptoms unfavorable for operation, the mass breaking down, or about to break down, a number of intense radiations should be given, walling off the mass as completely as possible in order to lessen the chances of further infection. Since a large majority of breast tumors are carcinoma, there must be at least two-thirds of the patients that come too late to be in a favorable condition for operation.

It is a well known fact that many inoperable cases who have been suffering from pain and toxemia have been relieved after twenty or thirty intense radiations of these symptoms for a period varying from six months to three years.

I will briefly summarize twenty unfavorable cases for operation, classed as unfavorable because there was extensive involvement of both axillary and supra-clavicular lymphatics together with a broken down mass, or about to break down.

| Extent of Disease. | Operation after Treatment. | Result. |
|---|---|---|
| I.—Ulcerated mass with axillary and supra-clavicular involvement. | Radical. | Lived four and one-half years. |
| II.—Large mass in breast with both axillary and supra-clavicular enlargement. | Radical. | Patient died within twenty-four hours. |

| Extent of Disease. | Operation After Treatment. | Result. |
|---|---|---|
| III.—Large mass adherent to skin in breast with axillary involvement. | Would not be operated upon on account of organic heart lesion. | After forty treatments and a severe dermatitis which lasted six or eight weeks, the mass reduced to a small nodular hard lump, freely movable. Patient well, lump still about same size seven years after treatment. |
| IV.—Both breasts involved with glandular enlargement. | No operation. | Pain relieved after six treatments but no reduction in size after fourteen treatments. |
| V.—Ulcerated breast with glandular involvement. | No operation. | Mass reduced in size. Ulcer never entirely healed. Patient relieved for six months, died three years later. |
| VI.—Mass in breast with extensive glandular involvement. | Operated upon after thirty treatments. | Patient lived three and one-half years. |
| VII.—Mass broke down by a plaster which caused rapid growth. | No. | Healed by forty-five treatments, apparently well for two years. Patient died of epilepsy. |
| VIII.—Mass broke down by a plaster with extensive glandular involvement, had symptoms of internal metastases. | No. | Healed over after forty-five treatments. Arm remained swollen and was amputated on this account. Patient died two months later. |
| IX.—Mass in breast with glandular involvement. | Would not consent to operation. | Mass reduced to size of marble after four months' treatment; lump about same six years after treatment. |
| X.—Mass broke down by plaster; glandular involvement. Had not healed after plaster. | No. | Healed over by thirty treatments, all external signs disappeared except swelling of arm. Patient comfortable for one year. Died six months later. |
| XI.—Large mass adherent to skin with extensive glandular movement. | Radical. | Patient lived one and one-half years. |
| XII.—Mass with extensive glandular involvement. | Would not consent to operation after treatment on account of her age. | Mass reduced two-thirds and comfortable for eight months. Died of organic heart disease. six months later. |

| Extent of Disease. | Operation After Treatment. | Result. |
|---|---|---|
| XIII.—Ulcerated mass in breast with glandular involvement. | Modified operation. | Patient apparently well three years after operation and treatment. |
| XIV.—Mass with extensive glandular involvement. | Modified operation. | Patient lived one and one-half years. |
| XV.—Mass adherent to skin with extensive glandular involvement. | No. | Patient apparently well after three years. |
| XVI.—Mass in breast with glandular involvement. | Radical. | Patient apparently well one and one-half years. |
| XVII.—Ulcerated mass with glandular involvement. | No. | Healed over after four months. Patient comfortable for one year. Died nine months later. |
| XVIII.—Large ulcerated mass with swollen arm and taking morphine to relieve pain. | No. | After forty treatments ulcer healed, patient was comfortable for one and one-half years, made trip to California and died three months later from internal metastases, with no local recurrence. |
| XIX.—Ulcerated mass with glandular involvement. | No. | Patient weak and suffering intense pain when she came for treatment, three or four treatments relieved pain to such an extent that when unable to come to the office she insisted on having a machine in her home to relieve the pain. Died three months later. |
| XX.—Mass broken down with extensive glandular involvement. | No. | Ulcer almost entirely healed and pain relieved for nine months. Died three months later. |

Every Roentgenologist can report similar cases of inoperable carcinoma and some more extraordinary cases and this proves not only the inhibitory action but that the Rays must be looked upon as a curative agent as well. Never depend on the Rays alone but call in surgical aid even in the inoperable cases, as more can be accomplished with the combination of surgery and X-ray than by either method alone. Now, while there are only five of these twenty cases living today, every one of them was sufficiently benefited to justify the treatment. The pain was relieved for a period averaging a year, in nearly every case the mass was reduced in size and in some cases it became freely movable. Almost every one of these patients was able to perform her usual duties and be with her famliy, free from pain and from the offensive odor so distressing in ulcerated carcinoma. The patients who died from internal metastases did so without external symptoms except swelling of the arm. As a rule, the patient did not know she was dying of carcinoma. This seems a great deal to anyone who has seen a number of carcinomatous patients with a broken down mass so offensive that it is almost impossible to stay in the room with the patient.

The Rays also have an inhibitory effect on the bronchial and mediastinal glands, but not to the same extent as on disease situated nearer the surface. This is demonstrated by the relief many derive from treatment when external signs of the disease have disappeared. I have two such patients, who know that a cure cannot be expected, and only come when the symptoms become unbearable.

Several surgeons who have operated on cases in which ante-operative Roentgen treatment has been given, coincide with the following statement: If lymphatic nodules were palpable they were found to be small and hard of the type met with in chronic inflammations. The tumor mass is reduced in size. Fibrous elements predominate. It is a well recognized fact that the type of neoplasm more than any other feature influences its course. The more pronounced the cellular and the less the fibrous elements, the greater will be the malignancy. This explains why the atrophic schirrous type is less malignant than medullary adeno-carcinomata. Since Roentgen treatment will increase the stroma or connective tissue and decrease cellular elements it decreases not only the mass but also the degree of malignancy.

A very noticeable and gratifying result of ante-operative treatment is the almost complete disappearance of the normal scar tissue which follows operation. One of these surgeons at the present time sends all his cases for ante-operative treatment as a matter of routine even if there is no glandular involvement. He states that post-operative treatment in the early cases is then unnecessary and that the patient can go to her home without taking any further treatment. Ante-operative treatment has not been carried out in a sufficient number of cases to say positively that it is advisable as a routine procedure. But since the growth can nearly always be reduced and a fibrous wall be formed delaying extension, it seems that in any case ante-operative treatment is allowable.

In recurrent carcinoma where the chest is studded over with nodules the external signs of the disease can be cleared up by Roentgen treatment providing the patient is in a fair physical condition. But if the bronchial and mediastinal glands are involved before radiation is begun, temporary relief with prolongation of the patient's life is all that can be expected.

In cases where recurrence had taken place with nodules studded over the chest and where the arm was swollen, I have been able to apparently cure only four cases although some have lived over three years. Since this is the experience of a number of other Roentgenologists it seems advisable that Roentgen treatment should be given to all these patients. The palliative effects of the treatment should never be denied a patient.

My experience has been that the treatment in this class of cases must be given somewhat more guardedly than in patients who have not been operated upon, as the skin is thin with a lessened blood supply and a dermatitis is more readily induced. When dermatitis occurs it is very slow to heal and the burned area cannot be readily excised as in an unoperated case.

Post-operative treatment of carcinoma of the breast has been adopted by a large number of surgeons as a routine procedure. It is indicated after all operations because more cases are cured and a longer freedom from recurrence is obtained. The treatment should begin as soon after operation as possible as success demands promptness, thoroughness, energy. The treatment should be given with all the severity the patient's tissues will bear. Inefficient treatment is not only useless but may even stimulate any remaining foci. It is, of course, harmful to push the treatments to such a degree that the skin over the chest undergoes degeneration. One advantage in ante-operative treatment, where there is extensive involvement, is that more intense radiation can be given and then if there is any degeneration of skin it can be removed at the operation. I always give twice as much radiation at a sitting, before operation as after on this account.

After operation there is no need to delay treatment as the healing of wounds, closing of sinuses, covering of granulating areas, etc., are hastened by radiation. A remarkable result of post-operative treatment is the rapidity with which the stiffness in the shoulder disappears. This must be due to the absorption of scar tissue. The scar which is left after operation is almost entirely absorbed. As recurrence very often occurs in the scar this alone is sufficient to justify the treatment. Rodman states: "If anything has been demonstrated it is that recurrence generally takes place in the skin, and its wide removal is the prime consideration, even though the necessarily large wound must be closed by either undermining or skin grafting." As we all know how amenable skin cancer is to the Rays, it is easily understood that any foci here can be destroyed by the Rays.

Radiation should be given over the anterior chest wall in the axilla and over the supra-clavicular glands. It should be particularly strong over the axillary glands and over the clavicle as here the tissues stand intense radiation and the glands are reached with more difficulty. In the past, many have given the longer amount of radiation over the site of operation. The length of post-operative treatment cannot be determined except by the indications of the individual. Sufficient treatment should always be given to produce tanning with a slight desquamation. This will usually require, when using a filter, between twenty and forty treatments of twenty minutes each with the tube placed at about twelve inches from the surface. Roentgen treatment should be given as carefully and as thoroughly as an operation is done. Then only can the best results be obtained. I am sure much of the post-operative treatment has been given carelessly. One reason for this is that oftentimes patients live in distant villages where they do not have an experienced Roentgenologist and it is impossible to keep the patient in the hospital for a sufficient length of time to secure the proper amount of treatment. A few days ago a surgeon called my attention to two patients to whom I had given Roentgen treatment after operation over eighteen months ago. He said he had expected a recurrence in both these cases within a short time on account of the extensive involvement and that he was positive that only the intense radiation had prevented a recurrence. At present, I am treating a recurrent case who had been operated upon with fifty subsequent Roentgen treatments six years ago. The disease was so far advanced that the surgeon did not think favorably of the operation and expected only temporary relief. In this case nearly all the treatment was given over the site of operation. The recurrence is apparent in the supra-clavicular glands only. Whether there is a deeper metastases remains to be determined. The recurrence is disappearing under treatment. Here is a case where the Rays have proven of great service even with faulty technique. The present day method might have worked a permanent cure.

Early operation and a thorough use of the Roentgen Rays will do much toward doing away with the clinical picture of cancer of the breast, which has been so drawn in past years, as to create a most unfavorable impression on the profession by the laity.

Post-operative treatment certainly makes the operation more radical, as glands can be reached which cannot be removed.

After the treatment and observation of a large number of cases both operable and inoperable, before and after operation or without operation, I concluded that a localized resistance to the invasion of carcinoma is temporarily or permanently established. This is especially true in the milder type of malignant epithelial growths. It is a noticeable fact that the more widely disseminated the less the reaction is produced. This principle may be observed in many of the localized infections.

I. To recapiulate:—Under the influence of the Roentgen Rays, used as a palliative remedy glandular involvement has melted away; ulcerated masses have healed over; adherent tumors have become movable; inoperable cases have become operable; rapidly growing carcinomata have assumed a more schirrous type; lymphatic pathways have been sealed against extension and a fibrous wall has been erected against further growth; life has been prolonged and redeemed from misery. This would seem to call for routine ante-operative use of the Rays even in favorable cases but experience is not yet sufficient to permit us to assert this as a demonstrated fact.

II. Post-operative treatment has diminished scarring, promoted healing, postponed or prevented recurrence.

III. Such results demand not only technical competence, but judgment, clinical knowledge of both the disease and the remedy, promptness, energy and courage.

IV. Surgeon and Roentgenologist must work hand in hand, each availing himself of the other's aid but each respecting the other's authority in his own field and each having a broad scientific understanding of the whole subject.

# THERAPEUTIC EFFICIENCY OF ROENTGEN IRRADIATION.

BY GEO. C. JOHNSTON, PITTSBURG, PA.

A perusal of the preliminary program of the 1910 meeting of the American Roentgen Society reveals a decided scarcity of papers dealing with therapeutics of the Roentgen Ray. The reason of this is that the ground has been so thoroughly explored that any paper dealing with the subject must almost necessarily lack originality and therefore to a degree interest also, whereas the field of diagnosis is constantly extending and each year shows some new use for the ray. The preponderance of diagnostic papers over those dealing with therapeutics might lead the general profession to believe that as the field of diagnostic value increased that of therapeutic value had decreased. This is far from being the true status of affairs. Once the truth has been established firmly we cease to affirm it; it is no longer necessary that you affirm the rotundity of the earth. Those whose opinions we care for have accepted the truth; those who have not accepted it are incapable of recognizing the truth when they see it, but there still remains a considerable proportion of the profession who read but little and are out of step with progress, who require to be educated in the value of this agent in the treatment of various diseases.

I have been asked more than once within the month by men otherwise professionally intelligent if it were true that the X-ray was capable of destroying rodent ulcer; it seems to me therefore that it is the duty of this society to spread more widely the truth regarding radio therapy.

There is absolutely nothing new in the few points that I wish to bring before you, but I should like to evoke a discussion which will be participated in by every man here who is doing therapeutic work. Radio therapy has proven itself of value in three classes of diseases: 1st, the dermatoses; 2nd, glandular diseases including leukaemia and, 3rd, malignant diseases.

To the dermatologist who is wililng to devote enough time to the study of this agent to insure its intelligent application, the ray has proven of extreme value. The physiological action of the ray upon the skin is pronounced and constant and all that is necessary to produce exact results is the ability to apply the correct dose at proper intervals or at a single sitting. (I still observe the persistence of the popular self delusion that the Roentgenologist is *per se* a Dermatologist, the Dermatologist a Roentgenologist and the Drug Store clerk a Doctor.)

The glandular affections wherein the ray has proven itself valuable are tubercular lymphadenitis and goitre in all its varieties except cystic. The treatment of tubercular cervical adenitis by means of the Roentgen ray is eminently satisfactory and leaves little to be desired. The results are permanent. A number of cases treated several years ago have never experienced any recurrence but remain in excellent health. Some twelve cases recurrent after one or more operations have completely recovered by the use of the ray alone and remain well today. Patients with multiple sinuses from scattered suppurating glands have cleared up completely with sinuses closed while the cosmetic result in these cases is most excellent. The only unsatisfactory cases encountered have been found in children from four to six years of age, with one or more boggy inflamed glands about to undergo suppuration and accompanied with tonsilar abscess or bad tonsils. Such cases should not be accepted for treatment until after the glands have been drained and a tonsilectomy performed. In a number of instances perfect results have been obtained in patients who had been previously operated upon once or more and given the benefit of sanitarium treatment, tuberculin, etc.

There seems to have been a hesitation among Roentgenologists about undertaking the treatment of the various forms of goitre, a number of men have reported unsuccessful results and but few cases of any kind have been reported. Simple hypertrophic goitre, while quite common, does not fall into the hands of the Roentgenologist until the enlargement of the gland with the resulting pressure symptoms forces the patient to seek relief. The gland is by this time quite large and its retrogression under radiation necessarily becomes a tedious process and unless the operator is confident in his technic he and the patient lose heart and the treatment is interrupted before sufficient dosage has been given to insure results. Some of these cases require from forty to fifty treatments. The sole reason for treating cystic goitre at all is in the hope of producing sufficient capsule to render the following operation easy.

Exophthalmic goitre is the most satisfactory of all the varieties from the standpoint of treatment if the cases come to observation sufficiently early to permit time to check the hypersecretion of the diseased thyroid by radiation. Some patients are so thoroughly toxic when first seen that immediate operation seems imperative; usually, however, by placing such patients at rest, permitting no physical or mental exercise and pushing treatment with massive doses, encouraging sweating and elimination, dangerous symptoms can be held in check until such a time as the physiological action of the ray in inhibiting glandular secretion, checks the formation of the thyrotoxin. Once the pulse rate begins to decline and the tremor to lessen the battle practically is won and a slow return to normal begins. As soon as the profession discovers the value of the X-ray in the treatment of this disorder, patients will be referred much earlier in the course of the disease, and the same rule will be found to apply here as elsewhere, the earlier treatment is instituted the better the results of treatment.

Personally, I have never experienced any difficulty in relieving all the symptoms and apparently curing early cases of exophthalmic goitre; twenty-four such cases have responded nicely to treatment and four are under treatment at the present time, but patients with marked protrusion of the eye balls, considerable vascular dilatation of the thyroid, marked tremor, profuse sweating, tachycardia, dyspnoea, with a pulse rate of 160 or higher, scarcely able to reach the office for treatment are *not* the class of cases in which X-ray is indicated. Where it is possible to put such a patient to bed and enforce absolute rest, bedside X-ray treatment may be tried with some hope of success, but the patient should never be permitted to get into such a condition before X-ray treatment is begun, since a few weeks' treatment at the beginning of the disease would have absolutely prevented such unfortunate progress. I have treated two cases of malignant disease of the thyroid by Roentgen irradiation; the first a young girl twenty years of age with a complete sarcomatous involvement of the thyroid, considered inoperable, was given 22 treatments which reduced the gland in size and rendered the case an operable one. Dr. C. Q. Jackson performed a complete thyroidectomy and at last report, some nine months after the operation, there was no evidence of recurrence. The pathologist pronounced the specimen sarcoma. Second case, an unmarried woman thirty-five years of age, referred by Dr. Jackson with malignant disease of the thyroid, was apparently cured, the tumor completely disappearing and it has remained well almost a year; under continuous observation the recurrence expected has not appeared. A number of other patients with malignant thyroids have been declined on account of the progress of the disease and the evidence of dissemination. I am convinced of the extreme value of this method of treatment in these cases, but large doses must be employed and the gland rayed from all sides, filtration by the method of Pfahler being an absolute necessity. Tubes of high penetration capable of passing 1¼ M. A. for ten minutes at 10 inches must be used.

## Diseases of the Skin.

The efficiency of the Roentgen ray in the treatment of rodent ulcer, epithelioma, and sarcoma of the skin is recognized the world over and requires no discussion. It is rather pleasing to see that recognition has finally been given to this treatment in the management of lupus vulgarus. Results are obtained in less time and at a less expense than by any other means. Lupus vulgarus requires energetic treatment. I have never cured a case without being compelled to produce a burn. Superficial treatment merely ameliorates the disease and within a year some portion of the diseased area is practically certain to recur. No case in which the mucous membrane was involved has failed to show slight recurrence from time to time even following energetic treatment but the recurrence has always responded to further treatment. The ability of syphilis to imitate every form of skin disease especially lupus must never be lost sight of. Any case of lupus no matter by whom diagnosed which recurs promptly after clearing up under the ray should be given the benefit of iodide. Lupus erythematosis is usually better treated by carbon dioxide snow.

The value of the ray in the treatment of pustular acne, chronic eczema and psoriasis is well known to all dermatologists. The treatment of leukaemia as outlined by Pancoast and others is worthy of careful attention. Personally, I have been temporarily successful, the first results while often strikingly brilliant have later proven disappointing.

There are a number of varieties of malignant disease that, due to location or other factors are peculiarly suitable for roentgen treatment. For example, the epitheliomas and carcinomas on and about the eyelids. These can be so beautifully removed that close inspection is necessary to show the location previous to treatment. In thirty-one cases so treated failure has resulted in but one and this patient showed a breaking down of the scar one year after apparent cure. The scar tissue simply melted out and a deep clean cut ulcer appeared which would not heal under any treatment. The patient was seventy-three years old and very feeble.

When ulceration has occurred and involved the ocular and palpebral conjunctiva, the prognosis is not so favorable and a number of such cases have shown only temporary improvement.

Rodent ulcer can practically always be cured by energetic raying. A decided reaction is necessary and the quicker the better. Following the throwing off of the resulting scab, a wait of two to five weeks will show whether any further treatment is needed. In any case of malignant disease involvement of the underlying bone, increases the gravity of the prognosis.

The admitted value of the ray in the treatment of recurrent carcinoma of the breast, etc., is the best argument for its employment before recurrence begins. Post operative radiation should be employed as a routine measure after the removal of every breast for carcinoma or sarcoma. If the axillary and subclavicular glands are involved at the time of operation mediastinal or pulmonary recurrence is a matter of time only, but this time may be much extended by a long course of energetic treatment. When the mediastinum is involved the ray must be delivered from all sides at different sittings as the sternum acts as an efficient shield to the very point necessary to reach.

Many hopeless cases can be given years of comfortable life by ante-operative radiation followed by operation and then the raying renewed. Any man doing this class of work must be satisfied with the temporary inhibition of the disease in a large proportion of his cases but will be rewarded by occasional brilliant results often when least expected. Where the patients present themselves early, before the disease has disseminated throughout the lymphatics, a course of ten to fifteen treatments followed by a radical operation going wide of the disease using no suspicious skin in the flaps followed by three months' post operative treatment is the course always recommended and the results are usually satisfactory.

What is most needed at present is the education of the general practitioner in the recognition of early forms of malignant disease so that the surgeon and roentgenologist may have a few hopeful cases to treat instead of the class of desperate cases so frequently seen at present.

# ROENTGEN RAY THERAPY AND ITS PRACTICAL APPLICATION IN MALIGNANT LESIONS.

BY DR. J. RUDIS-JICINSKY, CEDAR RAPIDS, IA.

Every Roentgenologist knows, that after several sittings and exposures of epitheliomata, cylindrical-celled Carcinomata, Carcinomata simplex and flat celled Carcinomata, changes take place in the lesions proper with various metamorphoses or degenerations, pointing to the fact that the Roentgen rays, having the selective power for diseased cells, especially in some individual cases, are of objective therapeutic value, and if nothing more, used properly and in proper dosage, will give subjective results in every malignant case whether they are combined with operative procedures or not, because they at least relieve the suffering of the patient and prolong life. In some cases when the Roentgen rays were administered over a sufficient length of time, the results were very promising, and we have many cases on record of epithelioma especially, which after an elapse of five or six years are still doing well, and even some inoperable deep cases and those of Carcinoma Mamae under this treatment progressed well and no metastases and autointoxications took place, the prognosis being comparatively good. And, strange to say, as you all certainly have observed in your practice, these promising conditions happen in all those lesions rayed, where the electro-chemical action of the rays is complete and the intercellular tissue in the lesions exposed becomes so abundant, as to nearly obliterate the cellular elements, the hard portions of these carcinomata becoming softer or even liquefied and honeylike discharge or exudate demonstrates itself at all points of sloughing, undergoing spontaneous cure perhaps in this way. In that respect we have all the same experience, I am sure, even in fibro-carcinomata, but not so in carcinoma molle. And again, we seemed to have better changes in deeper colloid carcinoma, myxomatodes and melano-carcinomas.

Having a honeylike substance in nearly all the open lesions, which progressed favorably, and reading the reports of others on the same subject, I have carried out a number of experiments to see if I could cause a certain reaction, or hasten the process of absorption under the Roentgen rays with the help of this seemingly healthy exudate which has some very active properties.

First I have implanted under the skin this honey-like exudate from the human cancerous lesions into the tissues of rabbits and guinea-pigs. Relatively large quantities of this substance were planted under the skin into healthy tissues of these animals without causing any symptoms of reaction, and only in three cases out of twenty was there local infection, which did not amount to very much; but if a very small quantity of such a substance of cancer of a rabbit was inoculated into the tissues of old rabbits or those suffering with any wasting disease or injury, very definite symptoms were produced. The temperature arose from one to two degrees F., at once, and this rise was accompanied locally by inflammation. This process was observed for a length of time carefully and microscopically. The basement substance of various layers of connective tissue, and especially the walls of the blood vessels, became swollen and thickened by their conversion into a translucent, firm, glassy, yellowish material, albuminous in character. The parts of the lesion felt larger than normal and had a peculiar dull shining appearance. Some direct transformation of the tissues progressed rapidly, the parenchyma cells undergoing atrophy, as the result of pressure from the swollen, degenerated tissue. Around each localized lesion produced, was an area, more or less marked, of heat and redness, and with the increasing congestion we had later a casting off of pieces of necrotic tissue, a humor being formed, the cells of which, advancing in the periphery made their way through the lymph spaces and formed new foci. In some cases metastasis followed in the distant part of the body, or general. And these secondary tumors being similar in structure to the primary foci differed in vascularity, abundance of stroma and shape of the cells, but nearly all of them seemed to be rapid in growth, if irritated in any way.

When this condition was recognized the Roentgen rays were employed at once, and the animals exposed individually for 15 minutes, first every day for two weeks, and then three times a week, and following the reaction we finally healed all the primary lesions produced, but the lesions of secondary character, even where the cells presented only the general characters of the epithelium of the part in which they occurred, varying much in this and other respects in every case, did not behave in the same way. We operated quite a few of these lesions once or twice, as the cases required, continuing the use of the Roentgen rays, but the final results were not satisfactory at all, though the animals did not seem to suffer much pain. As a last resort, knowing that phagocytes are disseminated after an irritation in these lesions, we have applied the honeylike exudate, produced in the primary lesions direct to the malignant tumors of secondary character, or reinoculation of the disease in the same animal, and to our astonishment found that the sloughing progressed more rapidly and with better results, the effect of our raying being more promising with every exposure. This discovery was made use of in human beings as soon as possible, and the secondary lesions of malignant character studied side by side with those which seemed to be primary. Fortunately, in spite of all our precautions, the honey-like exudate was employed in some of the cases of animals without regard to proper dosage and strength and the results were nothing short of disaster, the guinea-pigs especially dying quickly, in spite of all the treatments with Roentgen rays and absolute cleanliness of the lesions proper. The honey-like material taken directly from a carcinoma mamae was introduced into an open and healthy wound near the Radial artery and the wrist of the right hand of the experimenter himself, and the actual progress was watched carefully. Our condition being otherwise very good, no specific reaction was caused in the beginning of the introduction of the material in the wound produced. Simple infection followed and with the increased knowledge of the behavior of similar primary lesions in rabbits, we have waited for some secondary demonstrations later on. . . .

All the symptoms of infection manifested themselves, but not a cancer, the swelling of the whole hand was marked, and suffering with all the pain possible could be traced especially to the enlarged glands in Axilla. After an elapse of ten days some exudate and pus material formed in the wound, which I had kept not only clean, but open, and was removed and collected in a special vessel, the pain being relieved every day with the exposure of the original wound to the Roentgen rays, which seemed to raise the resistance of the body against the infection. With the relief of pain the swelling went down comparatively soon, the wound healed, and the human exudate and pus were used to see if we could produce more disturbance of secondary character in those rabbits still alive suffering with primary lesion. And, strange to say, all the rabbits so treated gave no reaction but suffered with very virulent local lesions, if the cancer was irritated, and died later, giving us a complete microscopical study of fatty, colloid, mucous and amyloid degenerations with ulcerations, hemorrhage and all the symptoms of prolonged irritation and this followed by inflammation. In two cases we also had enlarged remote lymph nodes, and the lesion proper healed, the nodules remaining for months. In my case the original local wound healed and the nodules in the Axilla and over the Pectoralis muscles on both sides remained, after an elapse of five years. One thing is sure, that the honeylike exudate in cases of carcinoma I am using up to the present time in a very simple way did produce more necrosis and more rapid sloughing and destruction of the diseased tissue of low vitality in the same carcinoma proper. I do not wash this material away, but take a clean brush and apply the honey-like exudate from one portion of the lesion of the patient to all the portions of his cancer, which do not degenerate quickly enough and am raying the whole. The amount of this exudate to be applied to the other parts of the same malignant lesion to hasten the resolution, absorption and sloughing varies according to the individuality of the lesion, the age, the personal characteristics and general condition of the patient, the type of carcioma, whether primary or secondary, its duration, extent and the severity of systemic infection. Something may be accomplished by this local treatment with the patients' own exudate and general Roentgenization around the lesion, but to use and transfer the exudate to others is not satisfactory.

This way the whole volume of blood of the patient with an otherwise strong body and with plenty of resistance as far as yet, if we start in time, dilutes the toxic stimulants and more is required to cause the increase and production of those fighting particles and corpuscles, as they are floating in the serous fluid mentioned above. The corpuscles seem to be identical with the white corpuscles of the blood; they appear to be derived chiefly from the blood by a morbid migration of its white corpuscles, although it is also very probable that some of them are derived from a later proliferation of the connective tissues, or other changes in the cells during the inflammatory process. If we examine carefully the exudate we will find that it is a fluid produced as one of the consequences of repair in inflammation. And taking the history of an original irritation in nearly every case and its results of malignant character into consideration, the alkalinity of the exudate, it being rich in potash, its serum albumen, fibrinoplastic material, casein, myosin, lecithin, cholesterin, leucin, etc., we at once will grasp the opportunity for a better chance for repair at the focus of infection, as the blood being charged with its own fighting material and circulating under the Roentgen rays more freely will give us a better local action, the charged cells eliminating themselves after a certain time and definite cicatrization occurs. I do not claim any priority in this study of mine, but would like to state that nearly all the cases of malignant lesions which came under my observation in time, some of them even after operative procedures, progressed very favorably under the Roentgen rays, with proper dressing locally as suggested, the exudate being one of the helping principles.

Observing the cells, and watching the progress of the degeneration of the lesions microscopically, I have not found any evidence of parasites and comparing the results with similar results in the vegetable cells of perfectly healthy cherry trees of the same age, same quality and same sort as planted in my own garden, may say with others, that there were neither any signs of bacteria. After an elapse of four years of constant irritation to the lower portions of the trunks of these trees done unintentionally with the lawn-mower, I observed new growths on all the trunks, and made slices for microscopical examinations. The proliferation of the cells was identical with that produced by irritation in human tissues and the changes at the site of the lesion were of the same character as the inflammatory process in human tissues, and to make the object still more interesting, the process of repair seemed to be just the same, Nature trying to help along in these peculiar tumors of the trees with an exudate yellowish and perhaps only of a little different composition. Trees without this exudate simply succumbed. My own favorable impression of the influence of this exudate has been principally formed by noticing how rarely the disease seemed to progress by the usual exacerbations and elapses in patients who were tolerating progressively increasing doses of the Roentgen rays, giving us more or less of the exudate in the lesions attacked, and in watching very weak and cachectic cases who were running slowly but steadily in a downward course, in spite of all the treatment.

I do not say that this exudate, $CO_2$ snow in some superficial lesions, or our Roentgen rays and even in some cases the Radium introduced right into the lesion itself are the specifics found for the cure of cancer, I do not claim to have discovered something altogether new, but I do claim according to my own experimentation, research and the results of actual treatment of hundreds and hundreds of carcinomas and other malignant lesions, that if only one life was saved and all the others did not suffer the excruciating, shooting pains of cancer proper on account of our treatment and their life was prolonged for the benefit of their families, and sometimes the whole of society, even public welfare, that I should be content as we all may be in thus working on and on towards the progress of our knowledge, science and art of healing. . . .

On the other hand, if we transplanted very tiny pieces of skin from embryo rabbits under the skin of twenty other rabbits selected, and after an elapse of two weeks implanted under the skin of each of these healthy rabbits this cancer exudate or direct grafts, cancer never developed. It was the same with those where the blood was mixed in the healthy rabbits and red blood corpuscles, not serum, injected. The inoculation or grafting with cancer was impossible as in the case of a guinea-pig, where the healthy spleen was removed a little piece of the same being introduced right under the skin of the same animal. We cannot assert, that by the use of these and similar methods, we can cure carcinoma, but they tend to support the theory that it can be prevented.

## Conclusions.

Carcinoma of whatever character or form, any malignant process in animal or vegetable tissues, is not due to any parasite, or any bacteria, but is a special virulent inflammatory process due to constant or certain irritation of the cells of different tissues, which by this irritation, or from other causes, are then of low vitality, being weakened and the circulation of the blood in them impaired. It cannot be transplanted from one species to another, the growth and spread of implanted cancer may be checked and the heredity is an almost negligible factor, the lesions being preventable.

Roentgen rays having selective power for such irritated and weakened cells especially, in some individual cases, when given in time, will give us objective and subjective results. They will prepare the field of infiltration for operation and in every case of malignant character relieve suffering and prolong life, and in the most desperate cases not only the pain, but also the odor of the discharge is checked right from the start and the patients are comfortable, even able to some extent to attend to their social duties. The electro-chemical action of the rays produces a yellowish, honey-like exudate in the open lesions proper and the treatment has robbed death from cancer of its horrible, painful and offensive elements.

To ray before the operation and after, to prevent recurrence is the safest procedure, because the infiltrated lymph channels and glands will be converted into fibrous cords and knots, which become the safeguards against systemic infection during the operation and after.

Primary lesions, or those of early stages, with surgical removal, if necessary, give the best satisfaction, best chances of permanent cure in time both before and after operation. In secondary lesions we are not certain of success, but even here we get the subjective results mentioned above.

By actual tests and experimentation it is proven beyond doubt, that the Roentgen ray treatment does not, and according to the absorptive and local action of electrochemical character cannot, cause metastases and internal involvement, but on the contrary prevents them, having most promising effect upon the tissue cells suffering under the special, malignant inflammation.

Even in inoperative cases in an advanced stage, and deep lesions if the resistance of the patient is good, the Roentgen rays may give us comparatively good results.

The sloughing in an open lesion will progress more rapidly and with better results, the effect of our raying being more promising in the most terrible case, if the exudate of the lesion is applied to those portions of the same, where the fighting material for repair of the cells is most needed for obliteration of the diseased cellular element, liquefaction of the same or absorption and degeneration occurring.

Every case has to be watched individually; the susceptibility of the patient, the age, the local lesion, the personal characteristics and general conditions of the patient, the type of carcinoma, whether primary, or secondary, its duration, extent and severity of systemic infection all taken into consideration.

# DISCUSSION ON PAPERS BY DRS. BOGGS, JOHNSTON AND RUDIS-JICINSKY.

DR. W. F. MANGES, PHILADELPHIA, PA.

I want to support Dr. Boggs in his views as to the ante-operative treatment, for the reason that one of the best surgeons in this country has found it valuable. It is becoming the custom of surgeons to refuse to operate in carcinoma of the breast. They consider such a case inoperable very much earlier than they formerly did. One of our Philadelphia surgeons, Dr. Gibbons, expressed himself rather forcibly along this line not long since. He said that when one can feel an enlarged gland in the axilla, the case is inoperable. He advises that in such cases every surgeon should refuse to operate, because of the wholesome effect this would have on future generations. The result will be that every woman having a lump of any size in her breast will promptly consult a surgeon and insist on its removal. Dr. Gibbons advises, further, that if enlarged glands can be felt in the axilla, the patient should be placed under the care of a competent roentgenologist, and that the treatment should be given for as long a time as he sees fit. If, in the opinion of the roentgenologist, the case becomes an operable one, then operation should be done.

MR. H. W. DACHTLER, TOLEDO, OHIO.

I have been very much interested in these papers because I have been doing some work in that direction. I have not had much experience with ante-operative treatment, but we know what is the course of this affection, and I do not believe we are justified in postponing operation. I have abandoned the method advocated by Dr. Gray of giving a heavy treatment just before the wound is closed, for the simple reason that the effect we desire to gain, that of blocking the lymphatics, cannot be achieved in one treatment. Furthermore, I do not believe that we are justified in keeping the patient under the anesthetic for twenty or thirty minutes longer than is necessary.

I especially want to commend the filter devised by Dr. Pfahler. It is a great help, one of the greatest helps we have in the treatment of these cases of cancer of the breast after operation. I usually commence to treat these cases the second day after the operation, or just as soon as I can get the patient to the Roentgen room. I give treatments every day, heavy treatments of fifteen or twenty minutes' duration, and after two and a half or three weeks I feel sure that I have secured enough results to allow the patient to go home, with instructions to return in ten days or two weeks.

I give them such a heavy treatment that there is produced sufficient inflammation to cause a blocking of the lymphatics. I think we should be careful to contribute something to the systemic effect of the Roentgen ray. I have seen patients who reported that they were gaining all the time, and yet I knew they were losing. I have never been able to determine by experimentation on a healthy person that any such result could be obtained.

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DR. HENRY K. PANCOAST, PHILADELPHIA, PA.

I want to call attention to a post-operative case of carcinoma of the breast which I treated recently. The great difficulty in these cases is to give tangible proof of the efficacy of the ray. We all feel that we get good results, but we cannot prove that these cases would have remained free from a recurrence had the X-ray treatment not been given. As proof that such post-operative Roentgen treatment in mammary carcinoma does do good, I will cite my case. The patient was operated on and the operation was a radical one. The breast was removed and the axilla was cleaned out, but the supraclavicular region was not invaded. Roentgen treatment was begun soon after the operation. I think the usual number of treatments was given—thirty or more. The patient was discharged with the advice to return in three months. She returned before the expiration of that time, very much disappointed to find a ring of recurrent nodules, extending from the level of the posterior axillary fold around almost to the sternal line in front. On examination I found that these nodules were entirely outside of the area of exposure, proving, I think, that the Roentgen treatment prevented a recurrence in the area exposed. There undoubtedly would have been a recurrence in the scar if the Roentgen treatment had not been given. These nodules are inoperable. But I am treating the patient now and they are decreasing in size rapidly.

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DR. D. R. BOWEN, ROME, N. Y.

I have had very little experience in the treatment of these malignant tumors of the breast. I have many more cases of exophthalmic goiter to treat and I presume that I should have reported them before this. In the earlier cases the treatment was too conservative to make a report of any value. In the last three cases I carried the treatment to the point of producing a slight dermatitis. In every case there has been great symptomatic improvement, and in no case have I been able to see any diminution in the size of the gland.

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DR. FEDOR HAENISCH, HAMBURG, GERMANY.

I would like to know what dosage Dr. Boggs gives in his ante-operative treatment; also how much he gives and how long the treatment is continued. Then, I would like to know whether he takes always every bit of the skin exposed, because we have often found that operating on X-ray skin is rather dangerous. The stitches will not hold.

I would like to ask Dr. Gray what he means by a series of post-operative treatments. We make it a rule to measure the doses by some definite method because it is useless to say twenty minutes or fifteen minutes every day, or three times a week. We must know the exact dosage, for how long it is applied, and how often. We must have some better means of measurement. I have found in my work that using one or other coil I get an entirely different amount of the rays.

DR. W. C. HILL, CLEVELAND, OHIO.

I would like to mention a few cases of papilloma of the larynx. One of them was a tumor an inch in diameter. It diminished in size rapidly and in about six treatments it entirely disappeared. Unfortunately, it recurred. Later on I treated another case through the skin of the neck and got the same result. In the first case I treated the tumor through the trachea.

DR. GEORGE E. PFAHLER, PHILADELPHIA, PA.

I am extremely interested in the therapeutic value of the Roentgen ray, as you know. I am sure that we are not speaking or writing enough about our results. I am more enthusiastic today than I have ever been. I am getting better results from my work and they are more permanent. I get them more quickly and with more certainty. I measure the dose very accurately, and therefore radiotherapy should progress and not stand still or recede.

As to ante-operative treatment, I suppose we are on safe ground if, when we speak of ante-operative treatment, we confine our remarks to those doubtful cases, the class of case to which Dr. Manges referred, and which Dr. Gibbons says are inoperable. It is in these cases that the glands in the axilla are involved. I think it is in that class of cases only that we are ever justified in recommending ante-operative treatment. The same cause that is responsible for the enlargement of the glands in the axilla has also produced an enlargement of the glands in the mediastinum and elsewhere, and I think that ante-operative treatment is useless in these cases.

A patient came to me with the entire breast involved by an ulcerating nodular malignant mass. The case was considered inoperable. I treated the patient until all signs of the disease had been reduced to a removable scar, one inch in diameter. The scar was removed and the patient is today perfectly well. So that I am convinced that in such cases Roentgen treatment is the correct thing, but we must work with the surgeon and not let him say to us to treat the patient for a week or two, after which he will operate. There must be every evidence that the disease has become localized. Unless localization has occurred the patient is not ready for operation.

Regarding the open wound method, I agree that it is not justifiable to keep the patient under the anesthetic any longer than is absolutely necessary. I agree further that the disease is just as likely to have extended beyond the wound, and therefore we are not going to reach it any better while the wound is open than we will afterward. Furthermore, the bandages and dressings are in the way. That is not a good procedure, because there is the risk of infecting the wound and of causing an explosion from the spark of the tube in the ether-laden atmosphere. These things must be kept in mind.

As to post-operative treatment, it must be given with the understanding that there is disease there. If there is no disease there, then there is certainly no reason for giving post-operative treatment. The mere fact that we resort to post-operative treatment implies that we think that there is still some disease there, some cells or nodules that have not been removed by the knife. Unless we recognize that fact, post-operative treatment is not justified.

If you give post-operative treatment, the dose must be sufficient to remove that disease, therefore we must not lose time by giving small treatments at long intervals. I have had surgeons send patients to me with instructions to give two or three treatments, and then let the patient go home. That is worse than doing nothing. I treated one post-operative case in which the disease had been very extensive. The supraclavicular glands had been removed as well as the axillary glands. I treated the patient, and a year afterward she seemed to be perfectly well. Suddenly there developed signs of visceral carcinoma, of which the patient died. At no time, however, was there any sign of a recurrence in the breast or axillary area, proving, I think, that at the time I began the post-operative treatment the disease had already extended to other parts of the body. That is why I did not succeed in effecting a cure, although there was no recurrence in the area exposed to the ray.

As to the dosage given, we must be more accurate in the measurement of dosage. In speaking of dosage, we must be able to describe our technic, so that anybody can do the same thing. We have now sufficient means for accurately measuring the dosage so that we ought to be able to standardize our own technic. Perhaps it is not necessary to use these tests in every individual exposure, but we certainly should be able, by means of these tests, to standardize our tubes and technic so that when we expose for ten minutes under certain conditions we know just exactly what dose we are giving. We must keep in mind in this connection that the action of a tube is not always the same, even when the same technic is employed. With my forty-plate static machine, with the anode of the tube twelve inches from the patient, four milliamperes of current going through the tube, and a vacuum of six or seven Benoist, in two minutes will give me one-half a Kienboeck unit, the ray having passed through the leather filter. In deep-seated work I use four tubes, running each tube two minutes. These tubes run from the static machine, which is giving four milliamperes at the time, and will produce on the skin at that distance, with the filter, uniformly two Kienboeck units. Therefore, if I am giving five such doses, I am giving a full skin dose, which is ten units. If I want to give that much, I can do so, although I do not, as a rule. I can give it in any number of days, but when I have reached that unit I must be careful, and it is best to allow an interval of a week to pass before another dose is given. We must avoid burning the skin, and yet get all the penetration we can. The reason you get a skin effect and do not get penetration is because the tube runs down. When we start with a tube it is not as high after we get through with it. There is not the same vacuum and therefore we do not get the same quantity or quality of ray.

For measuring my dosage I use the Holzknecht modification of the Sabouraud method, which is supplied to the profession by M. Singer, of Wien, VIII Dansgasse, 2a.

DR. FEDOR HAENISCH, HAMBURG, GERMANY.

I may have misunderstood what was said about ante-operative treatment and, as that is dangerous ground, I want to be precise in my statements. I asked Dr. Johnston to tell me what dosage he gives in his ante-operative treatment. I will try the method but only under one condition, that the case is absolutely inoperable. I would never think of treating carcinoma in the chest with the Roentgen ray. I would decline to do so for several reasons.

Dr. Pfahler said that we get a lot of doubtful cases from the surgeons, but even that is rather dangerous, for the reason that if a woman finds out that there is no chance of getting rid of the node in the chest except by operation, she will jump at it and all our efforts to train them to have the breast removed thoroughly at the first sign of tumor will come to naught. We all know that not every case of carcinoma reacts properly under Roentgen treatment. Therefore, I believe that we are on dangerous ground when we postpone operation by giving ante-operative treatment in any case that is not absolutely inoperable. In these cases I will try the method and I shall endeavor to prevail on my colleagues to do likewise.

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DR. GEORGE C. JOHNSTON (closing on his part).

I am familiar with Dr. Boggs' technic, having watched him work many times. The technic he uses in his ante-operative work is practically the same as he employs in post-operative work, and I think he is as negligent in the matter of dosage as I am. We neither of us employ as a routine measure any particular method of mensuration. We have at various times employed the Sabouraud and Noir pastilles, for the purpose of standardizing our particular forms of apparatus, to such an extent that we know very well what we are giving, but if we were to attempt to prescribe our doses for the use of any other roentgenologist on the same patient, we would have a sorry time doing it. The only way we could do it would be to remeasure our doses with the same instrument of precision, then give it to the doctor, letting him take it home and standardize his machine accordingly. Then he must have from twelve to twenty-five seasoned tubes. I have twenty-five tubes, any one of which I can put on the machine, start it, leave it there, and at the end of a certain length of time the machine will stop itself. That is the method by which we work, and while it is crude, it is safe. Neither of us would use a tube or even keep a tube which will go down while it is on the machine. If it goes up, the automatic regulator will bring it down, but no regulator will bring it up. As long as we hear a little reaction going on in the tube, we know it is standing just where we placed it. After we have seen the apparatus working for a half an hour like it should, we do not worry. We buy our tubes low and then season them up. Many of the tubes are run for hours before they are ever used. Never think of using a tube until it will stand up and do the work.

Ante-operative treatment is only employed by Dr. Boggs and myself in those cases which are inoperable. What is an inoperable case? To the average man an operable case is any patient who can be placed on the table, operated on, and put back to bed alive. If the patient dies on the table, it is an inoperable case. The majority of our surgeons term as inoperable a case which they do not believe they can operate on and cure by means of a radical operation. We consider that as an at-present inoperable case, but one which we hope to transform into an operable case. While we have failed many times in this attempt, we can point with pride to some successes. We have had cases pronounced as distinctly inoperable by surgeons and transformed them into cases that the surgeons were glad to operate. Some of these patients are living three and four years after the operation, whereas the expectancy of life when first seen was not more than six months. Of course, they will die eventually from a mediastinal recurrence. I have never seen a case of carcinoma of the breast make a recovery after any procedure whatever when the patient had progressed to the stage of axillary and supraclavicular involvement. I have had a number of such cases shown to me, but my standard of requirement for a case of carcinoma is high. The patient must have a carcinoma, the diagnosis to be supported by a competent pathologic examination; she must have been operated on for carcinoma, must have remained well for a period to exceed ten years, must die of some other disease and the post-mortem must reveal entire absence of any evidence of carcinoma elsewhere. That I consider to be a cure.

One of my very best friends, a surgeon, wrote a book on carcinoma of the breast and in it he reported a collection of cases in which a radical operation was performed, and he does a most beautiful radical operation. One of the cases mentioned in that book is a woman who remained cured ten years after the operation, and she was then under my care for a carcinoma of the lung, from which she died.

I saw a case of carcinoma, operated on twenty-one years before the patient was sent to me, and I found carcinoma in the supraclavicular glands and in the lung.

I read a paper on radiotherapy year after year. Even though it is not popular to read such papers, because we have to incur the ridicule and incredulity of the profession, there are men who have persistently produced results which can speak for themselves. The profession believes that radiotherapy is declining, whereas the contrary is the case. To us at the present time the securing of such results is an everyday occurrence, and we no longer think much of it. Nevertheless, we should call the attention of the profession to them, because it is certain that much good is being accomplished. I have given no credit to the work of anyone, but simply call attention to the fact that we are still getting good results.

There is a matter which we must consider always in speaking of malignancy. Microscopic and clinical malignancy are two separate things. The former gives no information as to the degree of malignancy, because it does not show the degree of susceptibility of the patient to the growth nor the degree of his resistance to the disease. It is my belief that when the supraclavicular and axillary glands are involved, the mediastinal glands are also involved. This is a question that has been raised time and again, but I do not see why the infection should travel the longest way around. The path to the mediastinum is infinitely shorter than the path from the right breast to the left supraclavicular space. I have never seen a case of that kind where there was no evidence of mediastinal involvement.

We never delay by giving ante-operative treatment in an operable case. Such a case does not require ante-operative treatment.

We all make the mistake Dr. Pancoast spoke of, because we use protection on the tube. We use a protective with an aperture of four inches in diameter, and the Pfahler leather filter. I avoid the recurrences Dr. Pancoast mentioned by treating in a series of concentric circles from the center of the disease.

The surgeons of this country require education in one thing, and that is that a recurrence *in situ* of a malignant growth is a recurrence in the skin, and is due to the fault of not removing sufficient skin. It is absolutely necessary to remove every bit of skin which may be infected, and if the wound is too large for ordinary closure a skin graft should be used. Use the ray later, when the wound is closed by granulation. Remember, too, that the tension should not be too great and, if sufficient skin is removed to avoid a recurrence, tension is something to be reckoned with. Skin grafting would overcome this.

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DR. RUDIS-JICINSKY (closing the discussion).

I am glad that Roentgen therapy has found some ardent workers in our midst and that we are beginning to understand what can be done with it.

With regard to the dosage, I have thrown out all the apparatus for measuring. I use my brain and my experience.

With regard to the treatment before and after operation, unfortunately I usually get these patients from the surgeon too late. He does not know what to do with them and then he sends them to the X-ray laboratory. You do not know the patient yourself. She remains with you for a week. You must do something for her. Then you find out you do not need a surgeon and the glands are decreasing in size. The surgeon was not showing himself a friend of yours when he sent this patient. He was glad to get rid of her. We must study our cases individually and not only the tubes and apparatus. If we do that conscientiously we will get results which are better than they were years ago. Why? Because everyone of us has his own standard and knows what to do with his apparatus. With better apparatus our standards will improve.

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DR. ALFRED L. GRAY, RICHMOND, VA.

Dr. Haenisch inquired what I mean by a post-operative series. My method is similar to that employed by Dr. Johnston. I can tell you what I do, but I cannot tell you how to do it. I have a number of seasoned tubes, whose capacity I have estimated from the standpoint of the coil I use. Using a tube with a penetration of about Walter 6, I find that by passing from one to one and a half milliamperes through that tube, which has an automatic regulator, my coil will produce a decided reaction on the unprotected skin at a distance of eight inches in thirty minutes. This is about one-half the time of any other apparatus working under the same conditions.

I had a rather painful experience when I learned that; I burned the face of a patient badly. From this fact, that these tubes working under these conditions, produce a reaction in thirty minutes by applying the law of inverse squares, I have made for this particular machine and particular apparatus a table by which I work.

In the post-operative breast cases my first series is usually given without a filter. I give thirteen treatments of five minutes' duration each, at a distance of twelve inches, on alternate days. That will usually produce a decided erythema. When I use a filter, I use a leather filter and give half as much again. With an aluminum filter I give doube as much, or more. I do not mean to advocate the administration of the primary maximum dose while the patient is still under ether and in the operating-room, but it is my hope that with these methods of standardizing doses we may be able to cut down our maximum primary dose to five minutes with the apparatus in an adjoining room, so that the patient may easily be run in and treated.

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DR. ALFRED L. GRAY, RICHMOND, VA.

In looking over my personal records, I have come to the conclusion that there is yet a great deal in the treatment of breast carcinoma that has not yet been brought out. The varying reports that Dr. Boggs has referred to, coming from different men, cannot but convince us that we are still deficient in our technic in the treatment of these cases. Dr. Boggs referred to the younger roentgenologists who are governed to some extent by the instructions given by the surgeons. If we are going to allow surgeons or anyone else to influence us in our methods of applying the ray, or in the frequency of its application, we should immediately give up our work. The surgeon should never be allowed to dictate to us any more than he would allow us to dictate to him.

I thought Dr. Boggs was not going to refer to the ante-operative treatment of carcinoma of the breast. I must confess that I was disappointed to hear him advocate such treatment. There is a time in the course of every carcinoma of the breast at which, so far as we now know, surgery is absolutely effective. We do not know when that time is at hand. Therefore, we may delay the operation until it is too late, and thereby render inoperable, a case which would probably have terminated favorably as the result of an immediate operation. For that reason I never give ante-operative treatment. No matter how small the nodule may be, I immediately refer the patient to a competent surgeon. When we take into consideration the fact that eighty per cent. of all tumors of the breast either are or will become malignant, the necessity for removing them is apparent. Therefore, I must differ from Dr. Boggs in his views concerning ante-operative treatment. I am firmly convinced, after an experience covering seven or eight years in the post-operative treatment of breast cancer, that every case should be submitted to post-operative treatment at as early a time after the operation as possible. I have seen advocated, and theoretically I heartily approve, giving a maximum dose of the ray just before the closure of the skin wound. If we can have our machines so regulated as the Sabouraud method promises to enable us to do, we can give a little short of the maximum dose while the patient is still under the anesthetic. I am not so sure but what I shall advocate that procedure.

Dr. Boggs properly referred to the difficulty that is experienced in giving the proper amount of post-operative X-ray treatment. It is a very difficult thing to convince either the patient or the surgeon that after the wound is thoroughly healed and tenderness has subsided and flexibility returns to the scar, that in the course of a few months these patients should receive a second series of treatments, a third, and even a fourth. It is my advice to both patient and surgeon that at least three series of treatments should be given in the course of the first twelve months following the operation, and two in the second twelve months, persisting in this treatment though there is no evidence of recurrence. I attempt to follow out this method as nearly as possible.

In the inoperable cases, aside from the relief from pain, one of the greatest benefits of treatment by the Roentgen ray is the comfort to the patient's mind. I undertake to treat a patient sometimes with absolutely no hope of doing any permanent good whatever, because as long as she can feel that something is being done, it keeps her mind at ease, and she will continue to take interest in life for many days longer than she otherwise would. Of course I have a thorough understanding with the family of the sufferer, what my intentions are and what they should expect.

## A NEW LOCALIZER.

The localizer devised by Dr. C. E. Coon, of Syracuse, N. Y., differs from the original Mackenzie-Davidson apparatus in the application of the thread and cross wire idea by means of simplified apparatus, which does away with tiresome adjustments and without sacrificing accuracy enables the operator to do everything, including placing of tube and patient, making exposures, developing plate and localizing, in a very few minutes. It is convenient for office use, requires only a small amount of storage room and is always ready for use.

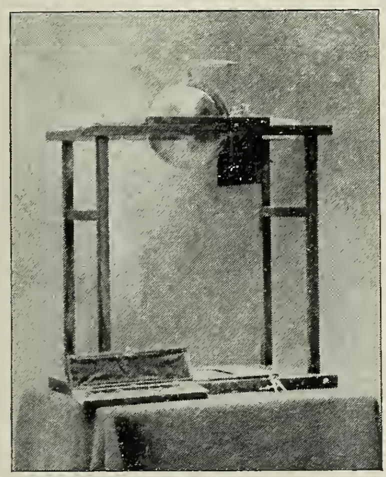

FIG. 1

Four uprights supporting longitudinal strips, top of these strips at a given distance from the base. The base carries a diaphragm cut out of heavy sheet brass, this is attached to base with hinges. The opening in diaphragm is fitted with crosswires and the intersection of these wires is located perpendicularly under the center of the area between the top strips, and the longitudinal wire parallel with the top pieces. Under the crosswire diaphragm the base is cut away and a piece of heavy ground glass is inserted flush with the surface. The top strips have cross markings in three places; the middle and at a given distance on either side for the purpose of centering the tube, to indicate the correct displacement in each direction and to support the wires which carry the threads.

The tube holder slides longitudinally along the upper surfaces of the top and fits to prevent lateral motion. On the under surface of side pieces and running transversely from center to center a V notch is cut. This holder will accommodate any of the commonly used tubes up to eight inches in diameter. The anode end rests in a stationary notch in cross piece and the cathode end is received between two movable uprights provided with clamp; when closed these automatically lock the tube in center between top pieces. The focal point of anode is brought into line between the notches on under side of tubeholder and also on line of the top of the frame, the latter adjustment being made by raising or lowering the cathode end of the tube; when tube is locked in this position and holder placed on frame the focal point is at all times perpendicularly above the longitudinal cross-wire, and its distance from base is, of course, constant.

FIG. 2

Fig. 3 shows diaphragm raised for insertion of plate; it is not necessary to be exact in locating the plate; a notch in one side of the opening will indicate the position of the negative. The diaphragm is closed down on top of the plate, the cross-wires being moistened with tincture of iodine or other convenient marker, and the patient placed in proper position.

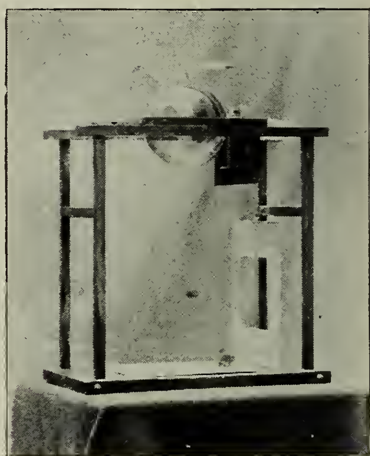

FIG. 3

Fig. 4. Position of tubeholder for one exposure. Notch on under side of holder placed over cross mark on top of frame.

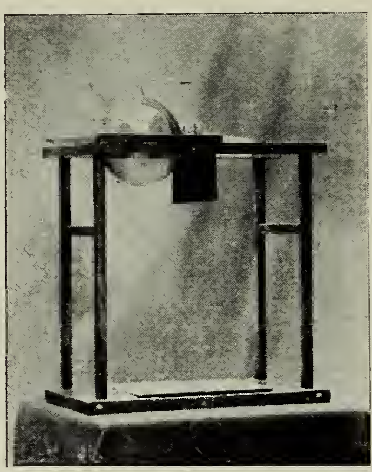

FIG. 4

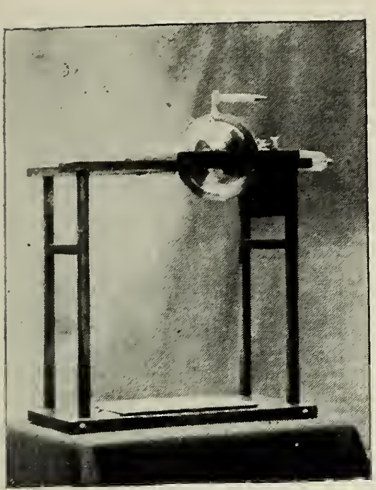

FIG. 5

Fig. 5. Position for second exposure. Notch on under surface of holder placed over cross mark opposite end of frame.

The negative shows outlines of diaphragm, the cross-wires and notch to indicate proper position in replacing plate. I have had little difficulty in getting two satisfactory exposures on one plate; some of the more difficult locations have been:—hypodermic needle in buttocks; fragment of steel in eye; fragment of steel in sheath of sciatic nerve in middle of thigh; bullet in front of lumbar vertebrae; concretions in vermiform appendix, etc.

Fig. 6. Looking at the top of the frame, shows cross-marks described earlier, and extending between the outer marks a wire with notch in center to carry threads attached to mouse weights; these wires being held in place and prevented from getting off-center by being bent at right angles at each end and fitted into socket on top pieces.

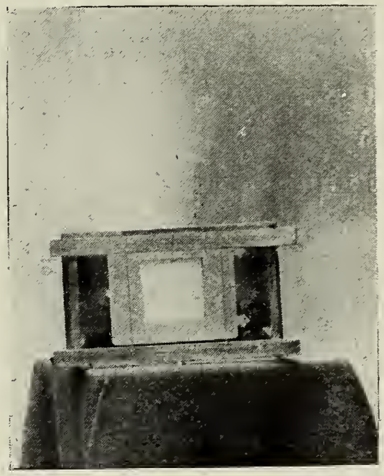

FIG. 6

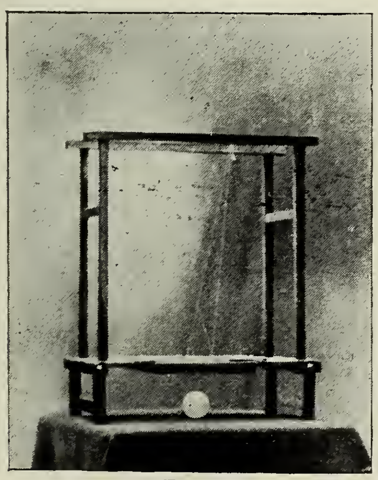

FIG. 7

Fig. 7. Arranged for transillumination, threads and mouse-weights in position, and ready to make the three necessary measurements.

When not in use, the legs for elevating the base to allow placing of electric lamp underneath, are folded along side of base.

## EDITORIAL.

It was the universal verdict of those who attended the Detroit meeting that it was a great success. This is due to the fact that all the members who attended entered into the spirit of the occasion, and contributed to make the meeting an harmonious affair. The originality of the papers read and the thoughtful discussions contributed very much to the quality of the meeting.

The outlook for the Richmond meeting is very bright. The executive committee has about decided to hold a four day meeting in place of a three day meeting, inasmuch as it is thought that the programme will take that amount of time, and that this plan will give a better arrangement for discussions and afford opportunities for the men to get together and have the private discussions which make up such an important feature of the annual meetings. Our members do not need any assurance that the famous Southern hospitality will be extended to them and will provide generously for their entertainment during the coming meeting. Further announcement with regards to this meeting will appear in the next number of the Quarterly.

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In a conversation which the writer had with the Medical director of a large Eastern Insurance company, he was told that the Medical Director had recently refused two of our well known members in their applications for insurance. His reason for so doing was that the occupation of Roentgenologist is classed as an extra hazardous occupation, and on that account, he did not consider that the average X-ray worker was a good risk. Upon further questioning, he admitted if the Roentgenologists could prove that their work was being so safe guarded that the dangers, which have been exploited so much in the public press, were a thing of the past, that these rejections would be done away with. Such comment by one who regards our work from purely a business standpoint, certainly should give us food for mature reflection. If we are to be classed in our occupation as running equal hazards with automobile testers and brakemen, it would seem as though we should demand from the public who seek our services an adequate compensation for the danger which we incur.

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The delay in the issue of the December number was a subject of great regret to those who had the task of bringing out the last number of the Quarterly. However, it will be the desire to avoid such delays in the future, and if arrangement could be made so that at the annual meeting those who have the tasks of tabulating manuscripts and arranging for illustrations could make verbal arrangements instead of having to spend so much time in long winded correspondence, much delay would be avoided.

The Eastern members who were fortunate enough to attend the Section meeting in New York, report that the day was spent very profitably. These Section meetings will undoubtedly be one of the features of our society, and will tend to keep up the interest in the membership. It is announced that the Section for the Western members will be held in Chicago, April 8th, 1911. The local arrangements are in the hands of Dr. Hollis Potter.

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Richmond, the capital of the Mother of States, the capital of the Confederacy, historic, cultured, the modern, up-to-date city,—hospitable Richmond extends to the American Roentgen Ray Society a most cordial welcome.

The seasons at which Richmond is at her best are the late spring and early autumn months. Being midway between the North and the South, these are the seasons that bring her the most visitors.

The city is becoming noted as a meeting place for conventions. The magnificent hotel accommodations and excellent convention halls offer inducements that few cities of its size can present.

The facilities offered by the dozen steam and electric railways and the steamship lines render Richmond accessible from all points of the compass. The suburban electric lines, which are numerous, offer those especially interested in the historic, abundant facilities for viewing the battle grounds, monuments, and cemeteries that mark the struggles of war.

The vicinity of Richmond is well supplied with good driveways, and during the visit of the Society opportunity will be given for automobile rides over the oiled roads.

Among the objects of greatest interest from a historical point of view may be mentioned: Powhatan, the place of rescue of Captain John Smith by Pocahontas; Washington's Headquarters; St. John's Church where Patrick Henry made his famous speech; St. Paul's Church containing the pews of Jefferson Davis and General Lee; Monumental Church built on the site of the old theater, which was burned and in which Governor Smith and many others lost their lives; The Capitol Square, in which are situated the Washington Monument, Stonewall Jackson Monument, Henry Clay Monument, Governor Smith Monument, the Hunter McGuire Monument, and in the State Capitol the original Houdon Statue of Washington.

From a medical standpoint, Richmond offers two Medical Colleges, both of which are ranked in the highest class, many excellent general hospitals and private surgical and special hospitals second to none in equipment and efficiency.

Beautiful Hollywood Cemetery contains the graves of Presidents Monroe and Tyler, Commodore Maury, John Randolph of Roanoke, Jefferson Davis, and many of the Confederate generals.

Other points of especial interest in and around the city are: Libby Prison site, Residence of General R. E. Lee, Lee Monument, Jefferson Davis Monument, J. E. B. Stuart Monument, A. P. Hill Monument, Jefferson Davis Mansion, now the Confederate Museum, Residence of Chief Justice Marshall, the Valentine Museum of Sculpture, and the Confederate Soldiers' Home. To those who have the opportunity, a trip down the historic James River, through Dutch Gap and by Jamestown Island will be found delightful, interesting and instructive.

These, however, are not the real reasons why the Society is going to have the most successful meeting of its history in Richmond in September. Under the leadership of such eminent, energetic and influential men as those who grace the executive offices, a most interesting and instructive program is assured, and, too, the three local members are interesting their friends of the Medical Profession and the public in the coming meeting, and with the co-operation of the Management of the Jefferson Hotel, where the Society will meet, will leave no stone unturned to make the meeting of 1911 long to be remembered as one of the brightest pages in the record of the A. R. R. S.

H. K. PANCOAST,
Chairman Executive Committee.
A. L. GRAY,
Chairman Local Committee of Arrangements.

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## ABSTRACTS FROM ENGLISH LITERATURE

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### ROENTGENOGRAPHIC EXAMINATION OF THE BLADDER.

Dr. John M. Garratt, Jour. A. M. A., Jan. 28, '11, p. 264, proposes to outline the size, position and conformation of the bladder by filling with bismuth (50), kaolin (250), water (1,000.) States that the mixture is well borne, being, in one case, the only injection the patient retained with comfort.

D. R. B.

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### POST-OPERATIVE ROENTGENIZATION OF CANCER.

In the "Therapeutics" section, Jour. A. M. A., Jan. 21, '11, p. 195, this subject is so ably summarized that we regret the omission of the writer's name.

The attitude of the roentgenologist, of the average surgeon, and the consideration of the patient are presented fully and consistently. "The dictum taught and written has been 'use the X-ray in inoperable cases and * * * the X-ray did not derive much credit from its use in these cases. It is indeed a tremendous tribute to its actual power that it derived any credit at all.' By first extirpating as extensively as possible in such cases, however, the amount of work to be demanded of the X-ray and the amount of contingent toxemia are tremendously lessened, and both measures are given opportunity to do their utmost under most favorable circumstances."

The subject of pre-operative Roentgenization is reviewed from an antagonistic standpoint, concluding: "If the effective pre-operative radiation were devoid of danger, the delay of operation involved would not be objectionable, but we have seen that this is not the case. (This dictum is sure to be rendered obsolete by improved technic in the measurement of dosage.—Ed.) Just so long as the ablative procedure is delayed, by just so long is the period during which sound tissues are threatened increased.

"A final word may properly be said regarding the operator. * * * As a matter of fact it may be interesting to know that those competent to judge estimate the number of competent radiotherapists in the United States at less than forty.

"Great pains should be taken, then, to send patients to some one who is profoundly versed in the technic, and thoroughly experienced in the practice of Roentgen-therapy.

"If any other has been intrusted with the application in any given case and good results have not followed, the method should not be blamed, but the responsibility placed where it belongs and a competent operator selected next time."

D. R. B.

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## PRESENT POSITION OF THE X-RAY IN THE TREATMENT OF RING-WORM.

S. Ernest Dore, M. D., London. Lancet, Feb. 18, '11, p. 432. History, advantages, and dangers considered at length, concluding:

"The method which I have found superior to all others, both in efficiency and in saving of time, is that first suggested by Kienbock and subsequently elaborated by Adamson.

"The tube is placed in a box having an aperature of at least three inches for the passage of rays. Three wooden pegs project from the margin of this opening, so that the tube is at the correct distance from the skin when they rest on the scalp.

"The child's hair having been clipped short, the scalp is marked out, five equidistant points being taken as a centre for each exposure. Allowing fifteen minutes as an average exposure, the whole scalp can be treated in one and a half hours.

"Hair begins to fall, usually, on fourteenth or fifteenth day. In three weeks the child is quite bald and free from infection. New hair appears in about six weeks, and in three months the scalp is well covered.

"When fully grown the new hair is often thicker in texture and slightly darker in color and, occasionally, curly instead of straight. In private practice, since I adopted this method one year ago, and at the Evelin Hospital (where more than one hundred cases have been treated) the results have not only been more satisfactory than before, but the saving of time has enabled a larger number of hospital cases to be dealt with without any increase of risk to the children." D. R. B.

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## SOME INVESTIGATIONS CONCERNING THE RELATION BETWEEN CARPAL OSSIFICATION AND PHYSICAL AND MENTAL DEVELOPMENT.

Dr. Eli Long and Dr. E. W. Caldwell, New York. Am. Jour. Diseases of Children, Feb., 1911, p. 113.

A long paper illustrated by many plates and charts, concluding:

"From this limited investigation we are led to believe that the ossification of one wrist of an individual is not an exact index of the ossification in the other wrist, and, therefore, it seems probable that the same inexact relation exists between the wrist and the remainder of the skeleton.

"Age, height, and weight, increase in general with the advance in carpal ossification, but with many exceptions in both sexes. It would be impractical at least, to regulate the mode of life of these children according to this classification alone.

"We find no relation between the degree of carpal development and quality of mind. The relationship between the stages of puberty and those of carpal ossification is too indefinite to warrant the latter's use as an index of physiological development. And, finally, though carpal development alone is not an exact index still, when observed at intervals and considered with other factors, it may become an aid in estimating the rapidity of growth of the skeleton in children."

D. R. B.

# The American Quarterly of Roentgenology

*Edited by P. M. Hickey, M. D.*

Vol. III | JULY, 1911 | No. 2

## TUBERCULOSIS OF THE LUNGS AS SEEN AND HEARD.

BY HENRY HULST, A. M., M. D.
Grand Rapids, Mich.

The paper is based on a collaboration. The forty-eight 14″ x 17″ plates on exhibition are from the Roentgen Laboratory of the Grand Rapids Tuberculosis Sanitarium which was opened by the Board of Health one year ago, and of which the essayist is director. To add to the interest of the work, the Board authorized securing the valuable services of Dr. J. B. Whinery, of Grand Rapids, a man of unquestioned superior ability as a diagnostician, for the special purpose of making physical examinations and records of his findings.

These are appended to the corresponding negatives with notes furnished by the city physician, Dr. R. Apted, of such autopsies as he was able to secure with the consent of relatives or friends. Descriptive reading of the plates themselves by the essayist, together with brief clinical excerpts collected by the assistant superintendent, Miss M. D. Shorneman, complete the legends.

The results were obtained independently, i. e., neither one knew the findings of the other. Dr. Whinery's notes and the plate readings were finished before they were finally compared, and are given unaltered.

The purpose of the work was that of comparing one method of physical examination with another, not merely to establish the superiority of one of them, but to observe how they agree and differ and supplement each other in their results, and thus to determine the place each is best adapted to occupy in a complete diagnosis of Tuberculosis of the Lungs.

The exhibition is intended to speak for itself. The paper, therefore, does not aim at an exhaustive description and analysis of all the facts elicited, but is intended only to call attention to certain observations and conclusions which forced themselves upon us, and which we trust will be of interest to others.

A number of the plates show the trachea not only, but its bifurcation and bronchi traceable in some of them from hilus to apex and base. Such bronchi are distinguishable from the other branches starting always from the hilus and covering the entire lung fields. Bronchi make double contourred shadows, enclosing the lumen which appears as a half tone or dark streak, as it does in the trachea. Speaking of the trachea, it may be interesting to note that even it is not always recognized as such by people who write books. In a recent Atlas it is mistaken for the spinal canal. This raises the question of the significance of the so-called "bronchial tree," always the first thing seen on a good roentgenograph of a normal chest. Minor says he never sees it in normal chests. But Minor is a fluoroscopist.

I believe the negatives by themselves go a long way to prove that Hickey in 1904 was entirely correct when in St. Louis he advanced his opinion based upon experiment that "the tracings which we often see in the midst of the pulmonary tissue usually represent the ramifications of the pulmonary vessels." Emil Beck in the last number of the Fortschritte, also last number of our Quarterly, declares these shadows were a conundrum to him until the stereoscopic method revealed to him their true nature, which, he says, is bronchial. Schwartz, on the strength of four cases in which he observed pulsation of the hilus, concluded, on the contrary, that the substratum of the hilus is vascular. "The hilus always pulsates, but this can be seen only in certain cases, particularly in such as present alteration of the lesser circulation." In this connection an observation by Köhler is significant. "In making up one's mind as to the true nature of suspicious looking hilus shadows, it must never be lost out of sight that the presence of a vitium cordis, favoring congestion of the lung vessels, may sometimes yield lung pictures resembling those in which there are caseating hilus glands." A year ago Fraenkel and Lorey made the observation on the atelectatic lungs of still born children that the roentgenogram did not show any trace of the usual ramification shadows. A partial inflation with air caused the trachea, bifurcation and bronchi to appear on the negatives, but as dark streaks and not as shadows. Upon further inflating the lung the bronchi disappeared, except the bifurcation, the columns of air no longer contracting sufficiently with their surroundings. But in their stead appeared another picture: hilus ramifications made up of shadows such as are seen in roentgenographs of living subjects. To bring out the bronchi, therefore, they should contain air, but the alveoli must be collapsed or nearly so. To bring out the blood vessels which contain blood even in the dead subject, the alveoli should be distended, the more the better. The former condition is a rare occurrence in the living subject. According to Fraenkel and Lorey, bronchi are seen only in atelectasis after closure of a main bronchus by a foreign body. When Beck wrote his article, he evidently had no knowledge of this work. If Hickey's experiments left any room for doubt, those of Fraenkel and Lorey, together with the evidence of these plates on exhibition, show that the normal "bronchial tree" is vascular. The plates, moreover, prove that the bronchi may be seen among, and distinguished from, the remaining vascular hilus branches, not merely in cases of atelectasis due to the presence of a foreign body in a main bronchus, but under the other abnormal conditions illustrated by the plates as well. Though in normal cases the bronchial tree, therefore, does not appear, in abnormal ones it often does when the ramifications are due to both bronchi and vessels, and therefore I object to Fraenkel and Lorey's substitution of the term "vascular tree" for "bronchial tree" as "overshooting the mark," and propose to call it **hilus** when that only is meant and hilus ramifications when the other branches are in question.

In 1905 Rieder declared it as his opinion that tubercles cannot to be shown. In 1909 Krause, of Haidehaus bei Hannover, placed pieces of tuberculous tissue on the outside of a normal chest, and found in this manner that miliary tubercles do not appear on the roentgenogram. Further on he says miliary tubercles can be recognized. This discrepancy evidently is unnoticed by himself, but is easily explained by the fact that the miliary tubercles he did find were roentgenographed where they naturally belonged, i.e., in the lungs themselves. The mere removal of the miliary tissue by Krause, viewed in the light of Fraenkel's experiment on the vascular nature of the "bronchial tree," changed the tissue physically, enough (total or partial removal of air from alveoli) to spoil the experiment. But even if the tissue underwent no such alteration by its removal from the chest, it is not a matter of indifference whether they are roentgenographed in their original site in the lung within the chest or on the outside of it. For instance, very small pulmonary vessels show very well through the chest wall, while the intercostal vessels, though larger, remain invisible. The question, it seems to me, is practically not very important when we consider that a bacillary infection as such cannot be recognized by any physical examination. Even "in the case of typical tubercle the tissues present more or less inflammatory reaction in the form of congestion, exudation, cellular immigration and proliferation," as Hektsen observes. The fact remains that in miliary tuberculosis the lung-fields are evenly mottled. Partial disseminated haematogenous miliary tuberculosis frequently found in autopsies in cases of chronic pulmonary tuberculosis are plentifully shown on the negative as partial disseminated miliary mottlings. These, of course, cannot be recognized as such by sense of hearing. Again, numerous negatives exhibited give a roentgenographic illustration of the following pathological description by Hektsen: "Radicals of peribronchial lymphatics being included in the tuberculous district, the bacilli easily find their way into the lymphatic vessels, and peribronchial lymphangitis results. Occasionally the process can be followed as peribronchial nodular cords clear to the lymph nodes at the hilus." As such mental picture can be constructed by means of the data furnished through the eight pair of nerves.

It will be seen that cavities, especially deep ones, were generally missed by physical diagnosis, though evident on the plates. Some of these show structural lung detail. This does not mean necessarily that the cavity is deep seated. Lung substance anterior to it or posterior or both may cause this appearance. Only large cavities or those with dense anterior or posterior walls are structureless. Their depth is best determined stereographically. According to Krause it is not true that a cavity filled with pus appears as a shadow. Cavities always look like cavities, contrary to what has always been thought, as dark spots, no matter whether full or empty, though they possibly may be hidden by extremely dense anterior and posterior walls. This is corroborated by our own autopsy findings on the bodies roentgenographed after death.

Speaking of the comparative symmetrical method of percussion, Dr. Waller, of Sweden, says: "If there be a dullness in the percussion sound heard at two symmetrical spots, and the difference in the degree of dullness is distinct, which often occurs, the dullness at the spot where the degree of dullness is greater may be miscalculated, i. e., underestimated, and the dullness at the other spot be neglected altogether." This is strikingly illustrated roentgenographically by some of our cases when symmetrical disease led to its recognition by sense of hearing on one side only. The other side was overlooked because of less fibrosis; i. e., because prognostically it was even worse than the other side, which was recognized.

A cursory examination of the Six Volumes of the Report of the Sixth International Congress on Tuberculosis suffices to convince anyone that the question of the primary seat of infection is of extreme importance. And although only "complete post-mortem examinations in very many cases will show us the channel of infection" (Tendeloo), especially inasmuch as "tubercle bacilli may exist in apparently unchanged organs" as pointed out by Bartel and others, and Roentgenology cannot be expected to decide the burning question whether the alimentary tract is the more common port of entry or the respiratory route—the Roentgenographer nevertheless has a vital interest in it.

Thus physical diagnosis is pretty well agreed that the primary seat of tuberculous lesions in adults is at the apex of the upper lobe as originally taught by Laeunec, though it may be sought for variously, in the suprascapular fossa, as does Babcock following Kingston Fowler, or in the inner part of the supraclavicular fossa and the inner third of the infraclavicular region, as does Minor (the latter possibly not influenced by his fluoroscopic findings which show that "a shadow in the sterno-clavicular angle above the clavicle is very much commoner than a shadow behind.") Of this Tendeloo remarks: "It has been accepted for a long time that pulmonary tuberculosis begins in the apex of that organ. But this is an error that has caused much confusion. All explanations of the primary pulmonary tuberculosis, founded on this error, fall with it. Nevertheless, the seat of the primary pulmonary foci is of deciding value. I mean recovered, as well as not recovered, latent as well as manifest foci, which we find by post-mortem examination, by inspection, and last, not least, by exact palpitation of the lungs." (If so, the Roentgenogram ought to be of great aid even in this quest.) He continues: "By far the most foci are found in the paravertebral cranial part of the lung; that is, in a pulmonary sector close to the vertebral column, cranial from the fifth rib, about between the hilus and the apex, including the apex. . . "

As I pointed out years ago, and as most of us have noticed a long time Roentgenography looks to the hilus and its periphery, especially to the paravertebral cranial region described by Tendeloo as the place where the disease manifests itself first radiographically. It is interesting to note in this connection that Krause, of the Sanitarium of Haidehaus, who has learned to make lung pictures by means of 2½ to 6 seconds' exposures (at the time of the Congress in Washington he still recommended 15-20 seconds)[1] now doubts the correctness of the older diagnostic view. "It seemed to us that the hilus was always enlarged when disease was present in the apex. The clinical method cannot discover such hilus changes, and this probably explains why the hitherto current opinion as to the primary seat of infection still prevails." Since this question is not to be determined by percussion, but as Tendeloo describes by autopsies, the Roentgen method may come nearer to the truth than physical examination by the sense of hearing.

"The diagnosis of tuberculosis of the lungs in infants by physical examination is impossible in a large proportion of children," says La Fetsa.

Mediastinal inaccessibility stands in the way of it. It is right here that the Roentgenographic method celebrates its easiest and most brilliant triumphs.

C. L. Minor, a phthisio-therapist, considers "the Roentgen Ray as of inferior accuracy to the physical examination." In saying this he but voices the opinion of the majority of his colleagues. The reason is not far to seek. Minor, for instance, asserts that "the radiograph gives such fullness of detail that it is difficult to distinguish at times . . . . between normal and pathological shadows. The picture given by the fluoroscope shows none of those misleading shadows, and thus is easier to interpret." He prefers the fluoroscopic image because it shows less! A picture taken by means of a long exposure, the patient breathing all the time, ought therefore to exactly meet his requirements! To be consistent he should stuff his ears when he auscultates. Other phthisiotherapists assign as their reason for preferring the fluoroscope the simple and more obvious one that it is much easier. It doubtless is. But also it must be insisted upon that it is their

[1] This is probably another Paul Krause, not from Haidehaus bei Hannover, but from Jena. The two should not be confounded as I did in the parentheses.

bounden duty to become expert in Roentgenography if they wish to do their whole duty. This some of them are doing. But many more not yet.

We conclude that distinction must be made between clinical and anatomical tuberculosis.

Thus a subject may be clinically, i. e., practically, well, yield no evidence on physical examination of the disease, yet react to tuberculin, and present post-mortem changes.

On the other hand, it is freely admitted that there may be auscultatory signs due to localized catarrh without lung changes and without clinical and roentgenographic evidence, the patient reacting or not to tuberculin. In the material presented, the roentgenograph never fails to show the disease in the presence of clinical evidence or physical signs. Moreover, the plate always showed more disease than was shown by the other method.

Hence a diagnosis should not be made upon the strength of a physical diagnosis alone, nor upon the tuberculin test alone, nor upon the Roentgenogram alone. The only one absolute test is the presence of the bacilli in the sputum. These being absent, a careful consideration of all these data in the light of clinical evidence should be insisted upon in making a diagnosis. The Roentgenogram, when as perfect as it can now be made as controlled by clinical evidence, constitutes the most valuable means at present at our disposal.

For prognosis symptoms are all important as compared with physical findings. This is less true of a Roentgenographic reading. In some of the series of plates the healing process is graphically shown—also the opposite. As Krause, of Haidehhaus, points out: "Physical methods fail us when we wish to construct a mental picture of the anatomical changes. In this respect the Roentgen method is a great improvement, inasmuch as it is able to furnish an idea of the anatomico-pathological changes." Or, translating Groedel freely: "The Roentgen method furnishes us new data with a new meaning."

The advantage of auscultation lies in the fact that Grancher's "respiration rude" can be heard before tubercles can be seen. But this also constitutes its danger. It is easy to imagine and even when really heard by no means infallible.

The advantage of the tuberculin test lies in the fact that bacillary infection can be proved, though the negative shows no lung changes. But herein also lies its danger. "So far as adults are concerned, it is now generally conceded that it is possible to demonstrate tuberculosis, or traces of it, in most people, at any rate among the people of the larger towns." This condition is not necessarily a disease, as Flick points out.

The great advantage of the Roentgenographic method lies in the fact that it furnishes us with a picture, a correct (though incomplete) graphic reproduction of the microscopic anatomico-pathological changes themselves. These pictures must be read, however, in the terms of post-mortem findings and not of auscultation and percussion.

Every roentgenographer is not a roentgenologist, least of all a phthisio-therapist; but the latter must be an expert diagnostician in his own line of work, and in order to be that it is not enough to do fluoroscopy, but he must be an expert roentgenographer as well.

## DISCUSSION

DR. LEWIS GREGORY COLE.

It is certainly most gratifying to me to hear this paper of Dr. Hulst's. In the past we have not always agreed as to what it was possible to show with radiograms of the lungs nor as to the interpretation of the radiographic findings, but with the exception of the one point to which Dr. Dunham referred, there is not a single sentence in this paper that I do not heartily indorse. In the radiograms of post-mortem specimens of the lung which I demonstrated at the Cincinnati meeting three years ago, one can differentiate the bronchi from the blood vessels by the hollow lumen of the former and can trace the bronchi from the bifurcation of the trachea almost to the periphery of the lung.

When Dr. Hulst began his paper I thought he was going to refer more definitely to the value of physical signs compared with the radiographic findings and I was entertaining a hope that he would compare both of these with the post-mortem findings. I have been radiographing a series of such cases with the examining staff of the N. Y. Board of Health. They have their independent physical examinations made by different examiners and recorded. When they all agreed on the physical signs, the process usually was so extensive that it could not be considered incipient. One of the most interesting points of this series of cases was the variation in the location and extent of the lesions as determined by their independent physical examinations compared with the radiographic findings. Sometimes three different examiners would locate the process in three different parts of the lung. The radiograph would definitely locate the lesion.

DR. HULST (closing).

I was very much gratified with the discussion, and, like Dr. Cole, I believe that we do not differ as much as we think. We differ in emphasis and not so much in our opinions.

I never doubted the value of the X-ray in the examinations of lungs, or I should not have practiced it so persistently. Dr. Dunham says that the hilus ramifications are bronchial. Dr. Cole spoke of pathologic cases, and I said distinctly that the picture of the normal lung is made up not simply of bronchi, and therefore should not be called the bronchial tree. It is not made up of blood vessels alone, and therefore should not be called the vascular tree. In pathologic conditions it is made up of bronchi and vessels. Therefore, it should be called the hilus ramifications. I believe it is difficult to demonstrate the bronchi in a normal lung beyond the bifurcation. You may imagine that you can see them, but you cannot differentiate them. Of course, the picture is a record of density differences, but only up to a certain limit, and also the differences must be considerable before the plate will record them. If we could get a record of all density differences on the plate, we would be doing wonders. However, we are doing much better now than we did formerly in the way of recording the slight density difference of soft tissues.

Dr. Cole spoke of comparing the various physical methods of examination. Physical diagnosis is a difficult matter. It is much easier to read a radiogram than to differentiate a respiratory murmur, especially the "respiration rude" of Grancher. Babcock, whose hearing is most acute, says in his book that if two diagnosticians go over the same lung, they are likely to give different readings.

Another point: The bronchi are tubes and you know what they do,—conduct sound, and one must not suppose that the disease is necessarily at the place where the sound is best heard. I think that the way to make the roentgen method of examination find a place in the diagnosis of lung tuberculosis is not by showing how much better we can do it by means of Roentgenography than by the older methods, but by showing how much more complete we can make it. The men who work with me have been converted to this method, and they appreciate it.

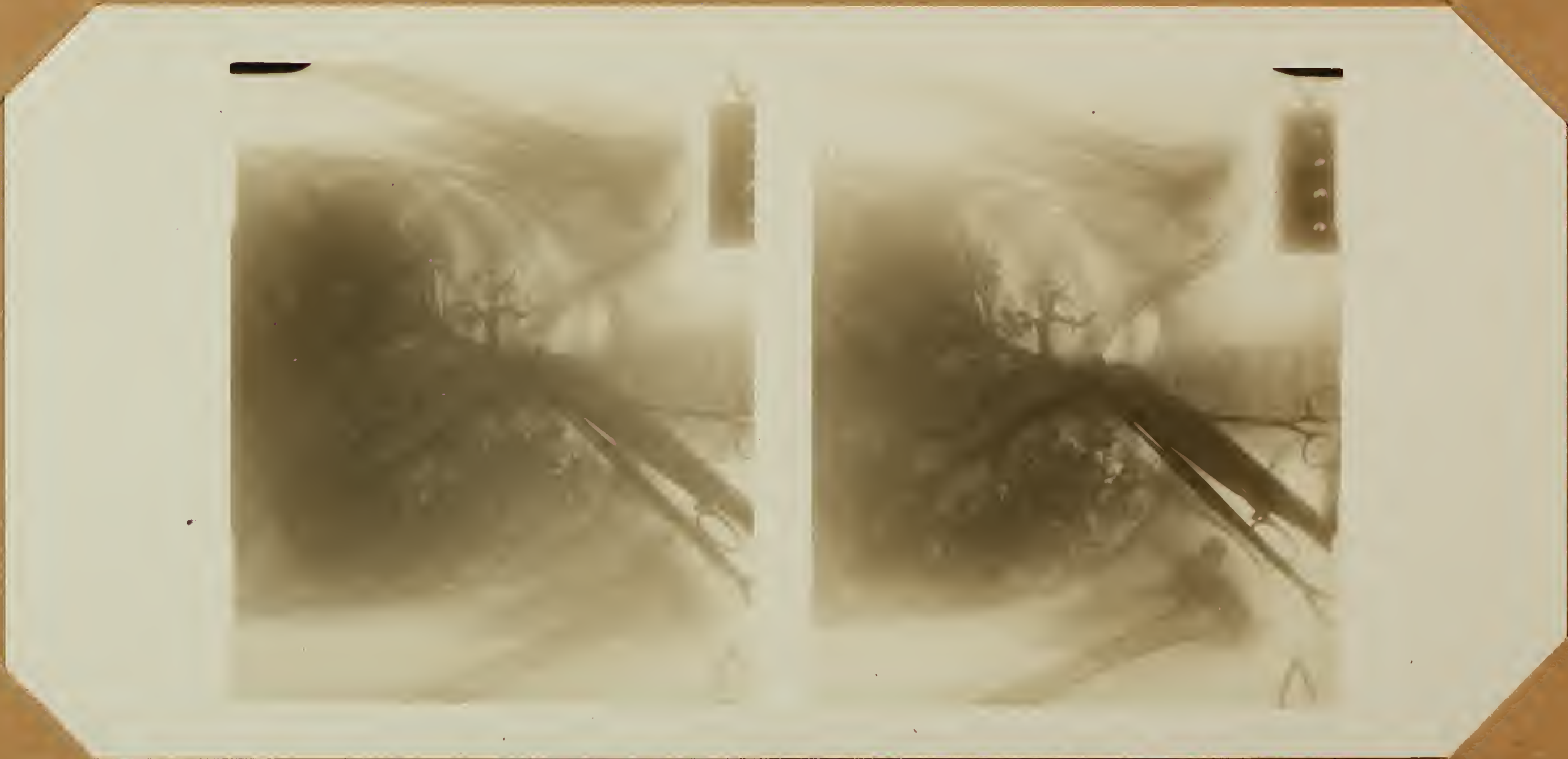
# THE TECHNIQUE AND READING OF STEREO-CHEST PLATES WITH ESPECIAL REFERENCE TO TUBERCULOSIS.

BY DR. KENNON DUNHAM, CINCINNATI.

From the very beginning of the use of the Roentgen ray in diagnosis, no part of the human anatomy suggested such possibilities as did the chest. Here the great differences of density were very alluring, but the necessary short exposures, so that the breathing and the pulsations of the heart would not disturb the finer markings, were very difficult to procure. Dr. Hulst presented to this Society the first one-second exposure which I had ever seen. The richness of detail was wonderful. Those of us who were compelled to expose from five to ten seconds were forced to the use of the fluoroscope for much of our lung diagnosis. Subsequently it became evident that even technically perfect plates, as Reeder calls them, would not do. The markings must be filtered out, as many densities of most important tissues lay one upon top of the other and could only be seen as one shadow. Stereoscopic plates suggested themselves. Here the technical difficulties were more than doubled. Many men showed such plates but either the markings were lost by long exposure, or too much time was allowed to elapse between the two exposures and the plates were imperfect. Certainly there were exceptions. Hickey showed us some at our last meeting.

To secure good stereo-plates, the exposure of each plate should not be longer than one-tenth second, and the time from the beginning of the first to the end of the second exposure should not be over one-half second, and this time must not be gained at the expense of the plates.

Such perfection has not been obtained in my work, but last winter a technique was developed which enabled me to secure two good radiograms and move my plates and tubes while the patient easily held his breath. On an average the



## CADAVER

Bismuth injection into trachea and bronchi. Tubing passed thro descending vena cava into heart. Left side, upper and lower lobes clearly defined, showing upper and lower divisions. Injection extends to periphery. On right side, bismuth has not passed to periphery of upper and middle lobes; lower lobe is fully injected.

Upper right lobe shows—trunk (I) passing parallel to the spine toward the apex above the clavicle. Trunk (II) passing from bronchus upward, backward and outward toward fourth rib in back. This is bronchus seen behind first interspace. Trunk (III) passing laterally and forward, giving off branches, one of which is seen behind first interspace. Branchings of the other trunk are seen behind second interspace. Trunk (III) and branches are usually seen lower than in this specimen. Trunk (IV) is usually not made out during life. Middle right lobe—Trunks come off from bronchus much below those of upper lobe, one passes forward and the other backward.

chest of a large man could be taken in two seconds for each plate, and plate and tube moved in two seconds, thus allowing six seconds for the operation. This was not good enough, but it would do, and this series of exposures was undertaken to ascertain the value and limitations of the stereo-roentgenogram in tuberculosis of the chest.

The work now finished will be presented in three papers:

I.—Technique and Reading (This article).

II.—Lung Markings as Due to Arteries, Veins, Bronchi and Connective Tissue (Dunham and Boardman).

III.—Correlation of Physical Examinations, Tests and Radiograms (Dunham, Wallman and Boardman).

Also the work has suggested that possibly in tuberculosis, there occur changes in the supporting connective tissue around the blood vessels and bronchi and even between the lobules beyond what is usually described by pathologists, and that these changes, with the diseased blood vessels and bronchi, might account for the changed markings noted in such plates. Therefore the work will be continued.

Lobes of normal and early tubercular lungs will be rayed stereoscopically and then large sections will be cut at different levels of the lobe so that any changes may be followed and described.

This first paper must refer to the second and third, but will deal with the technique and reading of stereo-chest-plates.

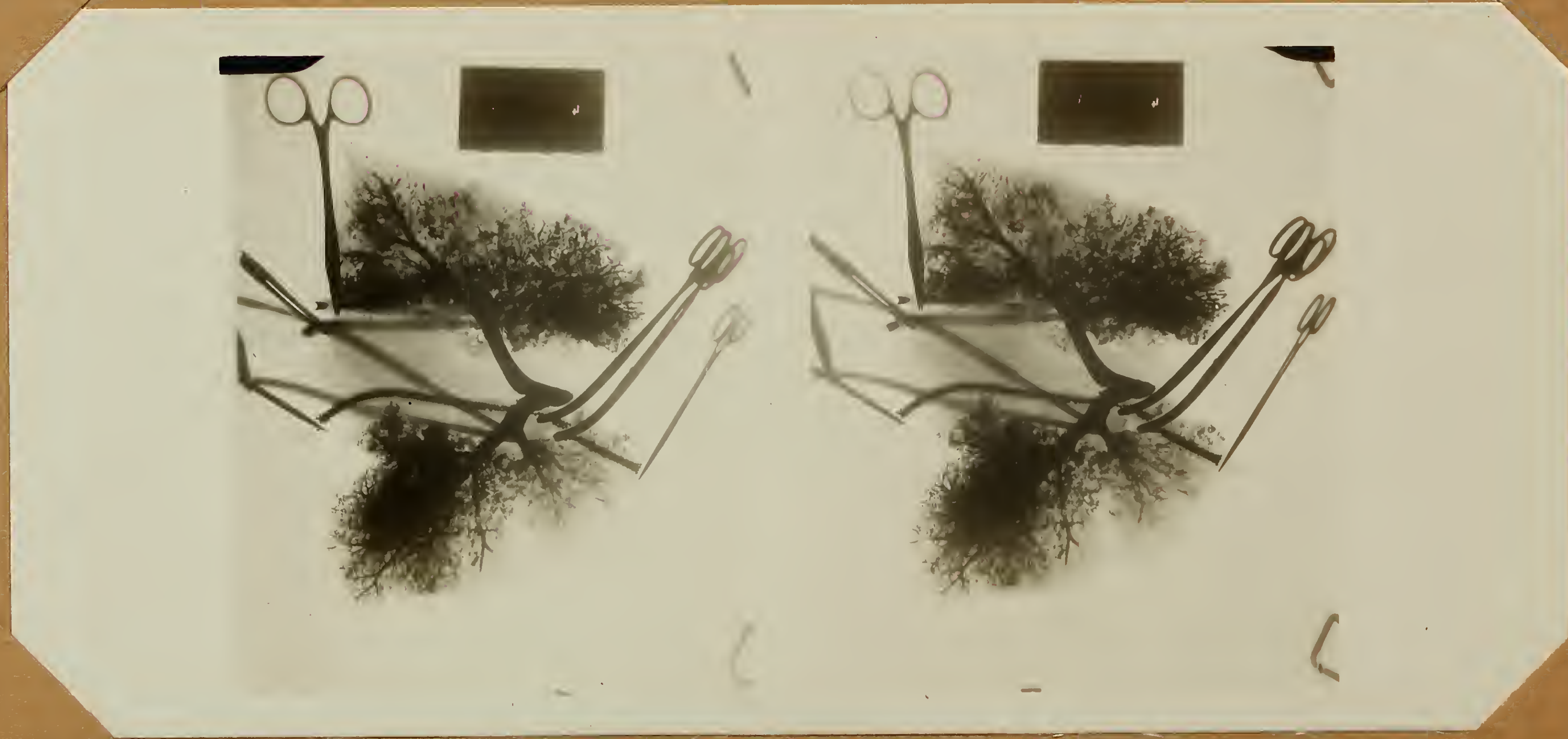
The advantages of the stereo-plates over the single radiogram have been well stated by Winkelbach (A. of R. R., Dec., 1908, No. 101). The physical and optical principles underlying the stereo-roentgenogram have been most graphically set forth by Eichman (F. a y d der be R. Juli 1909). This latter article has been a great help as it showed conclusively that the variable base of Marie and Rebou was not only troublesome and unnecessary but incorrect.

Two fundamental principles underlie the procedure of conveying the three dimensions of an object to the mind by means of two X-ray plates; these principles are linear and aerial perspective.

That part of linear perspective which is useful to us is utilized when two images are taken at different angles so as to simulate the different angles used by the right and left eyes. For reconstruction these images must be placed in such a position that we can only see the one image with the right eye and the other image with the left eye. In this manner if our eyes are as far from the image as the tube was from the plate, and if the plates are in the correct position, and further if the tube has been moved the exact distance our right pupil is from our left, then we will have the right image superimposed upon the left so that we recognize only one image but that will have the three dimensions and we will see the front separated from the back. From two chest plates thus taken, if the technique has been perfect and the patient has not moved, a mathematical reconstruction can be made which will give as exact an idea of the position of the different densities of that chest as if our eyes could see by the X-rays as they can by the sun's rays.

It is necessary, however, not to forget that the aerial perspective is due to the fact that distant objects appear more hazy and less distinct than those nearer to us. The window sill from which one sees, appears much plainer (whites and blacks more pronounced) than that of the house across the street. Thus if we take a ventro-dorsal stereoscopic picture of the chest there is a great tendency for the back to force itself upon us and make it appear as a back view. This is especially true if the tube has moved farther than the pupilary distance of our eyes, or if the muscles of our eyes are tired. This is largely a psychological effect produced by the fact that we are accustomed to see the nearer object more distinctly. That is, we are accustomed to use aerial as well as linear perspective.

As has been suggested, many difficulties have had to be overcome, but today it is as easy to take two good, not perfect, stereo-chest plates, as it was a year ago to take one flat plate. Our tubes, generators, tables and plate-changers are all better and stronger and are more perfectly adapted to



**LUNG SEEN IN No. 1 REMOVED FROM CHEST**

Rubber tube containing shot seen on right side. In upper right lobe some blood vessels also injected. The five divisions, three on right and two on left, should be easily made out.

their work. As has been seen one plate must be exposed, the tube moved, Plate 1 must be replaced by Plate 2, and the second plate exposed. This must be done quickly, the patient must not move, his diaphragm must not jerk and his heart must not beat a sufficient number of times during either exposure to blur the lung markings.

This is accomplished, after the first exposure, by having a tube carrier that will move just the necessary distance and no more by pulling one string while another string pulls Plate 1 out and Plate 2 in, without disturbing the patient. This accomplished, the second exposure is made.

The plates are then developed, dried, placed in a large-sized Whetstone stereoscope and read.

The distance the tube is moved—"B"—is called the base-line, and this should be parallel to the plate. A perpendicular from the focal point of the tube to the plate is called the principal ray—"R." Where this principal ray penetrates the plate is called the foot-point—"F." The steel rods perpendicular to the plate, which I have attached to the table above the plate, one on either side of the patient, for the purpose of finding the foot-points, I call the foot-point finders.

The base line is the most important part of the stereoscopic exposures. It should be six c. m. long and must be at least twenty-five c. m. from the top of the object exposed. It must be parallel to the plates, or the exact deviation must be reckoned and accounted for in the stereoscope.

Eichman gives the length of the base line as 6.5 c. m., while Snook, at the last meeting of the A. R. R. S., placed it at two and five-eighths inches. Both use as their standard the pupilary distance and this is correct. I have made my base line 6 c. m. because more people have a pupilary distance under than over 6.5 c. m., and the foreshortening of the perspective is so slight as to be negligible. Thus more people are able to see the plates stereoscopically and also the plates are more readily reversible. This is no great help, yet in border line cases it sometimes accentuates markings which might otherwise be overlooked.

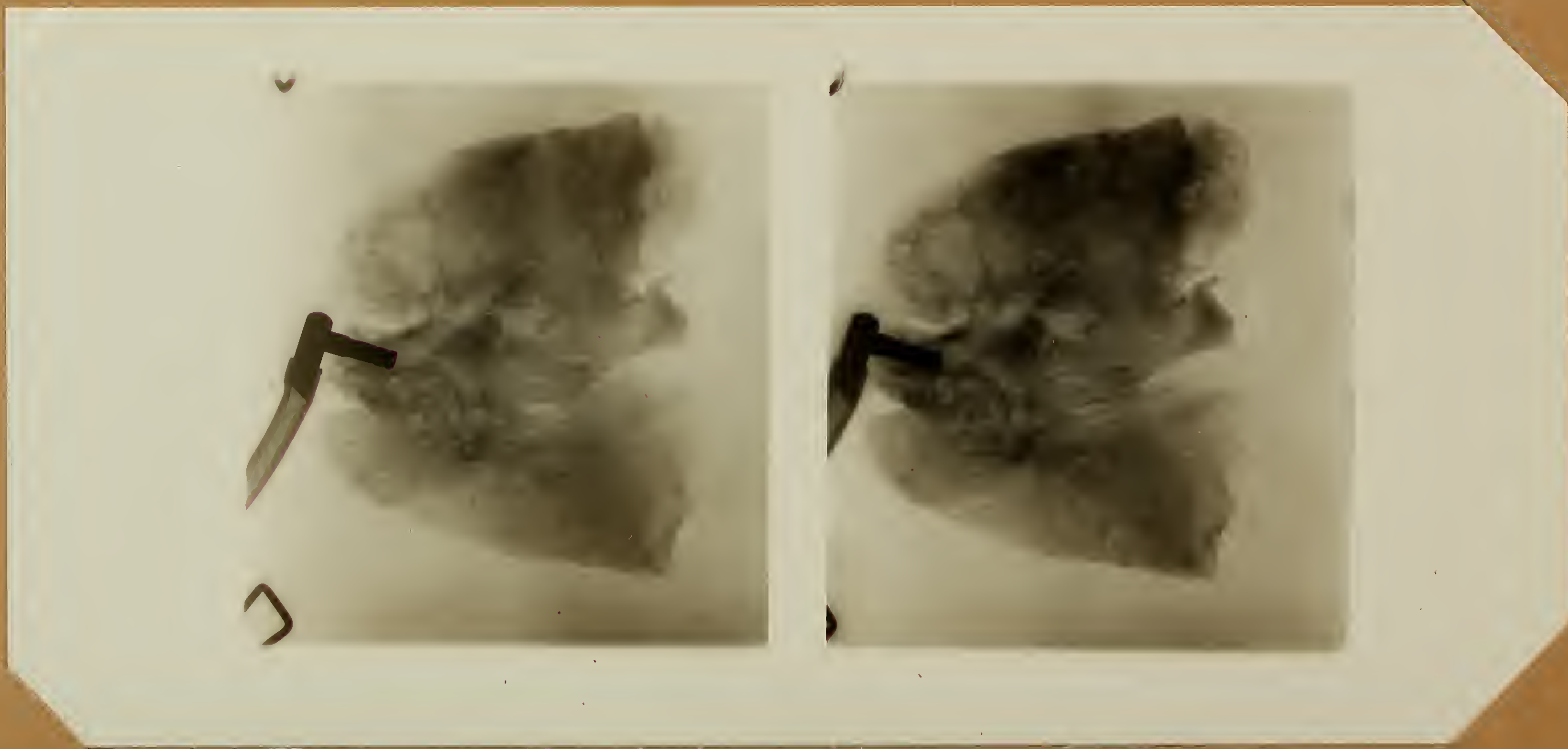
The base line must be at least 25 c. m. from the nearest part exposed, because stereoscopic vision is not possible much under it. That the base line should lie parallel to the plate and that Plate 2 should, during exposure, be in exactly the same position as that occupied by Plate 1 during exposure, is evident. The only exception to this necessity is when changes are accurately recorded and the stereoscope adjusted for them.

It is true, as has been said to me, that all sorts of liberties can be taken with the above fundamental stereoscopic rules, and still good relief be secured. Nevertheless, any deviation necessitates a disturbance of the image points and a mathematical reconstruction is impossible. A picture is obtained, it is distorted though it appears to be excellent and not having the object with which to compare it, you are fooled into believing that it is correct.

It is necessary to know the location of the foot-points if we desire to make a comparative study of the plates or wish to reduce stereoscopic plates so that they can be used in the hand stereoscope or desire to reproduce plates for publication. Also if we wish to make our exposures one like the other, it is necessary to ascertain closely the principal ray before exposure.

The latter is easily found by having a pointer that can project from the center of the diaphragm before exposure and easily be removed. The former I have accomplished by having two perpendicular steel rods (previously described) pointing up from the top of the table on either side of the patient's neck. The shadow falling from these uprights, as long as they are in a plane with the principal ray, can be extended along the plate toward the tube until they cross. The principal ray must reach the plate at this point. This is the foot-point. The relation of patient, tube, base line and plates is very important.

I maintain, although this series has been taken with the patient lying chest to plate, that the upright position is the best for thorax exposure, because it is easy to assume, the



**INFLATED LUNG REMOVED FROM CHEST**

Large caseous and calcified gland lying close to right bronchus; also small area of calcification seen in lower part of middle right lobe. The five divisions, two on left and three on right, should be easily made out.

heart disturbs the markings of the left lower division to a much less extent and it is easier for the patient to hold his breath. The **plate** should be to **chest** (dorso-ventral). This gives greater space between the ribs and allows the scapulae to be removed to the side of the chest by simply drawing the shoulders forward and further facilitates perspective because the ribs at the back are heavier than at front and cast a denser shadow. As we observe pictures exactly as we expose them, we see the ribs near the spine brighter and closer to the eye. Then the effect of aerial perspective adds to our reconstructed image, because, as has been said, that is the manner in which we are accustomed to observe objects.

The base line should cross the ribs, not the spine. This will necessitate viewing the patient as though lying on his side, but that is no detriment and it will allow us to see around the ribs while with the base line across the spine we would have to see around the spine. The latter position is useful when viewing mediastinal conditions, but the former when studying pulmonary conditions. I prefer to have my first exposure through the 7th D. V. and my second through the 4th D. V. or vice versa, but this is not material as long as the principal ray passes near the spinal canal and we know at which D. V. the principal ray has passed. Further the plate must be large enough to extend from above the apices to below the diaphragm. Usually a 14 x 17 inch plate accomplishes this if placed with its long dimension across the chest. A smaller plate will not serve so well.

The tube, generator and method of development are an all-important part of the technique, but I hesitate to speak of them because so many men get such excellent results in so many different ways.

It is necessary to have a generator with a sufficiently large output and a tube which will take it so as to get a good picture in at least two seconds without the aid of a screen. Even the best of the new Wolfram screens will not show the fine radiating markings with sufficient detail for this work. To secure perfect plates of the lower left base less than one-fifth second is necessary. I have one plate taken in one-fifth second on which the linear markings of the lower left are disturbed. I have repeatedly shown that not only the markings of the left lower, but of the right lower as well, are decidedly disturbed by a three-second exposure. The right base is usually clear with a two-second exposure.

My developing formulae are as follows:

| | | |
|---|---|---|
| A | Sodii Sulphite (dry) ......... | 250-500 grms. |
| | Sodii Phosphate (C. P.)...... | 120 grms. |
| | Hydrochinane ............... | 70 grms. |
| | Edinal ...................... | 50 grms. |
| | Water ....................... | 3500 c. c. |
| B | Potasa Carb (dry) ............ | 500 grms. |
| | Sodii Phosphate (C. P.) ........ | 150 grms. |
| | Water ......................... | 3500 c. c. |

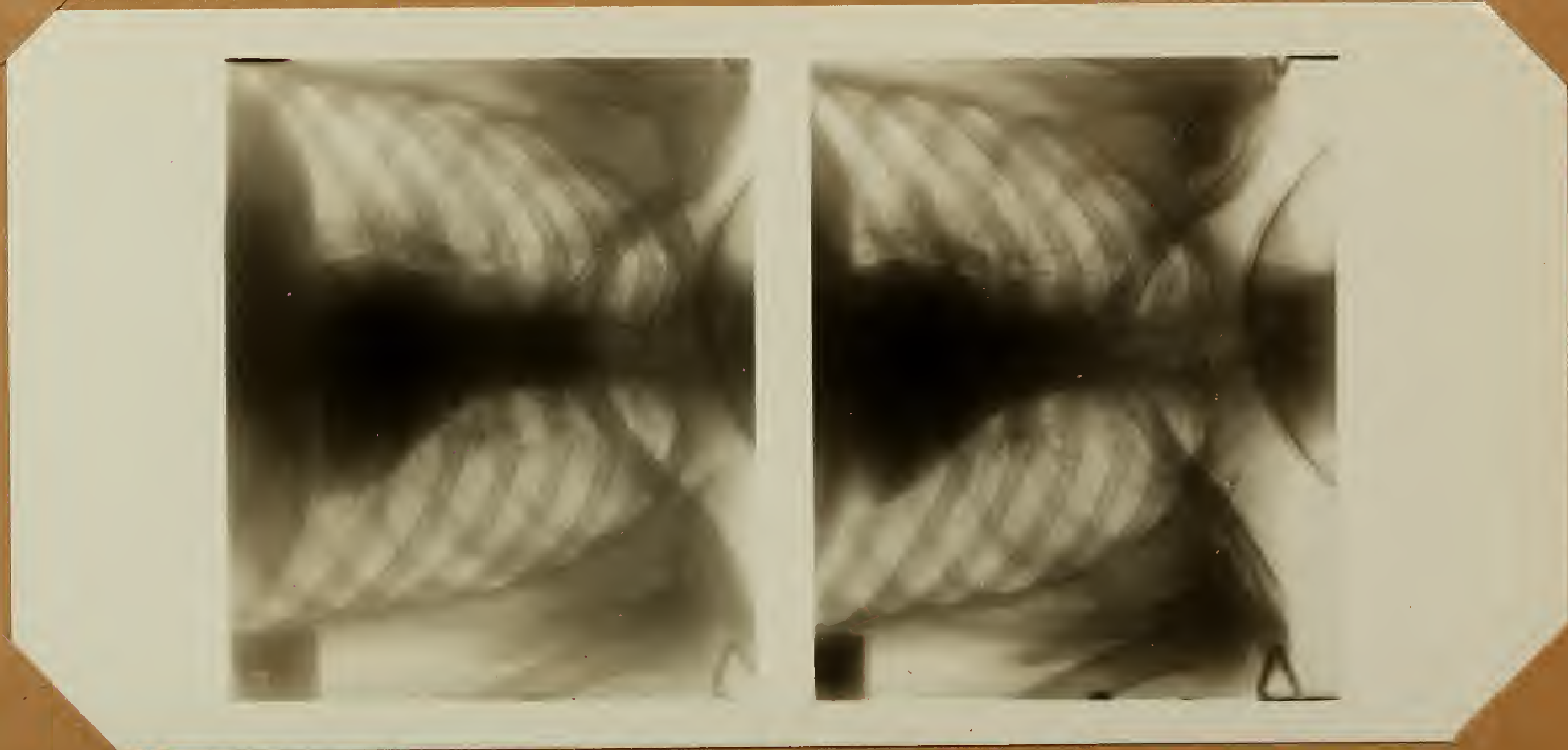
To use mix equal parts of "A" and "B" and use after first developing an unimportant plate before you try a good one. Add a small amount of developer after each two plates and filter frequently. Develop at a temperature between 65° and 70° F. There is no objection to bromide if you find it necessary.

This technique can be improved without changing tube, generator or table by a time switch, a penitiometer, constantly attached to tube and by tank development. This will remove three unknowns and give us three constants in their place which we can adjust until found satisfactory.

Having shown how stereo-radiograms may be taken it now becomes necessary to see them in relief.

The most practical method of reconstruction of which I know is the Whetstone stereoscope. It has some slight inaccuracies as shown by Eykman, but it works, though the triple reflection from the mirror is often very annoying.

The Whetstone stereoscope as now used consists of two mirrors at right angles to each other and set at an angle of forty-five degrees with the face of the illuminating boxes.



**CADAVER**

Hilus and trunk shadows abnormally heavy. Linear markings normal. Heavy density seen to right of spine between fifth and first ribs. Postmortem showed this to be caseous and calcified glands, also tubercular mediastinitus with parenchyma comparatively free.

By this means Plate 1 is seen by one eye, let us say the right, and not seen by the left, while Plate 2 is seen by the left and not by the right. To the mind this conveys the impression that only one image is seen, but that image appears as in relief.

By this method we have taken and examined in the Phipps Dispensary of the Johns Hopkins Hospital more than three hundred stereoscopic exposures and for practical purposes these have been very satisfactory. Much of the work has been purely experimental and, as has been said, will be reported later. Some cases which have been taken have been removed from the series, because the plates did not show sufficient detail and a second exposure was not obtained or the clinical history was lost. So our series only includes something over a hundred and sixty living and eleven autopsy cases.

Many of the living cases were clinically normal and the remainder were suffering with various diseases. The correlation of the physical signs, tuberculin tests, sputum examinations and X-ray readings in these cases showed that the clinician agreed with the X-ray findings very closely.

In explanation it must be noted that these were very exceptional physical examinations and every other known laboratory test was at the service of the clinician. Further, that Dr. Wallman, who had charge of the physical examinations, is one of the keenest pulmonary diagnosticians with whom it has been my good fortune to come in contact. Further that the X-ray readings in this series were made, as they should never be in practice, without a knowledge of the clinical condition of the patient. Also, many plates were reread without knowing whose plate was taken, and the results in every case corresponded with the previous readings.

Whether the plates agreed or disagreed did not depend upon whether the case had or had not had tuberculosis merely, but upon which lobe or division of the lung was the one involved and often upon many minor points.

It is further to be remembered that this work was done by a very new empirical classification which time must necessarily show incomplete and imperfect.

Therefore with this showing it seems only fair to draw the conclusion that although this is an empirical reading, it has somewhere a foundation in fact. These cases will be fully dealt with in our third paper.

These readings are absolutely dependent upon the stereoroentgenogram and cannot be made from a single plate. Therefore stereoscopy is a necessity. It will probably be found that tetraphony and polyphony (the taking of three or even four exposures instead of two as recommended by Eykman, A. R. R. June, 1909, No. 107) will be a great help, as it will give us exposures across the spine as well as across the ribs. But as Kipling says, "that is another story."

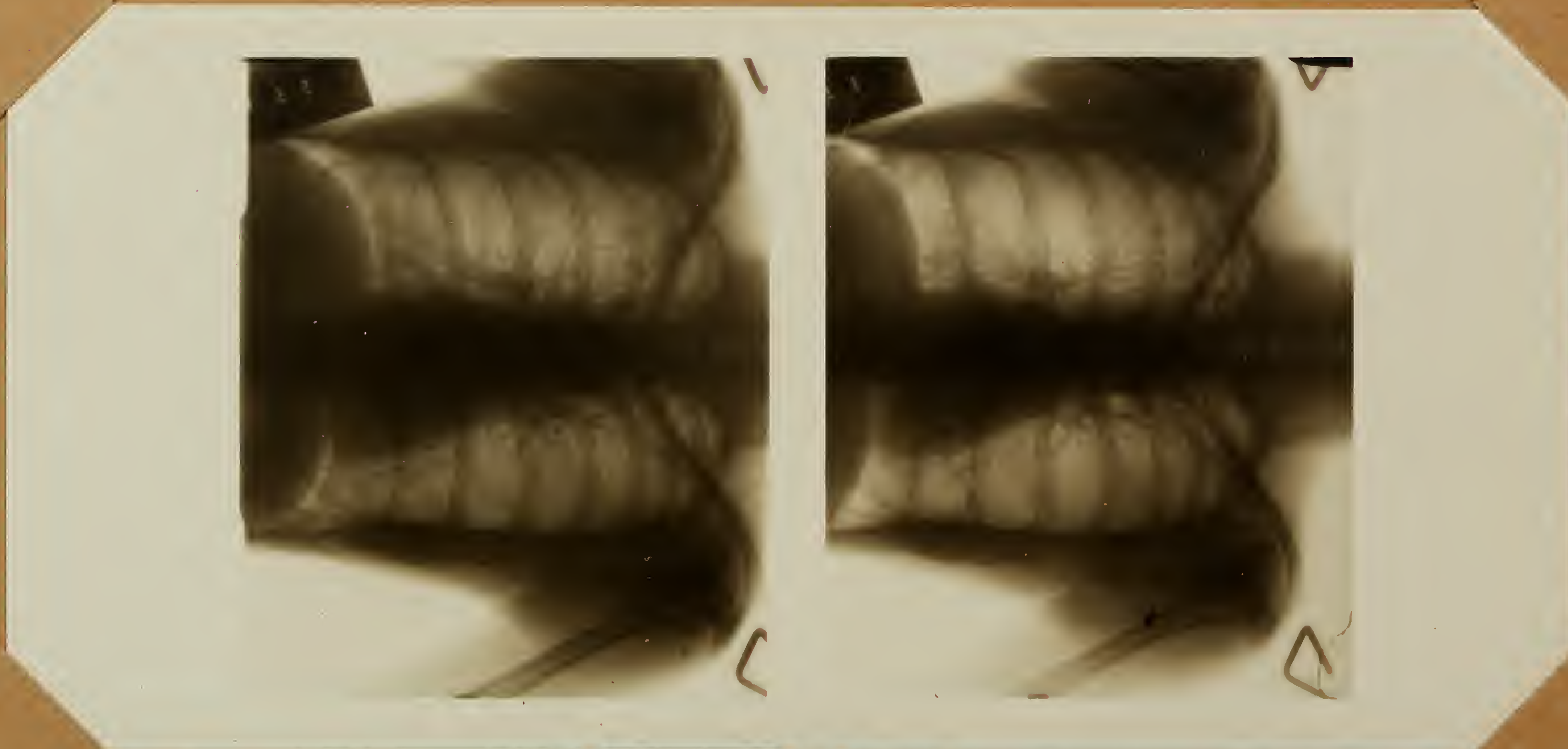
Before describing the markings characteristic of tuberculosis, let us consider what can be seen and then decide whether it is normal or pathological.

The bones should be noted with especial reference to the spine and the relation of the ribs to it; the cartilages, as to whether they are calcified or not; the muscles, pectoral, diaphragm and the heart with its vessels. The aorta is usually made out clearly.

This brings us to the lungs with their heavy hylus shadows, into which can be traced the trachea and from which pass the trunks. Beyond these trunks we see the fine linear markings. It is in these we find the most constant and characteristic T. B. changes. Much has been written as to the tissues which produce these densities but it is often difficult to say to which part of the plate the author refers. Therefore we will divide the pictures.

We will not here discuss heart and aorta, but first notice right and left thorax.

In the right thorax, just to the right of heart and often contiguous with it, is seen a large, heavy mass of increased density, which differs in almost every adult plate. This is the hylus shadow. From the hylus can be traced heavy trunks of increased density and these go to the three main



**TUBERCULAR CHEST DURING LIFE**

Hilus and trunk shadows abnormally heavy, with general breaking up of linear markings throughout the chest. This is especially marked in upper lobes, more on right than on left.

divisions which correspond roughly to the lobes of the lung. In bismuth injections of the bronchi these correspond very accurately to the lobes, and in some cases of disease these divisions are almost as clearly marked as in the injected cases.

Thus on the right side we have the hylus, the heavy trunks and three main divisions, an upper, middle and lower.

On the left we have again the hylus, but it is much less in evidence, being largely covered by the left heart and aorta. Again we have the heavy trunks but they run off in two main divisions which correspond roughly to the lobes, and can be clearly made out in the injected cases. In only one clinical case have I found the lingual tip of the lower left lobe made out. Thus on the left side we have the hylus (small), the heavy trunks and two main divisions.

Further the trunk going to either upper lobe has three branches. The first passes up from the hylus parallel to the spine toward the apex. The second passes out from the hylus up and backward. This branch is seen to lie behind the first interspace of the chest. The third branch from the hylus passes anteriorally and laterally toward the periphery and is seen behind the second interspace of the chest.

In many of these stereo-plates the trachea is clearly seen; it divides generally into the right and left bronchi in front of the fifth D. V. Frequently the bronchi can be traced either to the right or left, sometimes to both and is often seen to branch and pass to their separate divisions, as the bronchial branches pass to the lobes.

Beyond the heavy trunks, we have in health fine linear markings, which when viewed stereoscopically, radiate, break up into fine fibrils and on my plates do not reach the periphery. This radiation cannot be differentiated from interweaving on the single plate, but can stereoscopically.

In studying the plates of cases of tuberculosis, one notices four important changes from the normal. First, the large brilliant areas of increased density, which are probably due to lesions in the glands. They are only of importance when accompanied by increased density of the hylus shadow and heavy trunks. Then they suggest mediastinitis, probably of tubercular origin.

The second important thing is to note the thickened trunks with the changes in linear markings. These latter changes consist of increase of density and breadth; frequently their course is studded, sometimes almost to obliteration of the lines. Normally these lines radiate in all directions from the heavy trunks, and can be traced in the lung removed from the chest, to the periphery. With the normal lung in situ, I cannot trace them to the periphery with my present technique.

In tuberculous cases these radiations are lost and replaced by an interweaving, sometimes of fine, sometimes of coarse mesh, and the radiations are so much increased in density, that they are easily seen extending to the periphery. In more advanced conditions, cavity formations may occur. Rieder sometimes finds these quite early, but such has not been my experience. On the other hand, the area may be so infiltrated, that the interweaving is blotted out by means of increased density, even to the consolidation of entire lobes.

Any study of pulmonary tuberculosis must lead to a study of pleurisy, and pleurisy with effusion. The third noted change concerns pleurisy. The post mortem examinations have shown that marked pleural adhesion may easily exist without detection, and the clinical cases have shown, that one-sided muscular development may easily increase the density of that side, so as to suggest a pleurisy. Yet irregular folds of pleura may be detected at the apices, and sometimes at the diaphragm, while inter-lobular pleurisies of moderate magnitude are easily seen. But the evenly distributed pleurisy which spreads uniformly over one or both chest walls will frequently defy detection.

The fourth change is when there is pleurisy with effusion. Liquid in the chest, whether purient or not, whether associated with simple effusion or pneumo-thorax, or as a saculated inter-lobular effusion, is easily detected. In hydro-pneumo-thorax, with the patient in an upright position, the liquid remains horizontal and the lung appears collapsed. In effusion the surface of the liquid is not level, whether the patient is upright or prone. In the cadaver, where the internal pressure of the lung is relieved, the liquid naturally seeks the most dependent position of the chest.

Pleurisy with effusion presents in these stereoscopic plates a most interesting appearance. The liquid is confined in the limited area of the chest, and is pressed upon by the internal pressure of the lungs, which has a tendency to drive it up at the periphery and to hollow it out towards the base. The pressure of the lung is evidently not uniform, but is apparently held in place by trabeculae, between which the lung presses with more force upon the liquid. Thus we have upon the plate the appearance of the liquid being scooped out, which verifies the simile of Emmerson, between pleurisy and a partly filled, tightly corked bottle of water in a hot-water bag, pressed upon by the rubber bag which could be inflated. But were that rubber bag covered with a balloon net, the simile would be more complete.

This sums up the four recorded changes upon which I would base the diagnosis of tuberculosis. Here as in nature nothing is truly diagrammatic. The seeing is not so easy as it may seem; one is often in doubt. There are many border line cases. Nevertheless in a series of 92 cases (the ones examined by Wolman) we concurred absolutely, even to the location of the lesion, in 85. This included 14 non-tuberculous. Six of seven showed a disagreement as to extent, and in only one case was there an absolute disagreement. Thus it would seem that there was a good reason to believe that with the proper study of a large number of cases, some such classification would be found to be a great help in differentiating tuberculosis from other forms of pulmonary trouble.

It must be remembered that certain heart conditions such as mitral insufficiency with loss of compensation, may change the markings, and that pneumosiderosis might give a plate which would simulate even the stereo-picture of tuberculosis.

In this series no attempt has been made to read the lower left lobe. In almost all cases the linear markings have been disturbed by the heart and the finer branchings cannot be made out. When these markings are seen in the lower left, it is probable that we have peri-cardial adhesions.

Before concluding I wish to say that apex plates are also a necessity, but that they must be taken stereoscopically and that we have developed a special technique for this purpose. Birsch-Hirschfeld, Albers-Schonberg and Hickey have shown this necessity. It is very important to secure the correct angles. Here it is possible to use to advantage a softer tube and a longer exposure. But all this too "is another story."

This paper does not deal with the fluoroscope. These readings have been made without its use, but it would be a step backward to discard its aid.

The greatest danger to our diagnosis from the single plate lies in the fact that we are tempted to read too much. This is true to a less extent in the stereo-roentgenogram. The normal cases taken have been fully as instructive as the tuberculous.

We have found that it is the exception rather than the rule to be able to differentiate between active and passive lesions. So far as I know there is no royal road to this. A very careful history and physical examination, and close observation over a sufficient time are the deciding factors. If a lesion can be seen by this means to advance from time to time, it would be of great value. A ~~calumet~~ Calmette eye reaction—one or five per cent—seems to have some value.

In concluding I would say that by means of stereoscopic chest exposures a very accurate anatomical condition of the chest is suggested. We have certain changes which occur in tuberculosis, which are quite constant, but in what other diseases they might also occur we do not know. It seems possible, as I said, that such changes might occur in mitral lesions, with broken compensation, and in pneumosiderosis (we have not observed a sufficient number of plates to know whether these findings are constant in mitral lesions and in pneumosiderosis or whether they could be differentiated from each other or from tuberculosis). A great number of observations by many observers can alone settle these points. It must be remembered that the linear markings are blotted out by large areas of increased density in advanced cases. And further that the stereoscopic plates must be taken with geometric accuracy, with close attention to many technical details, since only "technically perfect plates" are of value.

In a subsequent paper we propose to show that these markings are produced by arteries, veins, bronchi, and probably by their supporting connective tissue, and possibly by the lymphatics. This does not mean that we expect to show each separately; we do not. It is evident that the change in markings in tuberculosis is due to changes in the vessels, bronchi, connective tissue or lymphatics and further research will be instigated at once to determine which is most changed and to what extent.

# CHRONIC JOINT DISEASE FROM A ROENTGENOLOGIC STANDPOINT.

BY ROLAND HAMMOND, M. D.
Providence, R. I.

The Röntgen rays have been of the greatest service to the orthopedic surgeon in enabling him to classify and diagnose, as had never before been possible, those obscure arthritides which had previously masqueraded under the loosely fitting garb of "rheumatism." Early in the development of Röntgenology, those workers who were especially interested in joint diseases began the study of plates illustrating these conditions. This work, combined with examination of pathological specimens, and the analysis of clinical data covering the observations of many years, resulted in Goldthwait's publication in 1904[1], which has put the subject on a most satisfactory foundation. His classification has been accepted by a majority of workers as adequate for clinical purposes. It was first shown that this group of cases does not represent rheumatism at all, but is composed of a number of chronic joint diseases, which tend to progress unless checked by favorable influences. These cases present much similarity from the clinical side, and an accurate diagnosis is possible only when a complete Röntgen examination is made.

**Etiology.**—Most cases of chronic joint disease in which some bacteriologic agent cannot be demonstrated, are shown to be due to faulty metabolism. The absorption of putrefactive substances from the intestinal tract, especially the colon, causes a deposition in and around the joints, of insoluble substances which act as irritants to the delicate synovial membrane. The auto-intoxication resulting from the absorption of products of incomplete metabolism is often found to rest on a simple mechanical basis. Ptosis of the viscera, especially the stomach and colon, allows the food to stagnate, and torsion and partial occlusion of the intestines resulting from the ptosis permit the delay in the passage of food and so favor the absorption of toxines from the alimentary tract.

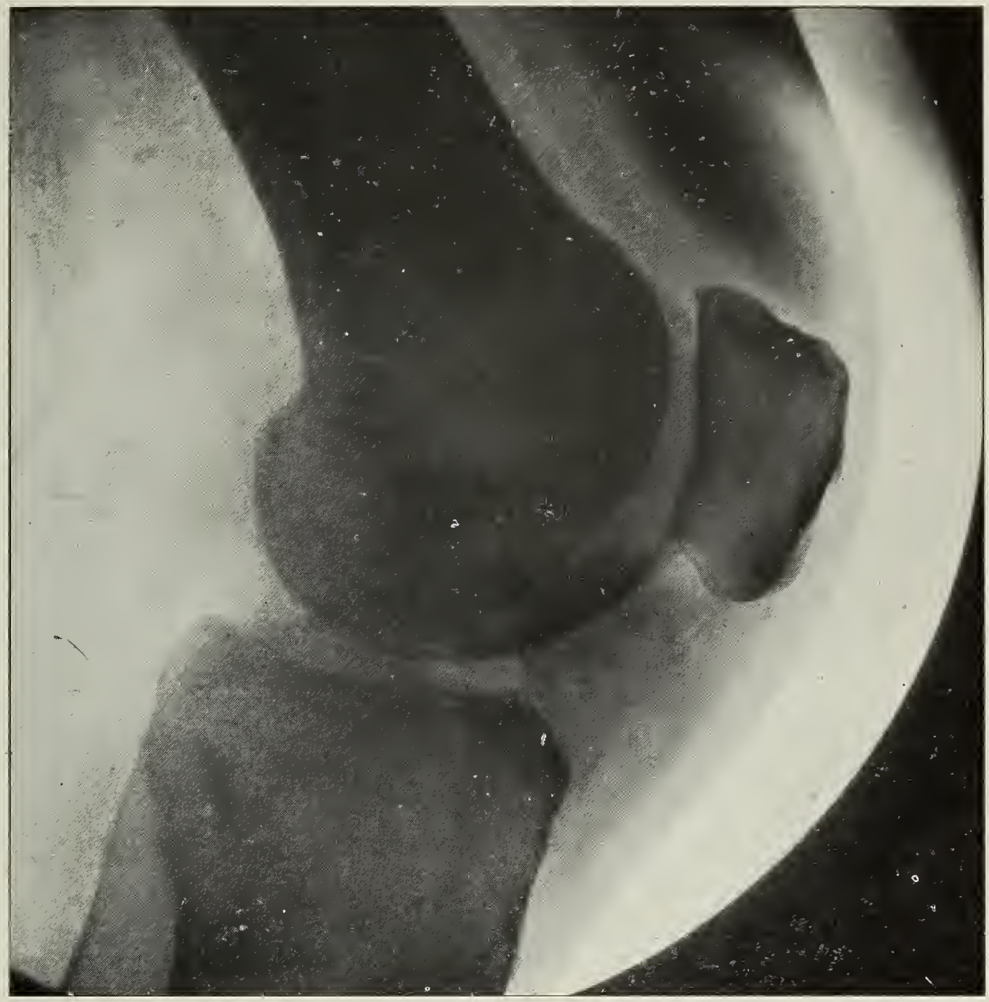


Fig. 1—VILLOUS ARTHRITIS
No bony changes. Thickening of soft parts beneath patella.

Great credit is due to the members of this Society, notably Hulst, Leonard, Pfahler, Pancoast and others, as well as the foreign workers, Rieder, Von Ziemssen, Holzknecht, Groedel, and many others, for calling attention to the normal position of the viscera in the standing posture of the body, and the observations on visceroptosis in a large series of cases. Last year at the meeting of this Society in Atlantic City, Dr. Percy Brown called attention, in an admirable paper, to the relation between bodily deformity and gastro-intestinal irregularities. The significance of this work was not fully appreciated at the time, but recently attention[2] has been directed to visceroptosis as a causative factor in chronic joint diseases. The ptosis may be congenital in some cases, at least the tendency to it is so considered. In a larger percentage of cases it is acquired, and is due to faulty attitudes of the body, relaxed conditions of the suspensory ligaments of the viscera, atonic muscular walls of the abdomen or skeletal deformities. These splendid contributions to living anatomy and living physiology promise to assume an important rôle in the future in placing these obscure diseases on a sound etiologic basis.

The first change noted in these chronic joint diseases is in the character of the synovial membrane. It loses its smooth, whitish, glistening appearance, and becomes roughened, reddish, and villous, giving rise to pain and stiffness, and revealing, on examination of the larger joints, the typical dry crepitus and the thickened, rubbery feel. This is the villous arthritis, most commonly seen in the knee. On Röntgen examination it shows only a thickening of the tissues beneath the patella in the lateral view, or a thickening of the soft structures at the sides of the joint. No bony change can be made out at this stage. There is a variable amount of fluid in these joints, due to local trauma from the villi catching in folds between the bones during motions of the joint. These villi often undergo fatty or calcareous degeneration and may become broken off and lie in the joint as "joint mice." This villous condition may be found in the early stage of any joint trouble, whether due to tuberculosis, purulent infection, or to the group caused by faulty metabolism, and commonly known as rheumatoid arthritis. Villous arthritis is also the result of strain from flat-foot, relaxed sacro-iliac joint, or faulty attitudes of the body.

If the disease is progressive, it may go on to cartilaginous or bony changes, according to the etiologic factor at work. In the class of diseases which we are particularly considering, the so-called rheumatoid arthritis, the joint may take on one of two characters; it may become atrophic, or it may become hypertrophic, and at times both types are present together.

In the atrophic form the bone is thinned, in the later stages markedly so, and the space between the bones is much diminished, due to the loss of cartilage. This atrophy may progress until all the structures of the joint are involved, and one bone may even telescope into the other, or dislocations and occasionally ankylosis may result, with a small atrophied joint. The disease is slowly progressive, often attacking joints in rotation, and months or years intervening before the next joint is affected. Contractures may be present, and often this fact is a cause of error in examining Röntgen plates. If the joint is not flat upon the plate the space between the bones will appear less than it really is, a fact familiar to all of you. In operations for straightening contractured joints, such as genuclasis, the thin, atrophic bone may be readily fractured unless great care is used in handling the genuclast. This difficulty is not usually experienced in operations on infectious joints, such as the gonorrheal type, because here the bone is thickened and eburnated, and possesses much strength and elasticity. The hand better than any other joint illustrates the type of disease present. It is affected early, and should be examined by the Röntgen method when there is any doubt as to the exact condition. The first row of phalanges first shows the characteristic changes, but the other joints may be involved later.

On the other hand, the hypertrophic form of chronic joint disease is proliferative in nature, as its name indicates. The bone is of good texture, and no atrophy is found unless the mixed type is present. The bone may be denser than normal

Fig. 2—ATROPHIC ARTHRITIS
Showing marked atrophy, some destruction of bone, and telescoping in some joints.

Fig. 3—HYPERTROPHIC ARTHRITIS
Note lipping on both femur and tibia.

bone. Lipping and bony excrescences characterize this group, and the phalanges of the hand, the condyles of the femur, the upper end of the tibia, the os calcis, and very commonly the patella, top and bottom, are affected. The same condition is found in the hip joint and along the front of the spine at the sides. These thickenings and ridges along the articular cartilages cause considerable interference with the joint motions and much resulting pain.

A group of cases closely allied with the above, and yet radically different in etiology, is that of infectious arthritis. The onset is abrupt, as distinguished from the atrophic type, but the involvement of the joints occurs rapidly following the invasion of the body by some micro-organism. The joints are usually affected about the same time, though one joint or several, and at times all the joints in the body share in the process. The joints may show no Röntgenologic change following an infection, and yet ankylosis may be present. The bone is of normal density and the cartilage shows no changes. These cases are probably due to the presence of toxines rather than bacteria. On the other hand, many cases show bone destruction or bone proliferation, probably caused by the presence of micro-organisms. In the repair of joints so diseased, new bone formation occurs at the points where infection was present, and not at the edge of the cartilage.

Chronic gout is liable to be confused clinically with some of the types of rheumatoid or infectious arthritis, and Röntgenologic and pathologic examinations are necessary to establish the diagnosis. The finding of urate of soda crystals in the deposits about the joints is sufficient proof of the nature of the disease. These deposits are not attached to the bone, and are softer than the bony excrescences of the hypertrophic form, with which they are most likely to be confused. The bony changes are interesting in that they are punched out and involve only a small area of the bone. Gradually the process extends into the rest of the shaft, either from one or both sides. All the bones in a joint are affected, so that the articulation is destroyed. The bone is atrophied, but not as in the atrophic form, where the bony outline is preserved. In gout there is destruction of bone, and the bony outline is lost.

The arthritides due to tuberculosis, malignant disease, hemophilia, Charcot's tabetic joint and others all present interesting features, but they are beyond the scope of this paper.

I cannot refrain from adding a word on the modern treatment of this interesting group of diseases. Those of you who are also members of the American Electro-Therapeutic Association have frequent occasion to employ the various agents of physio-therapy in the treatment of these cases, and I can do hardly more than mention the various lines of treatment followed.

A plain mixed diet, as found on the ordinary family table, carefully masticated, and in sufficient quantities to satisfy the appetite, but avoiding excess, is the first requisite. Many cases are poorly nourished because they have been told to avoid red meat, acid foods, etc., and improve when put on a nourishing general diet.

Outdoor life, exercise in moderation, a dry climate, avoiding foggy and humid weather, and warm clothing are all desirable. Supports for ptosed viscera, pelvic belts in the case of men, and belts attached to the corsets in the case of women, are sometimes necessary to hold up the organs until they are capable, through efficient stimulative treatment, of supporting themselves. Gymnastic exercises with some form of apparatus should be used, either to reduce superfluous flesh, a disturbing factor in many of these cases, or to exercise and limber up certain joints.

Hot air baths, high candle power incandescent lamp, the all-over incandescent light bath, are valuable agents in certain types of these diseases.

The various static modalities, the wave current, brush discharge, local sparking, as well as the high frequency, D'Arsonval, auto-condensation, and auto-conduction currents from the coil or transformer serve to stimulate general metabolism and consequently the local joint conditions. General vibration of

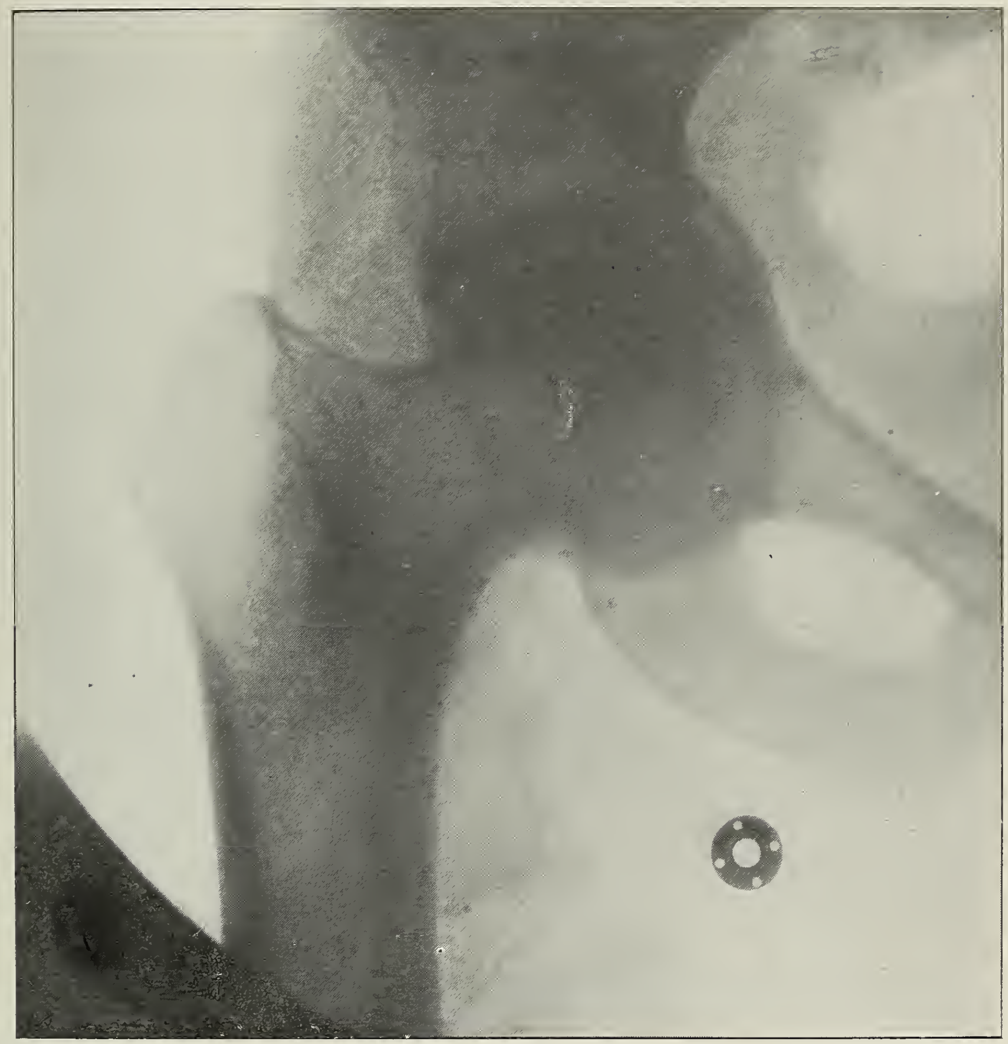


Fig. 4—HYPERTROPHIC ARTHRITIS

the spine, liver and abdomen, followed by vibration of the affected joints, should be a part of any treatment, whether light, heat or electricity.

Ionic medication and Röntgen therapy have a place in the treatment, and the latter is often effective in lessening pain and reducing swelling. The injection of fibrolysin into the general circulation, and of sterile oil and vaseline into the joints are reported upon favorably by some writers.

The surgical treatment of these cases, while of value in special types of disease, is being used less and less, as it is becoming demonstrated that the various agents of physiotherapy bring about even better results.

In conclusion, I would urge the careful Röntgen diagnosis of all obscure joint affections coupled with a careful clinical examination, for both are essential and neither alone will give the complete and accurate picture.

**References.**

[1]Goldthwait, Joel E.: Boston Med. and Surg. Jour., Nov. 17, 1904.
[2]Goldthwait, Joel E., ard Brown, Lloyd T.: Boston Med. and Surg. Jour., May 26, 1910.

## DISCUSSION

DR. PERCY BROWN, BOSTON, MASS.

Only a word is necessary to add to such a complete presentation of this subject. It is easily to be seen that a classification of this sort must be received very slowly by the general medical world, consequently, I think it has taken some years for this new nomenclature of old "rheumatoid" conditions to be received properly, and even as yet it is not accepted by a certain proportion of orthopedists.

A word as to chronic joint trouble in general, and abnormality in position of the stomach and the large intestines, in particular. It seems a far cry between a lame knee and an ailing stomach. The relation between the two at first glance seems strange. It has been my good fortune to examine about 175 of Dr. Goldthwait's cases, in which he assumed practically that there might be some relation between the position of the stomach and a chronic joint lesion from which the patient was suffering. He would say that a patient might present a sagging stomach, from what he gathered of her general attitude and physical deportment, to say nothing of whatever specific area might be involved. It was so in a large number of cases. As time went on I became more and more inclined to value the theory. It seems to me that there must be some direct relation between cause and effect. The work is only just begun and in a few years more there will be gathered much of value from it. It is found that where the stomach is low, the large intestine is also down, but it is also seen, so far as my observation goes, that the stomach alone may be the annoying organ, or that the colon alone may be the organ which is making mischief. Properly to classify the cases in which the stomach alone is the trouble-maker, or where the colon alone is the one to which we must look, will be the basis of my work for the year to come, and possibly I may have the pleasure of presenting some more dependable results on this work before long.

DR. CLARENCE E. COON, SYRACUSE, N. Y.

If the Röntgen ray had never done anything else than to help us to classify the conditions which we formerly called rheumatic affections, it has done well. The classification of these troubles is now in rather an arbitrary stage, but the work which Dr. Hammond has done is certainly along the line to enable us to arrive at something definite. All these processes, as shown by the Röntgen ray, appear to be different stages of one and the same primary cause, but I think that the condition is probably due to absorption and improper nutrition. First of all comes the intestinal tract. It seems to me that the source of infection, and in that case it would be an auto-intoxication, must in most cases come from a sagging transverse colon in which there is taking place absorption of the products of putrefactive fermentation. In the stomach there is not so much absorption. The fluid proceeds rapidly into the large bowel, as shown by many radiographs. The stasis takes place in the transverse colon and it is perfectly reasonable to believe that we get most of our absorption of putrefactive products from the material in the transverse colon.

Fig. 5—ATROPHIC AND HYPERTROPHIC ARTHRITIS
Mixed type.

# THE RADIOGRAPHER'S PROPERTY RIGHT IN THE RADIOGRAM.

BY G. H. STOVER, M. D.
Denver, Colo.

You have all heard, and many times, the question asked by a patient after radiographic examination, "When may I have the picture?" Before I give you the reply I make to such an inquiry, there are a few prefatory remarks which I wish to make. I have a peculiar and strong feeling toward my negatives; they are my pride and my treasure. They are always wonderful to me because they show in life so marvelously by means of that invisible yet terribly potent ray, facts regarding the structures of the human frame whose secrets the healers of human ills have sought for thousands of years to lay bare; and here we have these facts revealed to us in an instant almost, at any time when we need to know them. My feeble eloquence would fall infinitely short of expressing the wonder, the marvel, and the awe that I feel in the presence of this great new light that has been given to us. Is it any wonder that I love my negatives and am jealous of them? That I will not relinquish them to other hands? That waves of apprehension and rage pursue each other over my frame when a confrere (greater villain than the umbrella fiend in an art museum) approaches with impious finger or pencil the very heart of the wet, soft film when I am demonstrating to him from a freshly made skiagram?

But there are other reasons than sentimental ones which impel me to insist that the skiagram is mine and mine alone, so far as right of possession goes.

So when a client asks me, "When do I get the picture?" I say to him, "You do not get a picture; there is no picture." He is rather surprised at this, as a rule, so I go on and explain. "I am not a photographer, and I have not been making a 'picture' of you. You have been sent to me as an expert in examining by means of the X-ray, in order to get my opinion about certain things; in the course of forming this opinion, among other things that I do, I make a skiagram, but this is a very different thing from making a 'picture.' The skiagram shows certain things to me and I find out other things by other means of examination; the skiagram is not my opinion; I form my opinion partly from what information I get from a study of it and partly from other facts which I learn. I file these skiagrams away in a special room so that they will not be lost or defaced; then in future if any question comes up about your case we know where the skiagram is, and can refer to it."

I have so far found that this statement satisfies the patient that I am right and that his interest will be taken care of.

The skiagrapher is a medical expert and not a photographer; he has a much higher function than merely performing the mechanical act of producing a negative. And I am by no means belittling the skill required to make a perfect negative.

But far more than the ability to make a good negative is demanded of the Röntgenologist. In a former paper ("The Professional Position of the Röntgenologist") I have said: "For one thing, even though his work is not photography, he must be a pretty good photographer; for the reason that a good many of his mechanical procedures are based upon the chemical and manipulative methods first made use of in photography; he should understand the chemistry of his plates and developers, etc. He must be able to vary his formulae so as to produce various effects according to conditions present or results desired; he must be able to handle under-exposure and over-exposure, to prevent fog, to develop for contrast or for shadow detail; he must be able to intensify or reduce density; he must know how to vary his process according to the temperature in which he is working; he must know the short cuts for the removal of hypo, and for quick drying, and any number of technical points which must be known by the expert photographer.

"He must be a rather competent electrical engineer; he must understand the method of production of the electrical currents used in his machines, the characteristics of these various currents; he must be able to make many of the computations made by electrical engineers in the designing of apparatus; he must know about condensers and condenser action, shunt and series resistances, inductance, hysteresis, insulation, inverse discharges, rectification of alternating currents, or suppression of a phase, electrolytic and mechanical interrupters, electrolytic valves; must be able to distinguish the outside and neutral leads of a three-wire alternating supply; how to fuse a line properly; how to find broken or short circuits; how to test for polarity. These are just a few of the things he must know along electrical lines; there is not time to enumerate a quarter of the remainder. . . .

"The Röntgenologist must be a physician and surgeon. He must be able to make a proper estimate, many times, of the clinical symptoms of the cases referred to him in order that he may know what parts to examine and how to conduct the examination. He must know the pathology of many diseases in order to properly interpret the findings of his Röntgenograms, or in order to know what quality of ray to use. . . . His gastro-intestinal examinations require a knowledge of the physiology of digestion. He must be a good anatomist from the ordinary standpoint, and he must be thoroughly conversant with the appearance of normal parts as viewed by the Röntgen findings, and he must recognize pathological appearances in the various structures, and be able to differentiate between them. There is a vast difference in the treatment of syphilitic osteoperiostitis and that of osteosarcoma. The Röntgenologist must be familiar to a high degree with the growth and development of bones at different ages. . . . There is a host of facts with regard to appearances seen in Röntgenograms and their meanings which can only be acquired through wide experience, the study of many hundreds of skiagrams, and of the clinical symptoms which led to the examination, and a careful consideration of operative and post-mortem findings in cases which have been examined. How does a Röntgenologist know the difference between a sesamoid in the head of the gastrocnemius and a foreign body in the knee-joint? Or how does he know that a certain shadow found in the examination for a ureteral calculus is not a calculus but a calcified gland or a phlebolith?

"The Roentgenologist must be posted in therapeutics and surgical treatment, for he is often asked for his opinion or advice as to treatment of disease or the handling of fractures, etc."

We must see to it that the qualifications needed in a competent Roentgenologist are understood and recognized, not as a matter of petty personal pride of professional position, but because grave mistakes will often be made by the unqualified, those who are merely photographers, and whose negative or skiagram only is the sole result of their services.

The surgeon does not give to the patient or the patient's physician the tape by whose use he arrives at the opinion as to whether or not there is shortening in a limb. The physician does not give up the stethoscope which he uses in forming an opinion as to the condition of the lungs. And there is no more reason why the Roentgenologist should give up his negative to the patient or the patient's physician than there is for giving them the Crookes tube he has used or a leaf from the book in which he keeps his written record of the examination, for this skiagram is an integral and important part of his record, and is no more useful or readable to the patient or consultor than those written notes of technique would be. That record in its completeness should at all times be in the keeping of the Roentgenologist, for he is liable to be asked at any time some question about a patient that he has examined in the past, and if his skiagram is gone how can he refresh his memory fully? Where a number of skiagrams are taken at various times during the progress of a case the Roentgenologist must have all of them at hand for purposes of comparison in order that he may give an opinion as to the character of the changes that are taking place. Long after the details of a condition may have passed out of his mind, he may be called to testify in court. How necessary then to have the skiagrams at hand for reference.

Of great value to any Roentgenologist is the possession of a large collection of skiagrams which may be used for scientific study; there are a great many things yet to be read from skiagrams; if the question of the property right in skiagrams should ever come into court, the law should give great weight to this proposition alone.

It was a great satisfaction to me some time ago to be able to go through my collection in aiding Dr. Pancoast in his research regarding the sesamoid of the gastrocnemius. No prints or lantern slides can take the place of the original skiagram for study.

Photographic questions have appeared in the courts a number of times, but the question of the ownership of the negatives has been a very unimportant feature of the cases; all have hinged upon a violation of contract, usually of an implied nature, or upon a libelous use; the question of a right of privacy against the publication of photographs has also appeared; but in none of these cases, even where an improper or libelous use of an individual's photograph was alleged, was there a single effort made to obtain possession of the negative.

In a general way it would seem to be granted that the negative is the property of the maker of it, but the maker of it would not be permitted to make such use of it as to reveal the frailties of the other party to the transaction. I take it that the courts would consider that the skiagram is the property of the radiologist, but that he must not use it in such a way as to violate the confidential relation that is established by the making of the examination.

The individual who goes to a photographer does not go for the final purpose of having a negative made; his object is to have photographs or prints made. The negative made by the photographer is simply a means to the desired end of the transaction.

The individual who goes to the radiographer goes for a professional service, to obtain the scientific opinion of the radiographer regarding certain conditions. The skiagram is one of the means used in arriving at the desired end, the expert opinion. And the skiagram is a far less complete part of the radiographer's process than the negative is in the photographer's process. Given a photographic negative, any expert photographer could make perfect photographs from it. But the expert radiographer could not take every radiogram and give a correct and complete opinion from it as to the patient's condition every time, because every radiogram does not have the complete information upon which to base a correct opinion.

I have been required a number of times in medico-legal cases to show skiagrams to juries. I have always said to the judge before beginning my statement to the jury, that these skiagrams are a part of my records of the case, and that I did not wish the skiagrams to be filed as exhibits in the evidence, but wished only to use them for purposes of demonstration. This proposition has always been accepted by the judge and no protest has been made by the attorneys for either side.

To sum up then: The transaction between the Roentgenologist and the patient has for its actual object the furnishing of a scientific opinion by the Roentgenologist.

The skiagram contains only a part of the information upon which the opinion is based.

The skiagram is a part of the Roentgenologist's record of his study of the patient's case.

The interest of the patient in so far as it appertains to the skiagraphic record will be better conserved with the skiagram in the hands of the scientist who understands it and appreciates it and who has a proper means of preserving it, than in the hands of the patient to whom it is a mere temporary curiosity.

The value of the skiagram to the patient, as a mere object of curiosity, is greatly overbalanced by its value in the hands of the Roentgenologist as a scientific record to be preserved and studied and to be used for the further advancement of the science of healing.

# PHYSICS AND OPTICS OF STEREOSCOPIC ROENTGENOGRAPHY.

BY H. CLYDE SNOOK, B. Sc.

The object of this paper is to make a brief survey of the physical and optical principles involved in the making and viewing of stereoscopic radiographs. It is therefore not within the scope of this paper to discuss the mental process whereby the brain of the observer welds into one the two images received by his eyes.

The exact conditions to be fulfilled whereby this mental fusion may be made correctly and with ease to the observer have been, in my opinion, a matter of too little regard by Roentgen experts both in America and in Europe.

I believe that the tables of Marie and Ribaut, which have been quoted and published in the best works on Roentgenology, have been largely responsible for much incorrect and mediocre stereoscopic work.

These tables give a list of varying distances for the movement of the X-ray tube between the two exposures. I think these tables to be incorrect and have made a series of experiments to test their validity. My experiments show that the use of these tables leads the observer to make false estimates of the depth of objects and produces wrong images of the objects with loss of definition in the resultant fused images.

By the use of these tables one will, in the majority of cases, receive an impression of depth less than the real depth of the object examined. In a few cases the apparent depth will be greater than the real one, and in still fewer cases will the real depth be the same as the stereoscopic impression.

The tables of Marie and Ribaut state that in the case of an object 2⅜ inches thick when the tube is 12 inches away from the upper surface of the object, the tube should be moved 1¾ inches between exposures. I made such a pair of plates, using as an object a wooden block—an exact cube—

coated with litharge so as to get images of all six sides of the block. When viewed in a Wheatstone stereoscope with the optical path from the plates to the eyes the same as the beams of X-rays at the time of the exposures, these plates gave a resultant stereoscopic impression of a rectangular block of wood, less thick than it seemed long or wide. That is, the apparent depth was less than the real depth.

I then made a pair of plates, keeping all conditions the same as just stated with the exception that the tube movement between exposures was 2½ inches. On viewing this pair of plates the block of wood seemed to be just as thick or deep as it was long or wide. That is, it seemed to be a cube without any distortion whatever.

The Marie and Ribaut tables state that with the tube 12 inches from the upper surface of an object 4 inches thick, the tube ought to be moved 15 or 16 inches.

A pair of plates made in this manner with a 4-inch cube of wood, and then viewed in the stereoscope gave a stereoscopic image flatter than a real cube; but a pair made with a 2½-inch tube displacement between exposures gave the stereoscopic effect of a real cube.

An object 6 inches thick, according to Marie and Ribaut, with the tube 15¾ inches from the upper surface of the object, requires a cube displacement of 1⅛ inches. My pair of plates made in this way, of a 6-inch cube of wood, shows a flattened stereoscopic image; whereas the pair made of the same cube with a 2½-inch tube displacement gives a true impression of a perfect cube.

I have made a pair of plates of the 2⅜-inch cube with a 4-inch tube displacement at 12 inches from the upper surface of the cube. This gives a stereoscopic effect of greater depth than a real cube. This pair makes the block quite tall as compared with its length or width and is a striking contrast to the first pair of plates I have described which were made of it according to Marie and Ribaut and which made the cube appear flattened.

The incorrect impression of depth—relative depth is here involved as well as total depth—is a very serious matter when we remember that even mechanics who are skilled in estimating distances by mere inspection are unable to maintain a constant degree of accuracy in their estimates of distance and depth.

A good figure for the average distance between the centers of the pupils of the eyes is 2½ inches. I think that the tube displacement in all cases should be 2½ inches—no matter what is the thickness of the object. I have several reasons for reaching this conclusion, one of which is the results obtained in the experiments just outlined. Another reason is that the best sets of stereoscopic radiographs of human subjects that I have seen have been made with a 2½-inch tube displacement.

Then, too, I think that it is correct on the basis of theory. The radiograph is a projection of many objects on a plane, the projection being made from a common point for all the images.

A pair of stereoscopic radiographs is two such conglomerate sets of projections obtained from two separate points of projection.

If the angles with which the different images were made are different from the angles with which the observer's eyes receive the images it seems evident to me that incorrect stereoscopic fusion of the images must result; for the stereoscopic vision of an object in space depends on the reception of two sets of images obtained by projection from the centers of the lenses of the eyes and upon which the different angles of the different objects depend.

I believe, therefore, that in viewing stereoscopic plates, the eyes should replace the focus spots of the tubes. This is possible only when the tube has been moved the distance between the eyes, which as previously noted is 2½ inches for average eyes. In order to fulfill this requirement, it is also necessary that the optical path from the eyes to the plates be the same, as from the tube positions to the plates.

An interesting change in the apparent depth of an object can be produced by changing the optical distance between the eyes and the plates. In the case of correctly made plates a reduction from the true depth is produced by making the eye-plate optical distance less than the tube-plate distance and conversely the apparent depth is made greater than the true depth by an eye-plate optical distance greater than the tube-plate distance.

In the case of pairs of plates made with a tube displacement different from the 2½ inches, the incorrect impression of depth can be overcome by giving the eye-plate optical distance a value different from the tube-plate distance.

In the case of the apparent flattened and elongated cubes taken according to Marie and Ribaut, one can make the apparent depth correct for a small portion of the plate and in the case of small objects the effect is good; but the outer portions of large plates do not give good "focus," i. e., the images are distorted and do not superimpose except in one part of the plate at a time.

It should be remembered that for the sake of uniformity and convenience the line in which the tube is moved should be parallel to the plane of the plate and should be bisected by a vertical plane passing through one median line of the plate, while the projection of the line on the plate should lie in the other median line of the plate.

It should be recognized also that the object should not move between the exposures, otherwise the second plate will contain images of the parts giving incorrect visual angles and resultant false stereoscopic distances.

Now, assuming that the tube was correctly placed at the times of the two exposures, and assuming that there has been no loss of detail during or between the exposures, we are confronted by the problem of giving correct optical replacement to the focus spots of the tubes by the eyes.

We have available several types of apparatus, each of which has its own practical objections. Walter's stereoscope utilizes the plates mounted in a common plane adjacent to each other and enables the observer to view them through a pair of prisms or lens-prisms. The chromatic aberration with this type of stereoscope is exceedingly objectionable, because it gives highly colored fringes to all the bright portions of the plates.

There are several types of hand-prism stereoscopes, but they all have in common the serious objection that the eye-plate optical distance is not definitely predetermined and held fixed while the observer is viewing the plates. And also since they depend upon the observer's hands for support the field of vision is unsteady, making the observation difficult for most individuals.

The Whetstone stereoscope has the objection of producing a reversal in all the horizontal planes, making it difficult not to confuse a stereoscopic view of the right hand with one of the left hand, of the right foot with one of the left foot, etc. Then, too, the Whetstone and the Wenckebach stereoscopes suffer from the presence of the double images produced by the mirrors.

In all of these stereoscopes the best results are obtained when the eyes of the observer most nearly bear the same optical relation to the plates as did the focus spots of the tubes when the plates were made. Under such conditions the eye strain is the least and all parts of the object are in so-called "focus." Under other conditions, only a small portion of the object can be seen without change of the adjustments of the stereoscope or change in the "accommodation" of the observer's eyes.

It is remarkable to me to find the very great power of "accommodation" which some persons possess. Almost everyone can be taught to see stereoscopic radiographs, although it sometimes takes considerable patience and careful study of the new observer's eyes. One eye is often weaker than the other. The plate seen by the weaker eye should be illuminated a little more strongly than the other one. If the observer wears glasses for reading they should be worn in observing stereoscopic plates, because the virtual images of the object are at reading distances from the eyes. In this connection, I wish to observe that the greatest stereoscopic effect is obtained with ease to the observer when the distance from the focus of the tube to the near or upper surface of the object is the shortest easy reading distance. The oculist's standard reading distance is 14 inches. I believe that on account of the necessity for securing the maximum stereoscopic effect the distance from the tube focus to the upper surface of the object should be a constant distance—say not over 14 inches and not less than 12 inches—thereby making the tube-plate distance equal to this constant distance plus the thickness of the object.

For accuracy and convenience in the reading of plates they should bear records of their tube-plate distances. It is convenient also to use the "foot points" of Eykmann in checking up the tube positions so that the observer's eyes may be correctly positioned when viewing the plates.

I wish to urge a word of caution in the matter of the use of bismuth, lead oxide or other substances which are spread on the surface of the skin to outline it in space. It is my experience that these substances ought to be used in such a way as to show detail and landmarks instead of a uniform opaque layer because too much of it in uniform layers blots out important shadow detail of underlying tissue, and, on the contrary, too little is of no value.

The use of layers of opaque paste or powders to outline the skin surface over deep parts is not nearly so successful as on limbs and extremities. A paste of bismuth salt and vaseline spread on ordinary gauze wound around an arm or leg gives excellent detail of the meshes of the gauze for outlining the surface of the skin; while the detail of the skin itself, in the case of hands and feet, is sufficient when the paste is smeared on and rubbed into the folds and creases of the skin.

In closing, I wish to emphasize the fact that I am well aware that stereoscopic plates can be and are mostly made without regard to any fixed rules. I know that such plates give stereoscopic effects and look beautiful; but I wish to say that I think such haphazard methods are not right and will not promote excellence or accuracy in stereoscopic work.

# CASE OF PROSTATIC HYPERTROPHY; SYMPTOMATIC CURE BY X-RAY AND HIGH FREQUENCY CURRENTS.

BY SINCLAIR TOUSEY, A. M., M. D., NEW YORK.

The patient, I. A., was about sixty years old when the urinary trouble began, and was examined by Dr. Keyes, whose diagnosis of hypertrophy of the middle lobe of the prostate has since been confirmed by other urologists. The symptoms have been more those of irritation than obstruction. There has been some retention, but he has never used a catheter more than three times. This was attended by so much distress that it was abandoned, fortunately without infecting the bladder. He went along for a number of years without much trouble, but when he was referred to me, ten or twelve years after the onset of the trouble, he was obliged to get up from ten to fourteen times during the night. There was no pain, but he complained of a numb feeling at the neck of the bladder.

The treatment consisted in applications of the X-ray through the perineum, and of high frequency currents by a vacuum electrode applied to the perineum and hypogastrium successively. The X-ray tube was a Machlett Ideal tube actuated by a 12-inch Wappler induction coil with a mechanical ("wheel") interrupter with a rheostat transmitting about 4 amperes. The current through the X-ray tube was 1 to 2 m.a. The penetration of the X-ray was of about 6 Benoist and the intensity such that exposure of 24 minutes at a distance of 13 inches equaled a Sabouraud and Noire dose or about 5½ Holzknecht units. The effect was modified, however, by the interposition of a screen of heavy sole-leather which arrested most of the rays which would have been absorbed by the skin and transmitted most of those which could penetrate the flesh deeply enough to affect the prostate. A greater effect was made possible with reduced danger of dermatitis. The X-ray tube was in a Ripperger

Shield, a protective opaque box with a cylindrical orifice 4 inches in diameter which pressed against the perineum. The anticathode was 13 inches from the skin. The X-ray exposures on March 25, 28 and April 3 and 7, 1910, were of seven minutes each. After the last date the exposures were of two minutes three times a week and the last treatment was on June 1st. The high frequency vacuum electrode was a dome-shaped one for external application and had a leading-in wire. The current was a unipolar one derived from a small Guilleminot spiral, the equivalent of a Cudin resonator, and was of 200 or more milliamperes with very little spark-effect. This made the glass quite hot if applied for any length of time. The electrode was moved slowly over the perineum for two minutes and then over the lower part of the abdomen for five minutes. A somewhat longer application to the perineum at the first treatment produced symptoms of over-stimulation. The high frequency applications were made at the same sessions with those of the X-ray.

Except for a week or two while the patient had grippe or a severe cold, favorable progress was rapid and uniform and at the time of the last treatment he was getting up to urinate only two or three times a night and could make the seventy-mile railroad trip from his home to my office without discomfort and without having to urinate. At no time was there any dermatitis or any change perceptible in the normal dusky red skin of the perineum. The scrotum, of course, was always shielded.

It transpired that the patient had long experienced pain in the testes and urethra, but a radiograph showed the absence of prostatic or other urinary calculi.

# PRIMARY LYMPHANGEIO-SARCOMA OF THE LUNGS.

## REPORT OF A CASE.

BY A. L. GRAY, M. D., RICHMOND, VA.

While primary malignant disease of the lungs is unquestionably a condition of very great rarity, it is highly probable that were all of the facts known, miliary tuberculosis would have to surrender to this malady some of its mortality percentage.

The meager literature on this subject renders it difficult to obtain satisfactory statistics. Primary carcinoma is relatively more frequent than is primary sarcoma. West, quoted by Osler in his **Modern Medicine,** has collected five cases of primary sarcoma of the lungs, of which four were men, the sex of the fifth not being stated.

The case that I report was referred to me for Röntgen examination on June 8th of this year by Dr. Manfred Call. Two exposures were made, front and back respectively, with the patient in the sitting posture. The appearances seen were so typical of extensive miliary tuberculosis of both lungs, that despite the lack of harmony of the pathological and clinical findings with this condition, I made this my unqualified diagnosis.

The history of the case, obtained from Dr. Call's records, is as follows:

C. T.—White, male, age 27, single, salesman for an electric company, native of Virginia, residing in Chicago for the past six or seven years. For the past three months has had a persistent and annoying hacking cough; has had similar attacks each winter and summer for six years. The previous attacks have followed a severe head cold, which "settled on the chest." The present attack was not preceded by the customary head cold, but has persisted as a hacking cough for two months.

One month after onset of the present attack, he began to experience loss of appetite, "liver became sluggish" and his energy disappeared. Felt so bad he remained indoors for a week, then returned to light work for about three weeks.

Personal History: Negative, save for slight attacks during childhood. Confinement with present illness first in ten years. Patient denies venereal disease.

Family History: Father died at the age of sixty years of cardio-vascular renal disease; mother living and well; two sisters both living and well; no brothers.

Present Condition: Is well formed, but shows evidence of loss of weight. Has weighed 140, three years ago. Color, fairly good; some pallor of mucous membranes. Appetite gone, bowels regular, stools normal, micturition normal.

Hacking cough persistent, especially at night, disturbing his rest, but sleeps well when cough permits. Cough recurs in paroxysms and is attended with intense pain on both sides of front aspect of his chest.

Expectoration of moderately thin, white frothy mucus. Considerable "post nasal dripping," no haemoptysis. Dyspnoea, oedema and vertigo absent. Visual and oral apparatus normal. Skin lesions absent.

Physical examination shows the patient to be well-proportioned and of symmetrical muscular development, but somewhat anaemic, with evidence of wasting. Two glands, the size of almonds, found in the right supra-clavicular region. Glands freely movable under the skin, markedly hardened.

Heart appears normal.

Lungs, expansion equal on both sides. Littens phenomenon, present and equal. Slight impairment of resonance in left supra-clavicular region. Numerous dry rales in left interscapular and suprascapular regions.

Abdomen, negative. No masses, tenderness or rigidity.

Temperature, 98° F. Pulse, 80, regular and of good volume.

Small nodule just above left testicle. Right tonsil in condition of chronic hypertrophy.

Urine, slightly turbid; sp. gr., 1028; reaction, acid. Trace of albumen; no sugar.

A few renal epithelial cells and leucocytes; no blood; no casts. Leucocyte count shows polynuclear cells, 80%. Large lymphocytes, 18%; small lymphocytes, 2%.

Patient was sent to the country. Upon his return, after a few weeks, emaciation had continued, and he had greatly lost ground. He was admitted to the Memorial Hospital on June 1st. Physical examination at this time elicited marked impairment of resonance in left apex, reaching to third rib, a few scattered rales in the same locality. Pleural friction sounds were audible in lower axillae on both sides.

Three specimens of sputum failed to show the tubercle bacillus. Two leucocyte counts were made, the first showing 19,200 per cu. mm., polynuclears 89%, lymphocytes 11%. The second, made four days later, showed 22,000 per cu. mm., polynuclears. 86%, lymphocytes 14%. Widal, negative.

Specimens of urine examined at various times after his admission to the hospital showed albumen, renal epithelium, granular casts, pus and blood cells.

On June 15th, one of the glands in the supra-clavicular space was removed and submitted for pathological examination to Dr. E. G. Hopkins, who rendered the following report:

"Specimen consists of a neoplastic growth of interlacing columns of cells, supported by distinct connective tissue stroma. The cells of the neoplasm are polymorphous, chiefly polygonal and spindle. The nuclei of the cells are large and oval. Karyokinesis is not infrequently found. The protoplasm of the cells is relatively small in amount and non-granular. Diagnosis: Lymphangeio-sarcoma."

Patient died on June 19th. Unfortunately an autopsy was not obtained, but the evidence afforded is conclusive.

312 E. Franklin St.

# OBSERVATIONS OF CASES OF CONSTIPATION AND OBSTIPATION BY MEANS OF THE ROENTGEN RAYS.

BY ARTHUR HOLDING, M. D. ALBANY, N. Y.

We have arrived at that stage of the world's career in which the inhabitants of each municipality are planning for themselves a "city beautiful," and certain idealists with imagination (in olden times they might have been called "prophets") are talking about a "country beautiful," and, last of all, a "race beautiful." This is simply a logical progression, an application of the same principles to successively higher objects.

The first step in beautifying a city must be adequate sewage disposal and when we come to beautifying the human race we must start at the same problem. While the "Old Guard" and the "Black Horse Cavalry" of fashion is furbishing the outside by running the gamut between hobble and hoop skirts; between impossible hats and none at all; between "rats" and bald heads; between sheath skirts and numerous accessories to give the bumpy contour of an exaggerated Junoesque figure; between bloom natural and the drug store variety, etc., etc., the "progressives" of hygiene must devote their attention to the inside problems which are the real causes underlying those distressing symptoms of lack of figure, flat chests, round shoulders, curvatures of the spine, pale, pimply, pasty and yellow faces, bald heads, obesity, morbid psychology, bad teeth, catarrh, poor eye-sight, pronated feet and other outward signs of inward neglect which drive us to the beauty shop, the tailors, the drug store or the specialist instead of to out-door exercise, co-operation with our physiology and "to-bed-o'-nights."

To take up the matter of sewage disposal in man, there is no better way to find out the lines of his "plumbing" than by making an examination with the X-rays. It is the most accurate way of observing the patency, the motor function and localization of intestinal obstruction. I will not burden you with the description of technique of bismuth examinations, for it has been fully described by others. Suffice it to say that in my observations I have used bismuth oxychloride suspended in zoolak or mucilaginous mixtures by mouth and per rectum, respectively.

Previous to the examination, the patient should have thorough catharsis on three successive days. After the bismuth is administered, the patient should be examined in both the erect and the prone position, employing fluoroscopy for general orientation and observation of peristaltic activities. This can be done in perfect safety. Such permanent records as are desired are then made by skiagraphy, usually with the patient in the erect position and with a screen so arranged that the intestines may be observed fluoroscopically while the exposure is being made. Valuable information can be obtained by palpation of the patient's abdomen while observing the bismuth shadows. (Needless to say, I let the other fellow do the palpating). By this method of observation, we encounter another shock of disillusionment in regard to text-book statements. You have listened to the descriptions by learned members of this society, of the various collections they have found in their patients' abdomens in lieu of the classic stomach described by Gray and other anatomists. For instance, the "cow's horn," the "fish-hook," the "drain-trap" stomachs. The variations found in the intestines, including peristalsis, are quite as irregular but as yet they have not been described as poetically. I have purposely omitted to mention the Röntgen examination of the stomach (which is the first stage of a Röntgen examination in cases of constipation) as it has already been adequately described.

Fig. 1—The text-book outlines of the colon and viscera.

Fig. 2—The normal outline of the colon as it is found in life, patient standing erect.

Fig. 3—Shape of colon in atonic constipation—M-shaped colon.

Fig. 4—Shape of colon in atonic constipation—V-shaped colon.

Fig. 5—Extreme case of M-shaped colon with dilated stomach.

Fig. 6—Diagram showing sharp angulation at the recto-sigmoid juncture, caused by dropping of the sigmoid flexure over and into the right side of the pelvis. (Gant.)

Fig. 7—M-shaped colon after Lane.

Fig. 8—Loci of retention of bowel contents.

Fig. 9—Spastic constipation.

Fig. 10—"Lake Constipation."

Fig. 11—Same case three days later showing that the middle of the faecal stream had passed on, leaving residue along sides of the intestine, so-called "back-waters" of the intestine.

Fig. 12—A Rose abdominal support that exaggerated instead of corrected ptosis.

Certain general facts learned from observation of cases of constipation are worthy of mention:

I. In nervous patients we frequently encounter hyperperistalsis.

II. As a rule there is little delay in the transmission of the intestinal contents from the pylorus to the caecum.

III. The colon is largest at the caecum and grows progressively smaller as it approaches the rectum.

IV. The commonest sites of delay in the progress of intestinal contents through the colon are: 1, at the caecum; 2, at the sigmoid flexure; 3, in the transverse and descending colon; 4, in the ampulla of the rectum.

V. The commonest sites of obstruction in the colon by tumor are: 1, at the splenic flexure; 2, in the sigmoid; 3, at the hepatic flexure.

VI. Constipation has become so prevalent that the caecum seems to act as a retention reservoir into which the intestinal contents are discharged fairly promptly in most cases but from this point on, excretion seems to have become more a matter of mechanical extrusion than a matter of peristalsis. I have frequently been moved to call this apparent stasis and evident distension and accumulation of faecal matter at the caecum as "Lake Constipation." This stasis must have a very important bearing on the frequency of appendicitis.

VII. The marked difference in the position of the colon in the prone and erect positions makes one seriously question the Divine Architect's wisdom when he allowed evolution to raise man from all fours to stand upright upon his hind legs.

VIII. The fallacy of the so-called high enema; on introduction of fluid beyond the sphincter, the fluid will go rapidly to the caecum unless obstructed by bowel contents or a narrowing of the lumen of the intestine.

IX. The faecal current is like any other current, the center moves faster than the sides and collections of bismuth will frequently be observed for many days after the bulk of the bismuth has been evacuated.

X. The accurate localization of delayed transit in the faecal current, or kinks or flexures, in the intestines, or obstruction has an important bearing on the treatment of the individual case; prompt passage to the sigmoid flexure with constipation indicates enemata, proctoscopy, investigation of Houston's valves, O'Bierne's sphincter. Prompt passage to the caecum with constipation indicates the addition of massage to other treatments. Obstipation, sharp angulation of the colon, stenosism, congenital hypoplasia, with or without tumor formation, with delay in the faecal advance at a constant point may indicate surgical intervention such as intestinal anastomosis.

XI. Colectomy in cases of ptosis seems unnecessarily radical; the writer has found the various hydriatic, mechanical, pharmaceutical electrical and less radical surgical methods have been adequate in all cases so far observed without resorting to colectomy.

XII. Observations on the human appendix corroborate Cannon's observations on the appendix in animals, i. e., that anti-peristaltic waves pass the contents of the caecum into the lumen of the appendix.

# EDITORIAL.

The excessive hot weather repressed all editorial writing except the enthusiastic announcement concerning the coming annual meeting. All indications point to a largely attended convention which it is hoped will surpass all others in attendance and work. The program now being prepared by the President and Secretary promises to be most interesting and profitable. The announcements in the public press of Richmond concerning "coming convention of Roentgenologists" show that the local committee is alive and working hard to prepare for the entertainment of the visitors. The financial success which attended the manufacturers' efforts at the last meeting is good ground for believing that they will be well represented.

# ABSTRACTS FROM ENGLISH LITERATURE

## ROENTGEN RAY DIAGNOSIS OF CARCINOMA OF THE STOMACH AND BOWEL.

Pfahler (Medical Record, Mar. 25, 1911, p. 528) believes that we have in this method the most positive means yet devised for the recognition of carcinoma in any stage of the disease.

Standing next to exploratory operation, it is, in the hands of an expert, accurate, painless, and harmless.

Pfahler is "impressed with the great value of the fluoroscope in gastrointestinal disease. We are able to see the food enter the stomach, the course of which enables us to judge the outline, position and tone of the stomach, the effects of the peristaltic waves, respiration, abdominal contractions and massage, all of which must be practically ignored if the plate alone must be depended upon. Both are indispensable for accurate diagnosis." Following detailed description of the Roentgen appearance of varying phases of the disease, Pfahler concludes: a positive diagnosis can be made in nearly every case in which an indurating carcinoma is present.

In some cases in which good peristaltic waves are present a negative diagnosis can be made.

A positive diagnosis depends upon some interference with the peristaltic waves, encroachment upon the lumen of the stomach, interference with its motility, or some interference with the functions of the pylorus. These may occur singly or combined. Nothing short of an exploratory operation can give nearly as much positive and definite information, though other physical and chemical examinations must not be neglected.

Each interpretation should be made in the light of the history and other clinical data.

These examinations must be made most carefully and by a trained observer to be reliable.

In the hands of the expert, there is no danger to the patient and to the operator only so far as he must expose himself during the examination. Therefore, the trained eye in making quick judgment and skill in manipulating the instruments will go far in reducing the exposure. D. R. B.

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## COLON OBSERVATIONS.

Coon (N. Y. State Journal of Med. Mar. '11, p. 116) adds to a review of the literature his own observations concluding, "The passage of food through the digestive tract requires about 24 hours, from 16 to 18 of which it is in the colon. The material enters the colon as liquid and leaves it as solid. If the time is unduly prolonged, putrefactive fermentation occurs and its products are absorbed.

"Some degree of ptosis of the transverse colon does not appear to be imcompatible with apparent perfect health.

"The stomach may be normal in shape, size, and position and the colon be way below its normal position.

"Most chronics and particularly chronic rheumatism and neurasthenia should have the colon located." D. R. B.

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## STONE IN THE URETER.

Bryan (Surgery, Gynecology, and Obstetrics, Feb., '11, p. 135) considers this subject from all sides, concluding with a bibliography which may well serve as a model of completeness, arrangement, and utility. Five radiographic plates by Gray illustrate the article. Bryan believes that in the X-ray we possess the most reliable means for diagnosis of ureteral calculi.

Aside from recording the number, size, and location of the stones in the affected side, the unsuspected kidney and ureter are shown up, for stones are frequently bilateral.

The reliability of the X-ray in the hands of a skilled operator can not be gainsaid. A method which offers such positive claims and results, so economical, mechanical and determining in its character as the X-ray, can not be given a minor place in cases of even suspected stone.

In negative findings exploratory operation is not precluded. In positive findings it determines us how and where to operate. D. R. B.

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## ROENTGENOGRAPHY.

Fenwick (Brit. Med. Journal, Apr. 1, '11, p. 748) begins with the assertion that no truly over-mobile kidney exists without a thickened capsule, and that all kidneys with a thickened capsule appear in the radiograph as "dense" kidneys.

Without disturbing the relations between patient, tube, and plate Fenwick makes three negatives. Oxygen is used to aid the respiratory acts. The first, taken with forced expiration, is labeled "expired supine;" the second, with forced inspiration, "inspired supine," and the third, with table tilted 45 degrees or more and with forced inspiration, is labeled "inspired erect."

The first plate is now illuminated and, with a black pencil, an accurate tracing is made of each bony outline and of the kidney, the stone if there be one. This tracing is now superimposed upon plate two. If the outlines can not be made to superimpose accurately the examination is a failure. This tracing is made with red and in the same manner the kidney shadow on the third plate is made with blue.

"By this method I can usually avoid the mistake of false shadows. True shadows in the kidney move with the kidney." No movement at all indicates a fixed kidney and the knowledge of it is of real value in surgery.

A fixed "dense" kidney with profuse hematuria indicates carcinoma that has passed through the capsule and so fastened the kidney that operation is useless.

No mention is made of the previous work of Lange.

D. R. B.

## THE X-RAYS IN TREATMENT.

Riddell (Brit. Med. Journal, Apr. 29, '11, p. 985) gives his technique in terms of the Holzknecht radiometer for the treatment of rodent ulcer, keloid, psoriasis, lupus, tubercular glands, exophthalmic goitre, alopecia areata, leukemia, hyperhydrosis, pigmented moles, nevi, deep-seated malignancy, ring-worm and favus. Riddell also makes use of a method of measurement by the milliammeter and a mechanical counter to register the number of impulses from the (mechanical) interrupter. This method he checks from time to time with the H. radiometer. D. R. B.

# ABSTRACTS FROM FORTSCHRITTE AUF DEM GEBIETE DER ROENTGENSTRAHLEN

## Anatomic Contribution to the Interpretation of Lung Structure on the Radiograph.

By Hasselwander and Bruegel.

An anatomic study of the exact position, and method of division of the bronchial tree was undertaken in the hope of identifying the various shadows seen on the radiograph, and establishing their anatomic bases. The authors deplore the fact that there is no accepted anatomic work upon the bronchial tree especially with reference to the smaller peripheral divisions and with reference to the relations of the bronchial tree to the pulmonary veins and arteries. To avoid the confusion of shadows seen upon skiagrams of lungs injected solidly with opaque materials, the authors insufflated zirconium oxid into the air passages. The fine powder coats the walls of the bronchi and gives a delicate and very complete outline of the entire tree without obliterating any branches by superimposition of shadows. The pulmonary arteries were then injected solidly and their relation to the bronchi studied. In similar manner the pulmonary veins were injected. In their efforts to establish an anatomic system of the bronchial tree which would apply to the skiagraph, lungs were inflated and immediately frozen, hardened in formalin and then sectioned serially. Although it was found that a complete tracing out of the bronchial tree in the human was extremely difficult owing to its complexity, in the swine's lung the matter was much simpler. They conclude that the distribution of the bronchial tree in the chest follows a definite system, and that localization of single branches on the radiograph is possible. The arteries and veins follow the bronchial divisions closely and have definite relations to them. The arteries lie above (cephalad) the bronchi while veins lie on the opposite side to the arteries (caudad).

The lymphatic system likewise accompanies the bronchial tree but owing to its small calibre is invisible upon a skiagraph of an absolutely chest. In the average chest however evidence of the lymphatic system is seen in the small nodes and slight thickenings along the bronchial tree.

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### Dislocation of the Tarso-Metatarsal Joint.

By A. Ziegler.

Three cases of dislocation of the so-called Lisfranc joint are described. The condition is an unusual one and consists in an outward (lateral) displacement of the foot on the tarsus with or without fracture of the base of the second metatarsal or a fracture of the third cuneiform.

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### Recent Luetic Aortitis Shown on the Radiograph.

By Dr. Lick.

A young man who had been infected with syphilis seven months past was examined radiographically because of pain in chest, feeling of oppression, palpitation, anaemia and loss of weight. The plate failed to show tuberculosis of the lungs, but instead a peculiar enlargement of the aortic arch. It extended 2 cm. to the left and 2½ cm. to the right of the shadow of the spine. The shadow cast by the enlarged aorta was a rather faint or transparent one, differing markedly from the density of true aneurysmal enlargements or old arterio-sclerotic dilatations. This fact strengthened the theory that the enlargement was due to a recent luetic process in the aorta following the infection seven months back. The author calls attention to the importance of X-ray examination of syphilitics with chest symptoms. The prognosis is unknown.

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### Action of Roentgen Rays upon Cell Chemistry.

By Meyer and Bering.

Experiments were undertaken to determine the action of the X-rays upon

1. The normal cell ferments.
2. The chemical composition of the exposed tissues

The following conclusions are recorded:

A. The X-ray, in moderate dosage, has a slightly inhibitive action upon peroxydase (a ferment contained in horseradish). In massive doses, its activity is decreased 5 to 10 per cent.

B. Even in massive doses, the X-ray has only a slightly inhibitive influence upon the peptolytic ferment of yeast.

C. Intense irradiation has only a slightly retarding action upon pancreatin.

D. The X-ray has only a very little influence upon autolysis.

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## The Accessory Nasal Cavities and Their Diseases as Seen on the Radiograph.

By Brunslow.

This paper is based upon four years' experience at a military post. The great value and accuracy of the Roentgen method of examining the accessory sinuses in soldiers is emphasized.

In addition to outlining and detecting disease of the antrum, ethmoid and frontal sinuses, the author claims to be able to obtain the same information regarding the sphenoid sinuses. To delineate the sphenoids, he uses an angle differing from the accepted Caldwell angle where the central axis of the X-ray makes an angle of 25 to 30 degrees with the base line of the skull. To show the sphenoid sinuses the axis of the X-ray practically coincides with the base line of the skull. The shadow of the sphenoid is thus thrown higher than when using the Caldwell angle. It falls upon the shadow of the ethmoid cells but according to the author, the shadow of the sphenoid can be seen through that of the ethmoids if the radiograph is of proper quality. From such a postero-anterior view in conjunction with a lateral view, disease of the sphenoid sinuses can be detected and differentiated from lesions in the ethmoids. While regarding the postero-anterior view as the most important, the author nevertheless considers the lateral view of great aid in showing diseases of sphenoids, ethmoids, and frontals (especially where both sides appear cloudy on the front view) and is also of importance in antral disease, since it may reveal an offending tooth.

The changes in the sinuses which as seen on the radiograph he classifies as follows:

1. Indistinctness of bony outline.
2. Haziness of entire cavity.
3. Complete clouding of entire cavity.
4. Mottled appearance of cavity, which author believes to be due to fibrous thickening of the mucosa and osteophyte formation, such as would accompany old healed processes.

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## A New X-Ray Apparatus.

By Fritz Schlenk.

The principle employed is the single interruption of the primary current and a single flash in the tube. The innovation lies in the method of producing the abrupt break of the current. A copper rod surrounded by a close fitting non-conducting sleeve dips into a dish of mercury overlaid with alcohol, the level of which rises above the upper end of the insulating sleeve. The interruption is produced by withdrawing the copper rod through the sleeve. A column of mercury follows the rod, but becomes attenuated until the intensity of the current through the clinging thread of mercury causes a sudden explosion, breaking the current and forcing the mercury column down.

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## Influence of the X-Rays upon the Sexual Organs of Man and Animals.

By Alex Faber.

The article consists of a complete summary of the literature upon this subject. A complete bibliography and resumé of Roentgen therapy in gynecology is included as well as histological changes in the ovaries of irradiated patients who have later come to operation.

## Secondary Changes in Chronic Pulmonary Tuberculosis from the Roentgenologic Standpoint.

By H. Rieder.

The changes are considered under the following headings:

1. Dry Pleurisy.
2. Exudative Pleurisy.
3. Suction Exudates.
4. Interlobar Pleurisy.
5. Ensaculated Pleurisy.
6. Pleural Adhesions.
7. Pleural Thickenings.
8. Pneumothorax.
9. Displacements of Mediastinum.
10. Subphrenic Pyopneumothorax.

About 20 radiographs accompany the text illustrating each type.

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## Contribution to the Roentgen Therapy of Leukaemia.

By Guiseppe Lucibelli.

A well marked case of spleno-medullary leukaemia was treated by X-rays. White blood cells were reduced from 545,000 to 6,900, but the percentage of abnormal forms remained the same. Patient died at end of five months. A careful histologic report of all the organs is given which shows that incident to the vigorous X-ray treatment the organs lost almost all of their histologic characteristics of leukaemia. In spite of this remarkable change the patient lived but five months.

S. L.

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## FLUOROSCOPY OF THE GASTRO-INTESTINAL TRACT.

### REPORT FROM THE KANSAS CITY X-RAY LABORATORY.

BY E. H. SKINNER, M. D., DIRECTOR,
KANSAS CITY, MISSOURI.

Fluoroscopy was one of the earliest practical applications of the X-ray. However, the value of permanent radiographs in surgical diagnosis, together with a large number of burns of patients and operators in the early fluoroscopic examinations, have been responsible for sufficient adverse criticism to dampen fluoroscopic enthusiasm. The pioneer X-ray operators in Europe and America bear permanent scars that testify to the dangers of unprotected fluoroscopy, but the knowledge regarding the irritative possibilities that has been gained through calamities to pioneer roentgenologists will serve to dispel this fear and establish fluoroscopy in the widening horizon. When we look upon the martyrs of roentgenology, we become reassured, for it is only the pre-protection period roentgenologist or careless experimenter who has furnished us object lessons. We have yet to note injurious X-ray effects upon the roentgenologist who has worked with lead screen and protected tubes. We cannot, up to the present day, estimate the ultimate effect of the hard, penetrating portion of the radiations from an X-ray tube. We do know the results of continuous or interrupted exposure to the soft rays and are able to guard against them. In no new departure of medicine and surgery has there been so many to enter upon its pursuit with such meager knowledge of its possibilities and dangers. This not only resulted in harm to these neophytes, but has also acted as a hindrance to the propagation of exact roentgen knowledge. There has been, and probably still is, much X-ray work which is carried on with carelessness and ignorance. The scientific application of the X-ray suffers accordingly. The suggestion is then in order that such legislative action be taken as may preclude the use of the X-ray in other than skilled hands. This would mean elimination of the manufacturer, electrician, photographer and others without medical training from a field where only exact knowledge and careful application will eliminate ill-effects.

The gigantic possibilities of fluoroscopy behoove us to pursue its study only with such protected apparatus that no ill-effects may ever be reported. Constant use of and familiarity with fluoroscopic technique may lead one to a carelessness against which the roentgenologist must conscientiously labor. This admonition is likewise applicable to all manner of X-ray application.

A review of the fluoroscopic situation indicates that the American has attempted to promote radiographic technique that would obtain the diagnostic information upon a succession of negatives which the fluoroscope reveals at a glance. There is only one radiographic technique up to the present time that can approach ordinary fluoroscopy; we refer to the Bio-Roentgenography of Rosenthal, Rieder and Kaestle, that roentgen triumvirate of Munchen. The expense of this latter method places it without the realm of practical usefulness.

While the American has been venturing his rapid radiography, the European of France and Germany has been perfecting a fluoroscopic technique that avoids by ample protection the inherent dangers peculiar to the X-ray. The original fluoroscopic device of the Guilleminot type, with inefficient protection, followed by the cumbersome, protected apparatus of the Albers-Schönberg type, are giving way to the convenient Beclere type. The new Dessauer kliniscop has some advantages over the Beclere. These latter types of fluoroscopic apparatus have the tube in an amply protected, freely movable, X-ray and light proof box, the adjustments of which permit all manipulations of tube and diaphragm by one hand. The lead-glass covered fluorescent screen is adjustable, allowing the patient to be placed either sitting or standing between the screen and the tube box. The Dessauer kliniscop has the advantage of permitting examinations in the recumbent position also, similar to the trochoscope of Haenisch or Holzknecht.

The advantages of fluoroscopy cannot be gainsaid. Radiographic substitutes cannot, in any succession of radiographs, give the diagnostic information that the fluoroscope supplies, without the expense and tedious process of negative development. The inexpensiveness and immediate usefulness of fluoroscopic facts are incontrovertible arguments. The possible dangers can be guarded against by proper protection of patient and operator.

The peculiar superiority of fluoroscopy over radiography depends upon the ability to study the peristalsis and surgical anatomy of the alimentary tract. We may study the physiologic or pathologic conditions which influence the position and relations of the œsophagus, stomach and intestines with reference to the adjacent organs and bony skeleton; the anchorage of stomach and intestines, either normal or influenced by adhesions; the disposal of food in the gastro-intestinal tract; pathological filling defects and abnormalities of contour as presented by alterations in the tissues or interference with muscular function of the gastro-intestinal tract.

The fluoroscopy of the gastro-intestinal tract requires modern protected apparatus. It must be used in a totally dark room that will permit the inspection of the leaded glass fluorescent screen without shading the screen. The bellows type of fluoroscope is not useful in the least; it leads to incorrect estimates of shadow values and is woefully inexact. It would be splendid if the bellows fluoroscope were eliminated entirely. It is responsible for so many ill-effects and adverse criticisms that we would delight in a bonfire of those now on earth and ostracise the manufacturer of any duplicates.

The author's technique of fluoroscopy consists in the use of the Beclere type of apparatus, in a totally dark room. The current to the tube is controlled by a floor switch, in the primary circuit, which is opened or closed by the foot of the operator. The tube is regulated by a weighted string which operates an adjustment upon the regulating bulb of the tube and is at the right hand of the operator. With the water-cooled tube, regulation is seldom required. We employ a continuous current of water in the tube, after a fashion seen at the Albers-Schönberg Haenisch Institute at Hamburg. This consists of a two-gallon bottle, with a small rubber tubing attached to an outlet in lower segment. This bottle is placed about two feet above the tube. After circulating in the water cooling compartment of the tube, the water runs off through a second tube to a container upon the floor. So much for the regulation of the tube and current.

Into the frame of the lead-glass covered fluorescent screen is fitted with thumb screws a piece of plain glass, upon which may be charted the outlines of the bismuth filled organs and the anatomical landmarks, with blue and red fat-pencils. These charting glasses are readily changed and their markings may be copied later upon thin paper for record. It is poor policy to chart upon the lead-glass of the fluorescent screen, as one will not have time to copy and erase the sketches.

The patient is prepared for the examination by a fast of four to six hours; the removal of the clothing to the hips; metallic markers are placed upon ensiform and umbilicus; the patient may either stand, or sit upon a movable bicycle seat, between the movable tube box and the screen.

For the examination there is required bismuth capsules of varying sizes; paste of bismuth, sugar of milk, and water; bismuth in water, and bismuth porridge. We use a fairly thick porridge of cream of wheat, into which 40 to 60 gms. of bismuth oxychloride or carbonate is thoroughly mixed. This is the established Riederische mahlzeit, when flavored with raspberry syrup. We prepare this in a chafing dish at the office or in the kitchen at the hospital.

The scheme of Holzknecht for gastro-intestinal fluoroscopy, as outlined in his monograph (1) may be simplified as follows: The patient is placed in the right-anterior oblique position, and offered the small bismuth capsule. When the current is applied he is instructed to swallow. The route and rate of the capsule in the œsophagus are noted until it reaches and passes through the cardiac orifice of the stomach. The succeeding larger types of the capsules are then offered and their course noted. By this means we are able to determine the location and lumen of an œsophageal stricture. The capsules do not always find the orifice of a diverticulum; therefore we employ the bismuth paste, about a level teaspoonful of bismuth carbonate and sac lac, half and half. This is swallowed at the suggestion of the operator after the X-ray is turned on. The use of bismuth and water, two drachms of bismuth to two or three ounces of water, is then employed. By carefully noting the passage of the paste and the water mixture, one can determine the presence of œsophageal strictures, diverticula, abnormalities due to adhesions, cardiospasm, dilatations, pleuritic tugs, œsophageo-bronchial fistulas, carcinomatous filling defects and alterations of outline, pressure of aneurysms or tumors upon the œsophagus. The description of the fluoroscopic symptomatology of each of these conditions is worthy of a distinct and separate descriptive paper.

Personally, we feel that the role of fluoroscopy in gastric diagnosis is most alluring and satisfying. While certain diagnostic phenomena may be obtained from the inspection of a mixture of bismuth and water immediately after its ingestion, one should depend rather upon the Riederische mahlzeit immediately following its ingestion. The phenomena of interest brought out by the water and bismuth are briefly, as follows: 1. The disposition of the mixture by the stomach—whether it immediately reaches the caudal pole and pylorus;

if it does reach the pylorus, does some of it enter the duodenum before the reflex closure of the pylorus is provoked by the ingestion of food into the stomach? Upon this point rests the estimation of a patulous pylorus. Because the bismuth and water does not enter the duodenum at once, one should not assume that there is a stenosis of the pylorus, as the pyloric reflex may have been occasioned by the œsophageal reflex.

Succeeding the fluoroscopy of the œsophagus and stomach by these simple measures, we instruct the patient to slowly eat the ten or twelve ounces of bismuth porridge. This may take some time, as we frequently find gastric patients unused to such food.

To simplify and curtail this paper, we shall list the fluoroscopic symptoms of the more common gastric conditions in which this method offers such valuable diagnostic assistance:

**I. Pyloric Stenosis.** Fluoroscopic symptoms: 1. Dilatation of the stomach, both longitudinally and transversely. 2. Antiperistaltic waves running from the pylorus to the greater curvature. 3. Interference with the emptying of the stomach, the exit of the food being delayed eighteen to forty-eight hours. Suspicious symptoms which should be noted are: More or less degree of distension of the stomach; weakened peristalsis; food delayed in exit twelve to twenty-four hours; adhesions of the pyloric area, which produce a fixed pylorus; pyloric filling defects; absence of any peristalsis at the pylorus, the wave running only from the greater curvature to the pre-pyloric area.

The pyloric stenosis, whether produced by infiltrations and cicatrices about an ulcer or carcinoma, would produce almost identical symptoms. The differentiation can be determined by the stomach analysis, case history and subjective symptoms.

**II. Gastric Carcinoma** presents the following fluoroscopic findings: 1. Irregular filling defects in the outline of the stomach wall. 2. Abnormal peristalsis, there being no waves at the site of the filling defect; or, if the carcinoma involves the pylorus, anti-peristaltic waves are seen. 3. Hour-glass contraction where there is involvement of the middle portion of the stomach. The bismuth meal or water may be seen trickling through the narrowed lumen. 4. Adhesions of the stomach to adjacent organs, due to perigastic inflammation. 5. The lumen of the stomach is usually much smaller than normal, excepting where the carcinoma involves the pylorus we may have a dilatation.

**III. Gastric Ulcer.** 1. Filling defects, which are not as irregular in outline as in carcinoma, the filling defect being due more to an irritation of the muscular action than to irregular outlines of mass changes in the stomach wall. This interference with the peristalsis in ulcers of the lesser or greater curvature is interesting. Where the ulcer involves the pylorus we have the additional symptoms previously noted when there is interference with the exit of the food.

The pre-cancerous stomach that I offer for your consideration depends upon a clinical symptomatology of chronic gastritis, with loss of appetite, weight, epigastric uneasiness and the craving of small quantities of food, preferably meats. There is no hyperchlorhydria demonstrable. But the fluoroscope will reveal a stomach of lessened lumen, placed rather high in the left hypochondriac region. There is a small magen blase. The pylorus is frequently the lowest point of the stomach shadow, and the filling shadow of the stomach is funnel-shaped. We have here an atrophy of the stomach, dependent upon a certain degree of starvation.

## REFERENCES.

FLUOROSCOPIC TECHNIQUE:

1. Mitteilungen a. d. Laboratorium für Radiologische Diagnostik und Therapie. Edited by Dr. Guido Holzknecht, Privat Dozent für Medizinische Radiologie an der Universität in Wein. Band 1, Heft. I.
2. Beitraege zur Topographie des Magendarmkanales beim Levenden Menschen nebst Untersuchungen ueber den Zeitlichen Ablauf der Verdauung. Prof. H. Rieder, Fortschritte a. d. Gebiet d. Röntgenstrahlen. Bd. VIII. S. 141. Röntgenunter-Suchung des Magens und Darmes. Münh. med. Woch., 1906, No. 3.

3. X Ray Examinations for the Physician. A. C. Jordan, M. D. Archives of the Roentgen Ray, Vol. XIV, p. 70.

4. Die Röntgentechnik. Prof. Dr. Albers-Schonberg and Prof. Dr. Walter, Third Ed. Grafe & Sillem, Hamburg. 1910.

FLUOROSCOPIC DIAGNOSIS:

5. Die Radiologische Diagnostik der intra und extra ventrikularen tumoren, und ihre spezielle verwertung zur Fruhdiagnose des Magencarcinoms. Dr. G. Holzknecht and Dr. S. Jonas. Monograph.

6. Atlas und Grundriss der Röntgendiagnostik in der Inneren Medizin. Franz M. Groebel. 1909.

7. Carcinoma of Stomach; X Ray Diagnosis. Author's Abstract, Interstate Medical Journal, Vol. XVII, p. 344. May, 1910.

8. Constipation and Allied Intestinal Disorders. Arthur F. Hertz, M. A., M. D., Oxon., M. R. C. P. 1909.

SAFETY OF FLUOROSCOPIC EXAMINATIONS:

9. The Safety of the X Rays to the Modern Roentgenologist. Howard Pirie, M. D. Archives of the Roentgen Ray, Vol. XIV, p. 314.

10. X Ray Dermatitis and Protection. John Hall-Edwards, L. R. C. P. Edin. Archives of the Roentgen Ray, Vol. XIV, p. 374.

11. Comment. Dr. Guido Holzknecht. Am. Quarterly of Roentgenology, Vol. II, No. 3, p. 201. Sept. 1910.

OPAQUE MEDIA FOR FLUOROSCOPIC EXAMINATION:

12. The Study of Constipation by Means of the X Rays. A. F. Hertz, M. A., M. D., Oxon., M. R. C. P. Archives of the Roentgen Ray, Vol. XIII, p. 3.

13. Bismuth Emulsions. Author. Interstate Medical Journal, Vol. XVI, p. 635. Sept. 1909.

14. Zirconium Oxide. Henry Hulst, M. D. American Quarterly of Roentgenology. Vol. II, No. 3, p. 199. Sept. 1910.

15. The Question of the Poisonous Action of Bismuth Subnitrate and other Bismuth Preparations used in Roentgen Diagnosis. Schumm and Lorey. Fortschritte a. d. Gebeit d. Röntgenstrahlen. Vol. XV, page 150. June, 1910.

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The author has selected the preceding references from a large number of books, monographs and papers, as embodying the classical features of gastro-intestinal fluoroscopy.—E. H. S.

## DISCUSSION

DR. HENRY HULST, GRAND RAPIDS, MICHIGAN.

Fluoroscopy of the stomach has interested me for a long time, but I have not been so situated that I could do much of it. Especially do I feel myself unable to diagnose cancer of the stomach, as a rule. Dr. Skinner did not give us any definite data by which we can diagnosticate this condition. We can get closer to it by means of the X-ray than we can by basing a diagnosis on clinical findings. However, it is rather difficult. I have been able to make the diagnosis in a number of cases where no tumor was present, and operation subsequently confirmed my diagnosis.

I use the fluoroscope in the diagnosis of stomach conditions more than in any other work; I think it is the place for stereoscopic work. The information to be obtained, the location of the stomach, its action, is invaluable and cannot be obtained so well by means of a photograph. Holzknecht is given credit for being the exponent of the cow-horn-shaped stomach. Groedel and Holzknecht both say that the normal stomach is cow-horn-shaped.

A few days ago I was reading a book on Victor Hugo in which it was said that genius is more abnormal than criminality. If this were not true, there would be more poets than criminals, which is not the case. The normal is the average. There is no disputing that if you examine one hundred stomachs as they come to you you will find the cow-horn stomach. Genius is exceedingly rare and the average stomach is not normal. Now, how would I get the normal stomach? I have noticed that in proportion as people are well, as they are robust and well-built, the stomach is located high up. It is oblique in direction. It is without backing. That gave me the idea some two years ago, when I read a paper before this Society, in which I said, show me a Venus or an Apollo and I will show you a cow-horn stomach. Somebody brought in two Venuses and I found the cow-horn, comma-shaped stomach in both of them. An athletic woman, although forty-five years of age, also showed the cow-horn-shaped stomach. Men very commonly display this—not the atrophied stomach Dr. Skinner was speaking of. Such a stomach I have not seen.

Recently a lady came to me asking for a thorough examination. She thought she had kidney stone, gall-bladder stone and a cervical rib, and many other things. I examined her and found that she had the cervical rib all right, but nothing else. Her stomach was in excellent condition, simply because she herself was in perfect physical condition. That gave the fairly normal stomach. Some one made a diagnosis of gastroptosis in her case. It was not present.

Talking about diseases of the stomach and fluoroscopy, hour-glass stomach is what we all like to diagnose. It is a difficult thing to do. I have done it once or twice. There is a certain thing the Germans pointed out which is not well known. If you pass a stomach tube and instead of going down easily it curls up, then you may well suspect something being wrong. A gastrologist and I were entirely at odds about it. He found a stomach that was too small, a stomach that emptied itself in two ways, a stomach that was not in place. I found the stomach away out of place. I gave the patient some bismuth, the doctor passed a diaphane, and we got a picture which showed the instrument curled up. Do not diagnose hour-glass stomach simply because you have that shape. It is only when it is persistently so that it becomes significant.

One point more. You may get an hour-glass stomach in which the lumen is large enough to pass a good-sized broomstick. You would imagine that there would be no trouble in a case of that kind, that a person with such a stomach would have the advantage over one with an ordinary-sized stomach. Not so. I have been surprised at the great effect that has on the stomach. The mischief that comes from such a narrowing is very striking and hard to explain. The apparatus used in making these examinations varies in the hands of different operators. Dr. Skinner prefers the French type.

Others prefer other types. That matters little, however, providing we are accurate in our technic, and the patient does not get burned. I am using a tube designed originally by Dr. Haenisch, called a trochoscope. I also use the Albers-Schoenberg apparatus, but it is very clumsy. I like them both. The tube stand is clumsy, but if reenforced it is safe. The chair I like very much because it permits of placing the patient in any position desired. I also believe that these examinations can be made with very simple apparatus if one is inclined to do so. To recapitulate: Fluoroscopy of the stomach is something which in the future will be productive of much good. Roentgenography of the stomach will have its place, especially in the work Rosenthal is doing. How he succeeded in making his pictures in the way he did is a mystery to me. He was very fortunate to be able to do it just at the psychological moment and get what he did.

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### DR. ARTHUR HOLDING, ALBANY, N. Y.

I am very much interested at the attitude men take toward fluoroscopy. I am familiar with the method used by Dr. Skinner. I have a Beclere apparatus and I can go all over the room and try to find a fluorescence, but fail. At the same time I doubt whether it is as safe as we are led to believe it to be, because we cannot protect ourselves against the secondary rays generated by the direct rays, which strike the patient.

Dr. Pfahler has a very clever arrangement which enables him to work through a door. He has come nearer protecting himself against the secondary rays than anyone else.

I think we must make one more step before this method may be considered safe. I believe there will be a combination of the Albers-Schoenberg-Haenisch method with the Beclere method, which will enable you to use it without leaving the room and yet be safe.

We should not swing from the radical American position taken a year or two ago, when we said that we would not own a fluoroscope or look at one, and then come back to our former position. It all depends on whether you are afraid of the secondary rays or not, and whether they have any influence on the trophic functions. That is the question. We must bear that in mind when we are discussing these methods.

As far as the Beclere method is concerned, I think it must still be proved whether it is absolutely safe.

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DR. GEORGE E. PFAHLER, PHILADELPHIA, PA.

I have been doing considerable fluoroscopic work during the past three or four years, and I am one of those who is most afraid of the rays. I think we are stepping on very dangerous ground. We should go very slow, be very conservative, and do no fluoroscopic work rather than be rash, do much, and kill more men. Enough men have died as the result of doing this work.

So far I have seen no apparatus except my own that is safe. I think my apparatus is safe, although I cannot go all over the room without being able to see the fluorescence. Those of you who have been in my office know that I have a door that separates one of my working rooms from my dark room. I place on the outside of that door an arrangement to hold my tube. I have a diaphragm sixteen inches square made of one-quarter inch thick lead, which has an opening in the center, five inches square. The entire door is leaded with sheet lead, one-thirty-second inch thick. There is an opening of aluminum just big enough for the rays to go through. I then have a leaded glass screen opposite. The patient steps between the two points, the screen and tube working in unison. When I do my work with the patient in front of that screen of lead, one-quarter inch thick, and I look through an opening of lead glass just large enough to see through, the side facing my screen is covered with one-quarter inch lead. I have the room as dark as I can get the shadow of my hand through the fluoroscope anywhere.

I have been considered a terrorist by Dr. Holzknecht. I do not want to frighten you. I merely want you to be careful. That is probably secondary radiation. I do not believe that the rays I get in that room are due to primary radiation, but we do not know what secondary rays will do. Therefore, we should do no more fluoroscopic work than is absolutely necessary and essential.

Three days ago a patient came into my office whom I had treated for epithelioma on the back. I had given him five exposures in about six weeks. The epithelioma had disappeared. It was about one inch in diameter. I placed around that tumor a sheet of lead foil with an opening in the center just large enough to surround the epithelioma. I then brought down on this a cylinder of lead, so that the rays that came from my tube simply passed into this space. The diaphragm in the tube was made of one-quarter inch cast iron. The opening beneath the tube is covered by a layer of lead, one-eighth inch thick. I was using a quality of ray that is usually used in the treatment of epithelioma, about 5 Benoist. I had used about twelve units only, twenty being the full dose, yet when that patient returned the other day his skin was pigmented outside of the circle of lead. That proves one of two things—either that sufficient rays passed through the one-eighth inch thick sheet lead to cause the pigmentation of the skin, or else there were enough secondary rays to cause the pigmentation. If that is true, then we must be very careful with our fluoroscopic work. If the secondary rays do this, it shows how very careful we should be.

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DR. HENRY HULST, GRAND RAPIDS, MICHIGAN.

A way of detecting the rays is as follows: Electrify a strand of silk and it will stand out straight. Take that strand of silk into the dark room and it will not fall down. Use it around the X-ray box and it will fall down. I hung it up in the parlor and it would take half an hour before it fell down. I ran the machine and it came down in five minutes. Whether such rays do any harm or not, I do not know.

# THE VALUE OF THE ROENTGEN RAY IN THE EARLY DIAGNOSIS OF CARCINOMA OF THE BOWEL.

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BY DR. FEDOR HAENISCH, HAMBURG, GERMANY.

I shall endeavor to convince you of the value of screen work in the early diagnosis of carcinoma of the bowel. I have three cases now in which the diagnosis was confirmed by operation subsequently. The technic I used is as follows: I have the patient empty his bowels thoroughly the day before he comes to me and then have him take a high enema on the morning of the day of examination, so that I am reasonably sure that the intestinal tract is absolutely empty. Very often I instruct the patient to take castor oil for several days before the examination. In order to make the examination I place the patient on his back on the trochoscope, a table which I devised for this work and which possesses the advantage that it can easily be moved in any direction with the patient recumbent on it. I then introduce an India rubber tube into the anus, which is fastened to an irrigator. Through this I pass into the rectum a solution of bismuth and bolus alba, a mixture which Gester, of Munich, advocates for this screen work on the bowel. It is impossible to do this work when the bismuth is given by mouth because, as is well known, the bismuth passes from the stomach into the small intestine, and from there into the colon, where it appears to be more or less scattered about without really filling the lumen of the bowel. Therefore, you never judge whether a free space in the skiagram may have been caused by the absence of bismuth or by a stricture or something inside the bowel. Therefore, the bismuth solution must be passed in through the rectum and we must watch it go in, because there is possibility of making an error if this is not done. If you let the mixture pass in without actually seeing it go in, you never know whether the flow was interrupted. I have an arrangement by means of which I cut down the diaphragm of the tube while I am watching the bismuth go in, so that I do not have to expose the entire abdomen to the action of the ray, and still be able to watch the bismuth flow. In cases which were later proven to be positive, so far as carcinoma is concerned, I noticed that the flow of bismuth stopped suddenly and then after a little bit there was a finger-like projection from the bismuth mass which slowly moved onward, and suddenly widened again, filling the colon. I do not let the tube go all the time. I have an assistant stationed at the switch to turn the current off and on, as I need it. Therefore, I do not burn the patient. When there is some doubt I make a skiagram with a short exposure. If the skiagram corroborates what I saw with the screen, I tell the doctor to take his patient home and to bring him back in about two weeks. Then I do the same thing over again and if my findings correspond with that of the first examination, then I am pretty certain to tell the doctor that he is justified in opening the patient's abdomen to see what is the matter. I do not make a diagnosis of carcinoma, because the X-ray plate does not show that, but I do say that there is something wrong in there and that it should be looked after.

The first case I had was one of carcinoma of the sigmoid flexure. The patient was a lady, thirty-three years of age, whose trouble began about a year before I saw her. There were not many symptoms, except sometimes a slight amount of blood in the feces and some mucous discharge. She did not lose in weight and she seemed to be in good health. Now and then she had a little pain in the left side of the abdomen and in the back. Her physician used the X-ray and the screen with the patient in the erect position, but found nothing positive. He brought her to me. I advised an examination, and the result was that I got a picture of a condition such as I have just described to you. I did not attempt to make a diagnosis, based on the findings in the plate alone, because you can find many such openings or breaks in the bismuth flow, but when you watch it go in with the fluoroscope and you see it stop and then you see it go on again in a thin, finger-like process and widen out, something is wrong. I told this lady's doctor that I felt quite certain there was something the matter. I had the patient return in a week or two, when I made another examination, and saw the same thing again. She was operated on and a small carcinoma was found in the distal end of the sigmoid flexure.

In the next case the findings were practically the same, and in the third case they were duplicated again. In one of the cases the operation showed that there was a carcinoma in the sigmoid flexure and above that a stricture of the ascending colon. I did not diagnose these cases as carcinoma of the bowel, but the clinical symptoms and the X-ray findings were a sufficient reason for telling the surgeon to perform the laparotomy, and the supposition was shown to be correct when the carcinoma was found.

## DISCUSSION

DR. GEORGE E. PFAHLER, PHILADELPHIA, PA.

I had a case of this kind recently during Dr. Haenisch's visit to my laboratory. The patient had had symptoms of chronic trouble extending over a period of five years. I gave a course of bismuth by mouth and the trouble seemed to be in the colon, as was seen in the plate and through the screen. The next day I gave a colonic injection of bismuth and then examined the patient again by plate and with the screen. We disproved the findings of the previous day, but on account of gas accumulations we did not know where the disease was. We then used the method just described by Dr. Haenisch, and in the sigmoid flexure we found a constriction of the lumen of the gut, to about the diameter of a thumb. No matter how much we tried to distend the colon below that part, the constriction was not enlarged. We made a probable diagnosis of carcinoma, which was confirmed by operation three days afterward.

DR. GEORGE H. STOVER, DENVER, COLO.

If the bismuth meal were given by mouth and a number of plates were made showing the progress of the bismuth, would there not be an accumulation of bismuth above the stricture?

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DR. HENRY K. PANCOAST, PHILADELPHIA.

I would like to know as to the amount of the bismuth mixture Dr. Haenisch employs; what its composition is; how much pressure is used in its introduction into the bowel.

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DR. EUGENE W. CALDWELL, NEW YORK CITY.

I would like to ask the details of the administration of oil for emptying the intestinal tract.

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DR. LEWIS G. COLE, NEW YORK CITY.

I would like to ask Dr. Haenisch whether in any of the cases he radiographed the patient was placed in any other position, such as the plate before and the tube in front. I have just such a case, and with the tube behind and the plate in front, I get only partial outlines of a constriction, but by reversing the position of the tube and plate I am able to bring out clearly a constriction of the lower part of the sigmoid.

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DR. EDWARD H. SKINNER, KANSAS CITY, MO.

Anyone who has had the pleasure of seeing Dr. Haenisch do this work can understand how easy it really is. The possibility of making a diagnosis of stricture of the colon by means of the radiograph is slight. Why? Because frequently one sees in negatives of the colon that just at the point where it crosses the true brim of the pelvis, there is no bismuth, because the colon hangs over it, as one straddles a saddle.

The bismuth drops down on either side, none remaining on the bridge. The point is that you must see the bismuth trickling through the stricture.

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DR. HENRY HULST, GRAND RAPIDS, MICH.

If I had heard nothing but this paper, I would have been well repaid for coming here. I had the good fortune of working with Dr. Haenisch's trochoscope for some time, but I have not done any of this work which he has so well described.

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DR. HAENISCH (closing).

The mixture of bismuth which I use consists of bismuth carbonate, bolus alba and water. I never use the subnitrate of bismuth because death has occurred following its use. I do not know whether it is as dangerous as has been thought, but recent reports would indicate that danger does attend its use. I take 500 c. c. of warm water and mix from 250 to 300 grams of bolus alba with it, stir thoroughly and then add from 50 to 75 grams of bismuth carbonate, continually stirring this mixture until it is homogeneous, when I add 500 c. c. of water. The important thing is to mix the bolus alba very carefully, so that there will be no lumps in the mixture.

As to the pressure, the water is placed from eighteen to twenty-four inches above the patient. As far as giving this mixture by mouth is concerned, in order to make the method useful, you would have to wait six or seven or even twelve hours until the bismuth had passed into the colon.

Holzknecht says that the peristaltic action of the colon is not slow and continuous, but sudden and interrupted. Whether he is right, I do not know, but he has seen colonic peristalsis twice on the screen. From what I saw once I am inclined to believe that he is right. Before Holzknecht published his paper, I saw the ascending and transverse colon were filled. The descending colon was empty. I switched off my tube, waited a few minutes, switched it on again, and the ascending colon was filled, but the transverse colon was empty. The descending colon was full. I thought I had made a mistake, but two weeks later I read Holzknecht's paper, and then it occurred to me that my case might be a case in point.

As to emptying the intestinal tract, I leave that entirely to the doctor. I ask him to instruct his patient to have his intestinal tract thoroughly cleaned out before he comes to me. Sometimes they give castor oil and sometimes they give other things.

As to Dr. Cole's question, I have not had the plate at the back and the tube in front, but I will try that way. I do not think I can do that with the same screen I am using now. Besides, I do not rely so much on the plate as I do on the screen. With the patient on the abdomen everything is squeezed together, and I cannot see things so well with the screen as I can when the patient is on his back.

As to Dr. Stover's question, giving the mixture by mouth and watching it pass through the colon, that has been done by someone several years ago. That can be done only in cases where there is a very narrow stricture, in an advanced case, and one can widen the colon above the stricture. The three cases I reported were early cases, the tumors were very small—they could hardly be felt when the body was opened, and there surely could not have been any dilatation of the bowel above the tumor. I saw the stuff go in, stop, and then appear as a thin stream beyond the constriction.

# X-RAY FINDINGS IN GASTRIC AND DUODENAL ULCER.

BY HOWARD ELMER ASHBURY, M. D., BALTIMORE, MD.

The writer's intention in presenting this report is to bring before the society a series of experiments and results obtained in the effort to locate gastric and duodenal ulcer by a systematic and constant X-ray technique.

The attempt to recognize and definitely locate gastric and duodenal ulcer has been made by a small number of operators. The results, as far as I can find from obtainable literature, have been unfortunate in so far as they are inconstant.

Dr. J. C. Hemmeter in 1906, before the American Gastroenterological Association, spoke of the diagnosis of gastric ulcer, successfully seen by means of the X-ray, in animals. He states that the bismuth shadows were not sharply circumscribed; his observations were made with the fluoroscope.

Mathis of Colon was successful in but two cases. He gave bismuth by the mouth for several days and then discontinued it for two days, after which the patient was radiographed. His idea was that a firm crust would be formed in the ulcer and would persist for several days.

Dr. Crane of Kalamazoo states in his paper, "X-ray Evidence in Gastric Cancer," that in ulcer the alteration of form of stomachs is confined to the contracture type of deformed stomachs, and makes no reference to retention of bismuth on the ulcer itself.

Our method in the beginning was to give a single drachm of bismuth sub-carbonate in a glass of water, and to take the picture in a sufficient length of time for the stomach to have emptied itself of the excess, leaving a deposit of bismuth over the surface of the ulcer which could be skiagraphed.

At first we made this period from six to eight hours, but we found this to be too long, the bismuth having had time to get around into the transverse colon and confuse our interpretation, or for the stomach to have freed itself of the small amount of bismuth clinging to the ulcer surface; it was decided that a period representing the time in which a normal stomach would empty itself of food, would be the correct time for making the first exposure.

It was noted that, as a rule, the normal stomach was entirely free from bismuth in from four to four and a half hours; bismuth at this time would be located in the cæcum, entirely out of the stomach region.

The quantity of bismuth sub-carbonate we increased to 90 grains and lessened the amount of water to one-half glass, working on the basis that the smaller amount of fluid would be less liable to wash the bismuth from the surface of the ulcer.

The technique used at this time was: The patient having been on liquid diet for 24 hours, food is restricted entirely for 12 hours; then a drachm and a half of bismuth sub-carbonate is given in a half a glass of water, and the first exposure made from four to four and a half hours later, with the patient lying on the abdomen, the plate underneath, large enough to reach from above the nipples down to below the anterior spines of pelvis; a small marker is placed at the umbilicus, and if there is any special point of tenderness, that is also marked. The exposure is made while the patient holds the breath, at the termination of easy expiration, the time varying from four to ten seconds.

If this plate shows the bismuth sub-carbonate to be distributed over the stomach wall, which is very unusual, a second exposure is made in another hour, at which time we can feel reasonably sure that whatever bismuth is retained is due to either pyloric obstruction, stomach contracture, and if circumscribed to an ulcerated area, the bulk of the bismuth is usually seen in the cæcum.

A number of observations were made in cases of normal stomach and in cases of gastroptosis with intact gastric mucous membrane, and in every case the bismuth was found, on X-ray examination, to have completely left the stomach within four hours of giving it; care should be taken, however, that the stomach is empty at the time the bismuth is given.

It is not improbable that the negative results obtained have been due to allowing too much time to elapse before the X-ray exposure.

In complete pyloric obstruction, where the entire quantity of bismuth is retained in the stomach, the diagnosis of ulcer should be guarded.

In contracture such as hour-glass stomach, the time at which the first plate should be made after the initial dose of bismuth will have to be determined by the clearance time of that individual stomach. I have not had such a case.

In cancer the second plate will clear up the diagnosis, as a rule.

After this examination from one to one and one half ounces of bismuth sub-carbonate is given in a pint of water, and a second picture taken immediately afterwards. This examination has for its purpose, the obtaining of the relation of the stomach to the shadows previously noted (in the first plate), thus determining one of the points directed towards gastric or duodenal ulcer.

If the shadow in the first plate is found directly over the stomach itself, the location is evident; if outside, in the course of the duodenum, the diagnosis of duodenal ulcer is probable, provided accumulations in the colon can be excluded. This is rather difficult at times, and often repeated examinations have to be made to verify the findings. For this reason the diagnosis of ulcer of the duodenum has been made where the first plate failed to show the first dose retained in the ulcer.

The chances of error in ulcers located in the first and fourth portion of the duodenum must be considered, owing to the fact that the duodenum at these points usually lies back of the stomach.

It has been noted in a number of our cases of duodenal ulcer that the stomach assumes an exaggerated horizontal position with the pylorus retracted over to right, in some instances from three to four inches to the right of the median line. In these cases, the stomach is usually high up under the diaphragm, and instead of the skiagraph showing first portion of the duodenum close to the pylorus and above the horizontal plane of the stomach, it is usually absent and when seen is below this plane. We have had occasion to verify this by operation in several cases, the surgeon having great trouble to draw the stomach out of the incision for inspection.

In endeavoring to explain what bearing this position of the stomach may have on duodenal ulcer, I have examined the stomach and colon simultaneously and, as can be seen from one of these slides, the stomach is apparently resting on the transverse colon, which is also higher than the normal; what bearing this has on ulcer of the duodenum, I am unable to say.

By studying the tabulation of the cases examined, it is clear that our endeavors have been, in so far as we have gone, favorable.

It will be seen that the greater number of cases examined were not definitely diagnosed clinically, but were referred for X-ray examination to exclude ulcer; this was taken advantage of as a control for our work.

# RECAPITULATION.

The following Recapitulation Tables show a list of 45 cases examined for ulcer, during the period extending from July 19, 1909, to September 7, 1910, the technique being the same in all cases reported.

In the column of Remarks, we have given subsequent information that has helped to verify the X-ray and clinical finding.

**TABLE No. 1. DIAGNOSED ULCER BY X-RAY; 18 CASES**
**Group "A," consisting of 5 cases, verified by operations**

| No. | Date | Name | Clinical Diagnosis | X-Ray Diagnosis | REMARKS |
|---|---|---|---|---|---|
| 10 | 11-17-09<br>12-26-09<br>1-22-10<br>2-28-10 | Z. K. | Gastric Ulcer<br>Duodenal Ulcer<br>Duodenal Ulcer<br>Duodenal Ulcer | Duodenal Ulcer<br>Duodenal Ulcer<br>Duodenal Ulcer<br>Duodenal Ulcer | Operation, Gastro-enterostomy, Ulcer located, Cured. |
| 23 | 3-25-10 | J. H. M. | Old Ulcer | Old Ulcer, diagnosed by 2d Plate. | Operation partially healed, Ulcer, Pylorus. |
| 26 | 4-12-10 | F. G. | Gastric Ulcer. | Duodenal Ulcer. | Verified by operation, Gastroenterostomy, Cured. |
| 34 | 6- 8-10 | A. E. | Gastric Ulcer. | Gastric Ulcer. | Operation showed Gastric Ulcer, Pyloric obstruction. Plate taken 8-29-10 |
| 45 | ......... | M. W. | Gastric Ulcer. | Gastric and Duodenal Ulcer. | Both Ulcers located at operation. |

**Group "B," consisting of 13 cases, verified by subsequent ulcer medical treatment**

| No. | Date | Name | Clinical Diagnosis | X-Ray Diagnosis | REMARKS |
|---|---|---|---|---|---|
| 1 | 7-19-09 | L. L | Gastric Ulcer. | Gastric Ulcer. | Cured by subsequent medical treatment. |
| 2 | 7-19-09 | J. F. | Gastric Ulcer. | Gastric Ulcer. | Cured by subsequent medical treatment. |
| 4 | 8-20-09<br>9- 3-09 | H. H. | Duodenal Ulcer. | Duodenal Ulcer. | Improved by subsequent treatment. |
| 14 | 12-23-09 | S. L. | Gastric Ulcer. | Duodenal Ulcer. | Cured by subsequent medical treatment. |
| 16 | 1-14-10 | L. S. | Gastric Ulcer. | Ulcer of Pylorus? | Cured by subsequent medical treatment. |
| 17 | 1-17-10<br>8-13-10 | A. A. | Duodenal Ulcer. | Gastric Ulcer. | Improved by Medical treatment, bleeding necessitated transfusion two occasions. Operation not deemed wise owing to severe endocarditis. Unimproved. |
| 30 | 5- 8-10<br>8-19-10 | M. C. | Ulcer? | Duodenal Ulcer. | Cured by subsequent medical treatment, Plate taken 8-9-10, shows no trace of Ulcer. |
| 33 | 5-31-10 | R. C. | Gastric Ulcer. | Duodenal Ulcer. | Treated for Ulcer. Improved. |
| 28 | 4-28-10 | E. M. | Gastric Ulcer. | Gastric Ulcer. | Narrowing of Pylorus. |
| 40 | 8- 7-10 | L. I. | Cancer. | Duodenal Ulcer. | Improved by subsequent treatment for Ulcer. |
| 44 | 9- 7-10 | A. R. | Duodenal Ulcer. | Duodenal Ulcer. | Refused operation. |
| 42 | 8-15-10 | A. M. | Ulcer? | Duodenal Ulcer. | Unimproved, refused operation. |
| 31 | 5-28-10 | L. K. | Gastric Ulcer. | Gastric Ulcer. | Unimproved after 3 months. Clinical Diagnosis at present doubtful. |

## TABLE No. 2. ULCER EXCLUDED BY X-RAY; 26 CASES

### Group "C," consisting of 5 cases, negative diagnosis of ulcer, substantiated by operations

| No. | Date | Name | Clinical Diagnosis | X-Ray Diagnosis | REMARKS |
|---|---|---|---|---|---|
| 3 | 8-13-09<br>8-22-09 | W. P. B. | Gastric Ulcer. | Negative. | Operation, Chronic Pancratitus. Improved. |
| 7 | 9-28-09 | S. T. B. | Gastric Ulcer. | Negative. | Operation, Carcinoma of the Cardia. Died. |
| 43 | 8-20-10 | D. S. | Gastric Ulcer. | Negative. | Operation showed Gastroptosis and absence of Ulcer. |
| 11 | 11-29-09 | L. G. | Gastric Ulcer? | Carcinoma. | Operation, Cancer. |
| 21 | 3-11-10 | J. A. B. | Gastric Ulcer. | Pyloric obstruction. | Operation, healed Ulcer. |

### Group "D," consisting of 16 cases, negative diagnosis of ulcer, substantiated by medical treatment

| No. | Date | Name | Clinical Diagnosis | X-Ray Diagnosis | REMARKS |
|---|---|---|---|---|---|
| 6 | 9-26-09 | J. F. M. | Gastric Ulcer. | Negative. | Normal Stomach. |
| 8 | 10-16-09 | M. N. | Gastric Ulcer? | Negative. | Refused operation. |
| 9 | 9-16-09 | M. V. | Gastric Ulcer? | Negative. | T. B. tudes, refused operation. |
| 12 | 11-30-09 | L. M. | Gastric Ulcer? | Negative. | Dilated Stomach, Hyperchlorhydria. |
| 13 | 12-10-09 | W. J. M. | Gastric Ulcer. | Negative. | Malignant growth Lung. |
| 15 | 1-13-10 | J. S. | Gastric Ulcer. | Carcinoma. | A mass can be felt in epigastrium, Patient dying. |
| 18 | 2- 9-10 | H. Y. | Gastric Ulcer. | Negative. | Indigestion, cured. |
| 19 | 2-25-10 | B. E. M. | Gastric Ulcer? | Negative. | Gastroptosis. |
| 20 | 3- 2-10 | E. A. M. | Gastric Ulcer? | Negative. | Gastroptosis. |
| 22 | 3-15-10 | F. V. | Gastric Ulcer, | Negative. | Hodgskin Disease, enlarged spleen. |
| 24 | 3-31-10 | E. H. C. | Gastric Ulcer? | Negative. | Gastroptosis. |
| 25 | 4- 2-10 | U. S. | Malignant Ulcer. | Negative. | Gastric Catarrh. |
| 32 | 5-18-10 | J. W. | Ulcer? | Negative. | Gastroptosis Scoleosis. |
| 36 | 7-10-10 | B. F. | Ulcer? | Negative. | Gastroptosis. |
| 37 | 7-15-10 | B. S. | Ulcer? | Negative. | Enteroptosis. |
| 41 | 8-15-10 | R. T. | Gastric Ulcer. | Negative. | Enteroptosis. |

**Group "E," consisting of 2 cases, negative diagnosis of ulcer substantiated by autopsy**

| No. | Date | Name | Clinical Diagnosis | X-Ray Diagnosis | REMARKS |
|---|---|---|---|---|---|
| 5 | 8-26-09 | L. F. | Ulcer? | Carcinoma of the Stomach. | Autopsy, Carcinoma of Stomach. |
| 27 | 4-28-10 | F. K. | Gastric Ulcer. | Cancer. | Post-mortem Gastric Cancer. |

**Group "F," consisting of 3 cases, negative diagnosis of ulcer substantiated clinically. Operation for gall stone refused**

| No. | Date | Name | Clinical Diagnosis | X-Ray Diagnosis | REMARKS |
|---|---|---|---|---|---|
| 35 | 6-10-10 | H. McC. | Ulcer? | Negative. | Gall Stones. |
| 38 | 7-29-10 | M. B. | Ulcer. | Negative. | Gall Stones. |
| 39 | 8- 4-10 | W. H. | Duodenal Ulcer. | Negative. | Gall Stones. |

**TABLE No. 3. CASE NOT DIAGNOSED EITHER CLINICALLY OR BY X-RAY; 1 CASE**

**Group "G," consisting of 1 case**

| No. | Date | Name | Clinical Diagnosis | X-Ray Diagnosis | REMARKS |
|---|---|---|---|---|---|
| 29 | 4-29-10 | T. L. S. | Pyloric obstruction. | Pyloric obstruction. | Operation, Duodenal Ulcer causing total obstruction by adhesion. |

## DISCUSSION

DR. FEDOR HAENISCH, HAMBURG, GERMANY.

I am sorry to say that I do not believe I would dare to base a diagnosis of gastric or duodenal ulcer on very many of the plates we have just seen. About five or six years ago a man called attention to a certain thing. That was Professor Recklinghausen. He found that bismuth was a very good thing for curing ulcers. Another man thought that if von Recklinghausen's statement was true, then to give bismuth by mouth ought to make it stick on the ulcer. So we tried it and after giving the bismuth we had the patient assume a position which we thought would give the bismuth a chance to adhere to the ulcer. However, we soon found out that that was very seldom the case. I have about three cases, and several others have them also, where we can see a little portion of the bismuth left after the stomach was empty and we hoped that it was what that man talked about, but we soon learned that in order to have the bismuth stick not only must there be an ulcer, but it must be a perforating ulcer, because otherwise the bismuth would not have a chance to stick. Otherwise bismuth would pass out through the stomach in a normal way.

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DR. GEORGE E. PFAHLER, PHILADELPHIA, PA.

We should not let this paper pass without pretty thorough discussion. Any of us who have done a great deal of stomach work know very well that we can rarely ever place a patient on his abdomen and take two pictures that would be the same. So that from that point of view you cannot judge, and from the standpoint that the retained bismuth is to be found always in the ulcer, if it is retained at all, it must be due to a spasm and not to the ulcer. In other words, the bismuth is surely not in the ulcer. I am sure that no one has seen an ulcer so large as the quantity of bismuth shown in the plates would indicate. Therefore, we must be extremely careful in work of this kind. I would not in the case of any plate shown have believed, and do not believe now, that there is the least evidence of ulcer. We must be extremely careful about making statements that ulcers can be diagnosed by means of the Roentgen ray. We have all seen such peculiar groupings of bismuth in the stomach, especially when pressure has been brought to bear on the stomach. That emphasizes the importance of fluoroscopic examinations in stomach troubles, and I for one would be willing to discard fluoroscopy in all my work except in stomach and colon cases. I do not believe that this work should be passed unnoticed or uncriticized.

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DR. GEORGE H. STOVER, DENVER, COLO.

While I agree with those who have disagreed with the essayist in that it is impossible to state that these spots on the plates indicate the retention of bismuth in an ulcer, yet we must acknowledge that this work is leading us in the direction where we may eventually arrive at something definite. We find many things to-day that we did not find ten years ago; therefore, it is quite possible that we may find some substance which will adhere to an ulcer or to an ulcerated mucous membrane of the stomach. It may not be bismuth, but something else. Therefore, I hope that Dr. Ashbury will continue his work, because I am sure that he will find something that will adhere to the ulcer.

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DR. ASHBURY (closing).

This work was done from a purely humanitarian point of view, with the hope that the X-ray might be used to make a positive diagnosis of ulcer of the stomach and duodenum, a diagnosis which ordinarily is sometimes rather difficult. We tried to do the work as accurately as possible, and the cases I have reported are actual cases, and were reported exactly as we found them. I am sure that in the future we will select the substance which will give us a definite shadow, and I feel that even though these shadows are irregular and may exaggerate the size of the ulcer, it will lead us into a right line of thought later on.

# THE UNIVERSAL HAND STEREOSCOPE.

## A NEW PLANO-PRISMATIC STEREOSCOPE.

BY H. THRELKELD-EDWARDS, M. D., SOUTH BETHLEHEM, PA.

By way of foreword be it said that the stereoscope, and the other little things exhibited at Richmond, of which I am invited to write a description for publication in the Quarterly, were designed and made for personal use, and, in particular, to aid in Roentgen demonstrations at Medical Society meetings. In a very literal sense, their production was mothered by necessity—for it was only because I needed something which I could neither beg, borrow, nor steal, that I constructed them. From the inception of my work as a Roentgenologist, it had been a matter of surprise to me that the general practitioner did not avail himself—more frequently and more generally—of the Roentgenologist's services in both the diagnosis and treatment of certain chronic cases; for, surely, in no specialist can the man in general practice find a consultant of such all-around value and assistance, in difficult and obscure cases, as the trained and experienced Roentgenologist.

If on the one side I was convinced of the doctor's need of the Roentgenologist, I was equally persuaded, on the other, that the Roentgenologist would not "enter into his own," and receive his just reward, until the general practitioner was made conscious of his need, and it was in furtherance of a Roentgenological "Reciprocity" crusade, that I enlisted my humble efforts, a year or more ago.

Believing that the general practitioner, be he country doctor or city physician, fails to properly appreciate the Roentgenologist and his work only because he is unfamiliar with the present day possibilities of the art, it remained to inaugurate a campaign of education along the line of least resistance; i. e., the County Medical Society.

It was apparent from the outset that the first step in the work of disseminating knowledge of modern Roentgenology must be to arouse the active interest of the individual doctor in the subject itself; it was also apparent that to do so would call for more than the usual exhibition of radiographic specimens, since even lantern-slides were not appreciated by the profession in general; while the ordinary picture —either plate or print—was surely "flat," if not equally "stale," and without profit. The chance showing at a Society meeting of a few small stereo-prints—reductions made of stereoscopic radiograms for use in a hand stereoscope—aroused such genuine enthusiasm, and led to so active an interest in stereoscopic Roentgenology in general, as to make it evident that one need look no farther for a method of approaching the subject.

A search for a stereoscope to be used in demonstrating a collection of stereoscopic X-ray plates at Medical Society meetings, etc., showing the same to a number of persons, and within a limited space of time—yet insuring satisfactory stereoscopic vision to individuals unfamiliar with stereoscopy—disclosed the fact that no instrument at all suited to the purpose was for sale—either at home or abroad.

Instruments of the Whetstone and Wenckebach type were naturally barred by their size, high cost, etc.

Of the small models, or hand stereoscopes, all specimens offered in this country were of the lens-prism type, and proved useless because of their short focus.

Two models of small size were specially imported, the Pirie from London, and the Lothian from Scotland. The Pirie makes one of a "reflecting" prism of peculiar form—a single glass being inserted in the right-hand tube. At first this instrument gave promise of being useful, until in practice, it was found that not one person in four could successfully use it without preliminary practice; furthermore, its construction was such that unless the interpupilary distance was quite normal, one could not see into the eye-pieces at all. The Lothian (popular in England for viewing small stereoscopic pictures) is optically similar to our small hand stereoscopes; both types using lenticular prisms of various focal length. For this reason, as before stated, they are useful only in near work with small prints, or for lantern-plate transparencies.

The result of ten months' work, with all the available models, and experimenting with various combinations of lenses, prisms and mirrors, is the little instrument herewith described and illustrated.

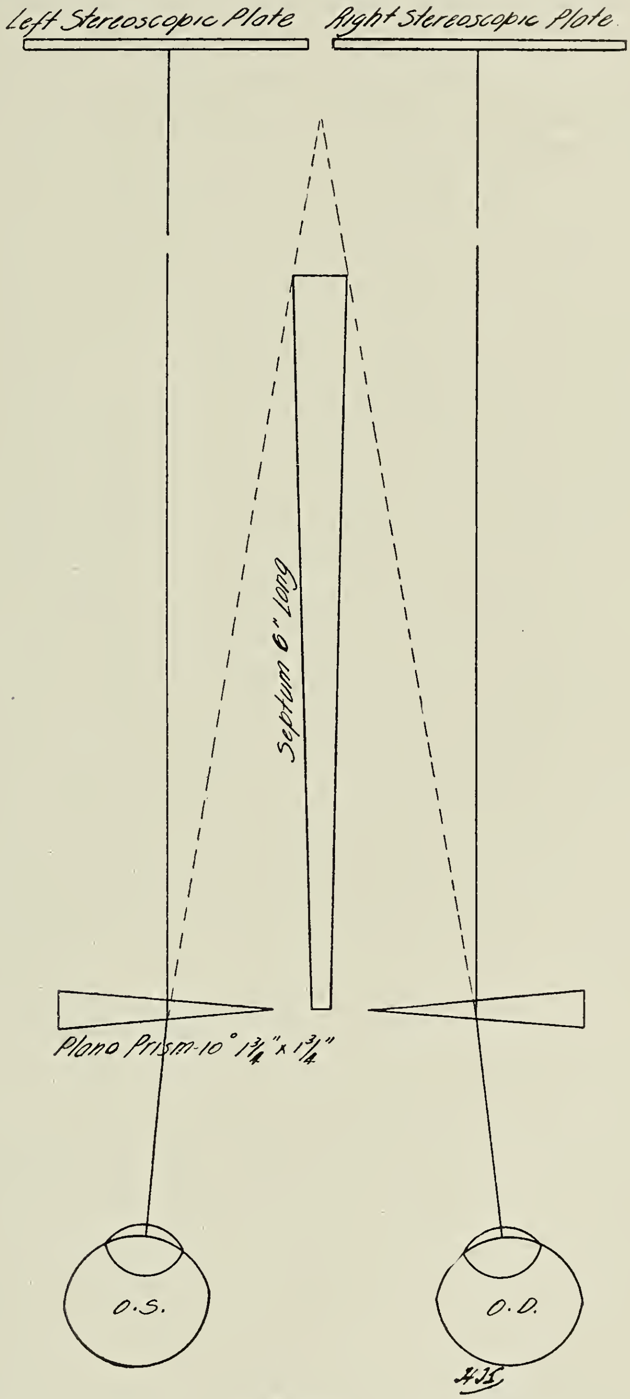



FIG. I

Illustrating theory and use of Dr. Threlkeld-Edwards' Stereoscope

As will be seen by referring to the photographs and the line-drawing, the instrument itself is extremely simple in design and construction, and the essayist claims no special creative originality in its evolution. The optical principle involved (See Fig. 1) is properly orthodox and respectably well known —even the architecture is reminiscent of an existing and popular type of hand-stereoscope. Nevertheless, this little stereoscope is, in action, unlike any of its prototypes now used in examining binocular pictures to give them the plastic or perspective effect, so far as my knowledge goes.

While it is quite possible that instruments of this type and contraction may have been made before, and even be in use at the present time, it is certain that there is nothing like it upon the market, or available for general use, anywhere.

Three of these instruments have been in daily use in my laboratory for several months now, and in this time the model has been tested out and compared with other stereoscopes by competent observers—in every way proving itself not only equal, but superior, to the most elaborate and expensive models. Its use is simplicity itself, no practice or experience in stereoscopic technique being required before a clear image in three dimensions is sensed; in this respect and in the clarity and plastic rotundity of the combined image, the Universal is superior to the Whetstone or Wenckebach instrument. There is also no objectionable reversal of planes, as with the former model; and, as no mirrors are employed in the Universal, there are no annoying and troublesome reflections or double images, as occur with both the Whetstone and Wenckebach types.

As both prisms have plane surfaces, the image is free from spherical aberration—so serious an objection when convex lenses of any form are employed.

In case the subjective image is blurred, therefore, the cause should be looked for in the observer's vision, for while it is certain that the eye possesses a wonderful power of accommodation, marked abnormality in vision will undoubtedly result in a certain amount of deviation from the usual binocular effect of this stereoscope—or any other for that matter.

From the foregoing, I think it has been proven that as a practical means for securing binocular vision of pairs of stereoscopic plates or prints, the Universal suffers less from optical defects and aberrations in any form than any similar instrument now obtainable, and it is introduced and offered to the profession in the confident belief of its general utility, as well as a trustful hope that it may prove a **sine qua non** in popularizing stereoroentgenology with the medical profession.

In order to facilitate the home construction of this instrument, the following description is made as explicit as possible; exact dimensions and detail explanations being given throughout. If constructed in this way—exclusive of labor—the Universal may be completed at a cost of less than two dollars.

I call the little instrument the Universal stereoscope, because it can be used equally well in examining stereo-negatives of any size, from lantern-slide plates to the fourteen by seventeen inch pictures of the chest and abdomen; or for paper prints, made from the above—either directly by contact, or by the reduction process. In the case of negatives, or diapositives mounted as transparencies, the plates for right and left eye are placed in their proper order before the illuminated back-ground; the right plate in line with the right eye, and vice-versa—both upon a common plane and with the adjacent edges in contact. The matter of properly illuminating the plates by transmitted light is of sufficient importance to be briefly considered. At home I use a large but narrow box, with an opening in front twenty by thirty-six inches in diameter. This is covered by a single pane of opal glass, to evenly diffuse the light from a number of tungsten lamps placed within the box. The interior of the box is lined with asbestos paper, to reflect light, as well as to prevent over-heating. The lamps, in order to preserve their characteristic white light, are controlled by switches and not by rheostats. The glass front is set at a slight angle, with just enough slope to prevent the plates falling forward. Provision is made to exclude any illuminated area, above or to the sides of smaller plates, by curtains of the black rubber cloth used for buggy curtains, etc.

For exhibitions before the County Medical Societies, I make use of a portable rack, similar to the one suggested by Dr. A. L. Gray, and described in the Quarterly for December, 1909. This rack is a most useful addition to the Roentgen equipment, and when properly illuminated by tungsten lamps, at least four sets of stereograms can be simultaneously examined by four observers, each using a Universal stereoscope for this purpose, with the plates arranged with two pairs on either side of the rack; the pairs being separated as far as possible from each other, and a portion of opaque black muslin, or rubber cloth, covering the space between, in order to limit the light, and confine each field of vision to the illuminated area of a single pair of stereograms.

In appearance the Universal somewhat resembles the popular hand-stereoscope known as the Holmes. This type was originally invented by Dr. Oliver Wendell Holmes, and is now used in Roentgenology to give the third dimension to small prints, reduced from regular stereoscopic negatives. The Holmes instrument is naturally restricted to this form of picture, since it uses a pair of prisms with convex surfaces, and this form of prism having magnifying power, has also a fixed focus. This property of the lenses, while enhancing the depth and beauty of the plastic picture produced by the prisms, quite unfits the instrument for any purpose where stereograms of more than three by four inches are to be examined, or when it is desired to examine any size picture, from both near and distant points.

The optical part of the Universal consists of a pair of matched "plano-prisms," of either eight or ten degrees, and in size not less than one and three-quarters inches square. These are set in a wooden frame, with bases out and apices towards the center, where the adjacent edges are separated by the middle part of the frame, three-quarters inch in width. The frame itself is of soft pine, or poplar, one-half inch thick by six inches long and four inches wide; the four corners being rounded until the frame is of oblong or lozenge shape. Two openings or "windows," to accommodate the prisms, are cut, one on each side of the three-quarter inch central portion. The prisms should fit these windows snugly, each being firmly held and supported in the correct position by adjusting small inner frames of aluminum tape around the edges.

An original feature of the Universal is a special septum situate in front of the prisms, and extending forward for nearly seven inches. This septum is essential to prevent superimposing of the images of the right and left plates, one upon the other. It is made of thin sheet aluminum or light wood, shaped to the form of a prism, with its apex—one-half inch wide—fixed to the frame, in front of and between the prisms. From the frame, it extends along a two and one-half inch base board, for six and one-half inches, ending in a base about one and one-quarter inches wide, forming here the front end of the instrument.

A hood of sheet aluminum surrounds the frame supporting the prisms, its function being to shade the prisms, and the eyes of the observer by cutting off adventitious reflections. To serve its purpose more efficiently, it is made to extend over both sides of the frame and is unlike the hood of the Holmes instrument in this respect. This hood not only acts as a shade, but it is so proportioned in the part extending backwards from the frame, as to maintain a certain distance between the prisms and the observer's eyes, for the stereoscopic effect is best obtained when a space of four inches or more exists between the cornea and the prisms. The hood is cut from a sheet of aluminum (about twenty gauge) twelve and one-half inches long by six inches wide; one side is cut in broad curves to accurately but comfortably fit the forehead and temples, etc.; the other side (to extend in front over the prisms) remains with straight edge. Thus fashioned, the hood is attached to the circumference of the frame by small screws set about one inch apart around the top and sides. In front it extends over the prisms and the apex of the septum for about one and one-half inches, thus effectively shading the glasses by intercepting reflections from above and at the sides, in front. From the back of the frame the hood passes to the shaped edge, measuring at the narrowest portion (the forehead) three inches and at the temples four and one-half. It passes downward around the cheeks to the level of the bottom of the frame and the base board, where a space of three inches between the lower edges is left open for ventilating, and to prevent condensation of expiratory moisture upon the prism surfaces.

A base board to support the septum and frame and to provide attachment to a handle, is cut from a thin piece of white pine, seven and one-half inches long by two and one-half wide, and it is secured to the bottom of the frame by three flathead screws, which should be countersunk flush with the surface.

In front the base-board extends as far as the base of the septum, the lower edges of the latter being firmly fixed to the board by small screws or flathead brads set at short intervals from apex to base. A thin piece of oak, two and one-half by three inches, to which is attached a hinged wooden handle, is screwed to the base-board, below the frame, and the instrument is complete except for the painting. It must be given a couple of coats of some good black paint, or varnish (one drying with a dull finish), to prevent reflection from the metal surfaces. For this purpose there is nothing better than a mixture of lamp black and shellac (orange or white). Before applying any varnish the prisms must be protected by paper pasted over the surfaces, or the glass will be badly splashed. The black shellac is to be applied with a small bristle varnish brush, evenly to all parts of the instrument—especially to the inner surfaces of the hood, to the sides of the septum and the top of base-board.

The foregoing description applies to the models made last summer, and which I exhibited at the Richmond meeting. Since that time I have added a simple attachment to hold binocular prints, etc., to the forward end of the stereoscope. This consists of a light frame seven by four inches, to hold the cards or glass transparencies; the frame is fixed to three small brass rods—sliding into tubes attached to the septum and base-board in such a manner as to slip in and out when focusing the pictures. Provision is also made to hold extra lenses before the prisms to magnify the pictures.

The salient features of the Universal may be summed up as follows:

It is universal in action, any size plate or print being perfectly seen at any distance.

It is free from optical defects and can be used without practice.

It is light, yet well balanced, and can be held steadily before the eyes for an hour at a time without fatigue of eyes, hand or arm, provided the view box is properly placed in front of the observer.

The prisms are so placed, and of such dimensions, that they accommodate without adjustment all variations in pupilary distances. I have yet to find an individual in possession of even fair vision in both eyes that cannot see a pair of stereoplates in proper perspective on the first handling of the instrument. In some cases it has been found necessary to carry the stereoscope a little farther away from the plates than is usual, before a beginner can combine the images; but after the plastic picture is once seen, the observer returns to the near view and is able thereafter to examine plates at any distance desired. The long septum effectually prevents superimposing the two images in all normal cases, and eight by ten plates may be correctly viewed from any point between six inches and twelve feet (in the former position the end of the septum will be in contact with the adjacent edges of the plates), but of course there is with every set of stereograms a certain and predeterminate optical distance from which the picture is best seen, depending, no doubt, upon the tube-plate distance of the original exposure. In viewing fourteen by seventeen inch plates it is usually necessary to go back six or seven feet, in order to properly see the whole of the plates at once, though adjacent portions of them may always be viewed at close range.

Fig. 2

Dr. Threlkeld-Edwards' Stereoscope

# THE BROMIDE PAPER SCREEN TECHNIQUE.

BY LEWIS GREGORY COLE, M. D., NEW YORK.

While the use of bromide paper as a substitute for plates is not new, it having been used as long as ten years ago for direct exposures of extremities, I do not know of its having been used in conjunction with an intensifying screen for more difficult work such as head, kidney, spine and gastro-intestinal tract. The manufacturer of an intensifying screen—practically free from grain—revolutionized radiography. While its greatest application is in the gastro-intestinal radiography, it is not by any means limited to this region, and I am using it, exclusive of lung radiography, more and more extensively for other regions.

The selection of different plates for various types of radiography is being adopted by many radiologists. One kind of plate is used where speed is an important factor and another where contrast and crispness are desired. But very little advance has been made toward obtaining a plate which could be considered strictly an X-ray plate.

One of the principal disadvantages of an intensifying screen is the fact that the X-ray must penetrate either the screen or the plate before reaching the emulsion. While personally I think there is little choice, the manufacturers of the screen advise using the plate in the reverse position, allowing the rays to pass through the plate rather than the screen. The variation in the thickness and compositions of the glass add a variable factor which is much increased when one is using a low vacuum tube. The use of a film of course would overcome this, but it occurred to me that bromide paper with the intensifying screen might be of value, particularly in light work, but I was surprised to see that it was also of value in the more difficult work.

The advantages of bromide paper are that it is lighter, not easily broken, and a dark room is not necessary for develop-

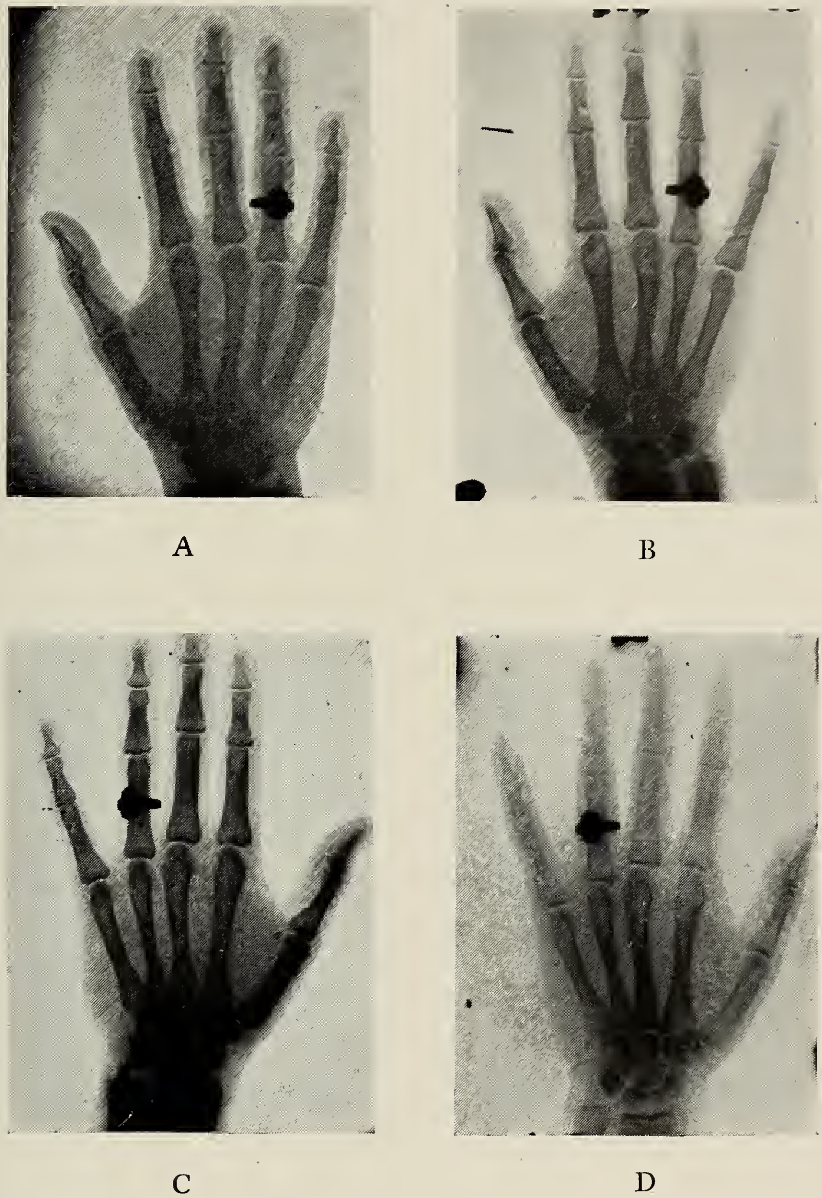



FIGURE 1.

(A) Hand without screen—paper negative.
(B) Hand " " —plate negative.
(C) Hand with screen—paper negative.
(D) Hand " " —plate negative.

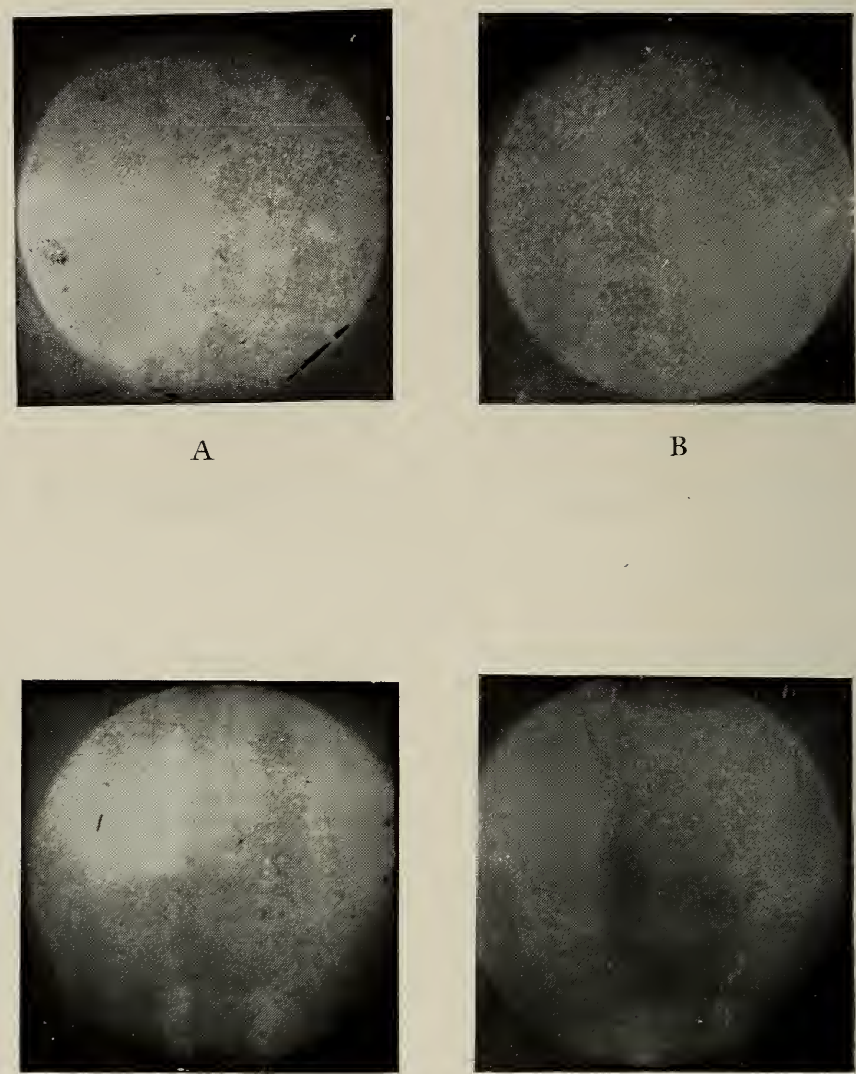



Figure 2—Trunk region.

(A) Kidney stone—paper with screen.
(B) Kidney stone—plate without screen.
(C) Spine of 200 lb. woman with screen and paper.
(D) Spine of same woman without screen on plate.

ment; it is rapidly developed and fixed, and the rays do not have to penetrate glass before reaching the emulsion; it does not scratch or rub the delicate surface of the screen; it is much less expensive and as many negative prints as are desired may be trimmed and squeegeed on glass and photographed before dry, giving a finished positive reduced print of all the negatives on one print in a few minutes. There are many disadvantages of the bromide negative print, but most of these can be remedied. The most rapid paper that I have yet obtained is much slower than the regular X-ray plates, but undoubtedly this can be improved and I see no reason why any plate emulsion could not be applied to paper. In hot weather the paper is likely to blister, but not more so than a plate is to frill; we are much less accustomed to examining negative prints than we are negative plates; paper is readily torn but this can be prevented by backing prints with cloth.

Figure 1—Illustrates the character of radiograms of extremities made on paper and plates with and without screen. Detail in bone structure is the one place where the screen is at a disadvantage, therefore, while the hand is the easiest of all parts for regular radiographs, it is the most difficult for screen work.

Figure A—Is a radiograph made with bromide paper without screen.

Figure B—Is with a plate without screen.

Figure C—Is with bromide paper with screen.

Figure D—Is with plate with screen.

Figure 2—Illustrates the relative value of paper with screen compared with plates without screen for radiographs of the trunks.

Figure A—Is a radiograph on paper with screen of a large man. It shows two kidney stones and the outline of the kidney.

Figure B—Is the best of several radiographs of the same patient made on plates without a screen.

Figure C—Is a radiograph on paper with screen of the spine of a woman about five feet three who weighed 200 pounds.

Figure D—Is the best of a series of radiographs of the same woman made on a plate without screen.

Figure 3—Shows four radiographs of the stomach of a moderate sized woman; these are made on paper with a screen and demonstrate that even with a slow bromide paper exposures may be made sufficiently short to show the gastric peristalsis.

Figure 4—Demonstrates that even in radiography of the head the use of paper and screen compares favorably with that of plate without screen.

Figure 5—Shows the cæcum, ascending colon and appendix well filled with bismuth solution.

Figure 6—Demonstrates the very great practical value of this method. This case was a young girl who had been shot in the back with a 22 calibre bullet and was practically paralyzed below the waist. The accident happened in the country and in the nearest town to which she was taken only alternating current was available. The examination was made on a bed with a small "dress-suit case" coil and a single cell rectifier. Only two radiographs using paper and screen were made; the first was developed by my assistant in a shaded room, but without a red light, while the second exposure was being made; and the second paper negative was developed in like manner while the third exposure on a plate without a screen was being made; and within three minutes after the second exposure was made, we were studying the bromide negative which is shown in Figure 6—A. This paper negative was carried home in a wet roll and not thoroughly washed until the next day and it has turned yellow which makes reproduction difficult.

Four plates were made and later developed at the laboratory and the best one of the four plates is shown in B. and you will see that the original bromide negative obtained within three minutes after the exposure and developed in a practically darkened cellar compares favorably with the best of the plates.

Figure A—Is a radiograph on paper with screen.

Figure B—Is a radiograph on plate without screen.

While I do not advocate the universal use of paper as a substitute for plates, this article shows that it may be used even on the most difficult cases, but it is of greatest value in cases of foreign bodies or fractures. Where an immediate report

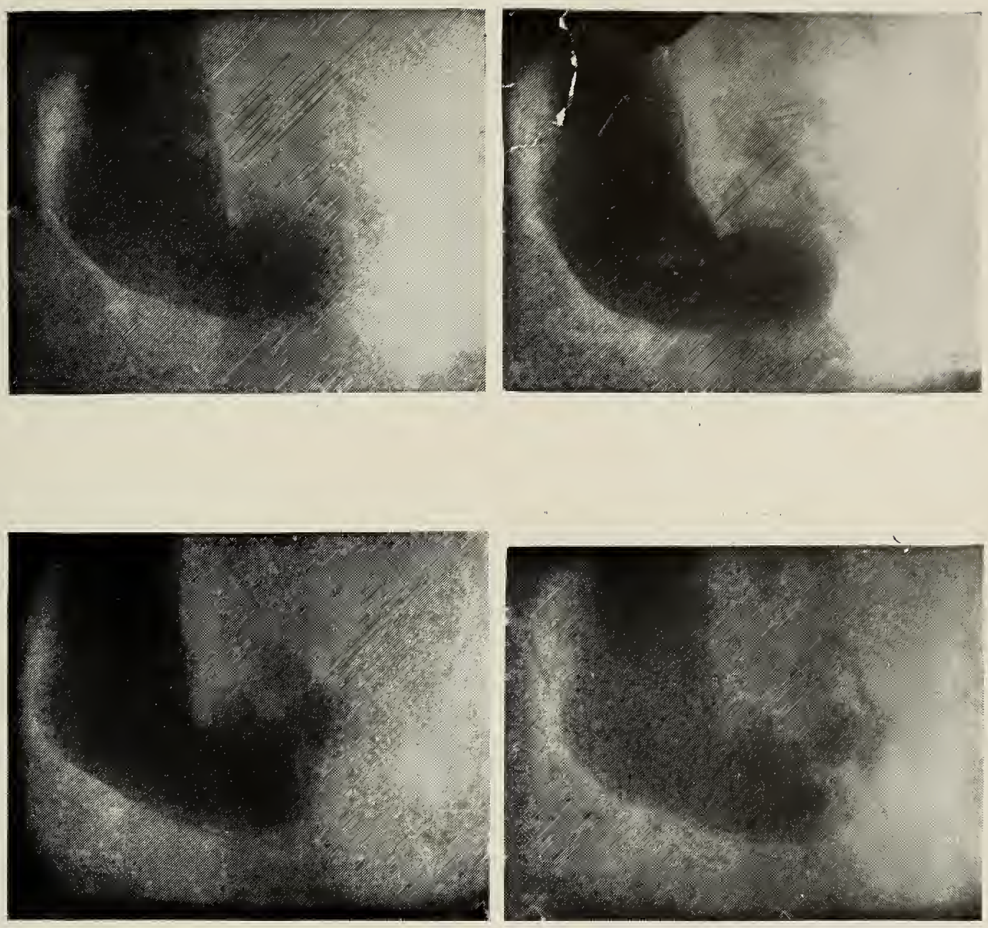
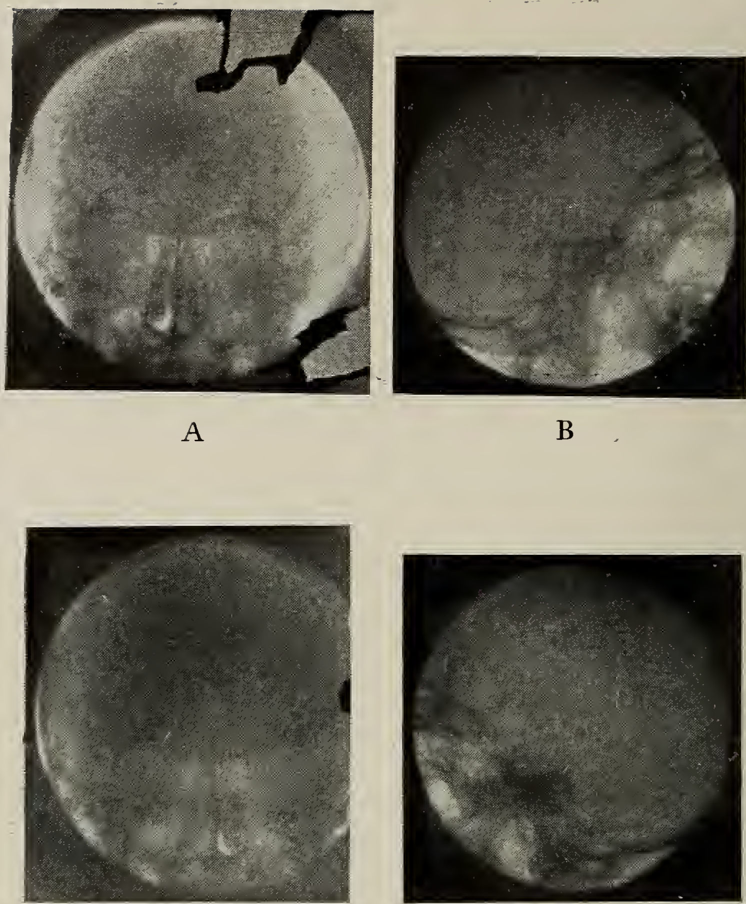


FIGURE 3.

Four stomach plates with paper and screen showing gastric peristalsis.



A B

C D

FIGURE 4.

(A) Antero-posterior head with screen and paper.
(B) Lateral head with screen and paper.
(C) Antero-posterior head without screen and plate.
(D) Lateral head without screen and plate.

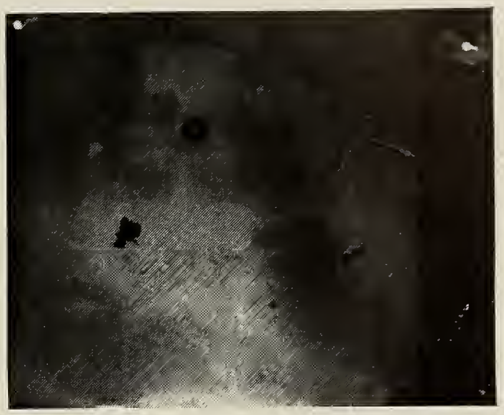
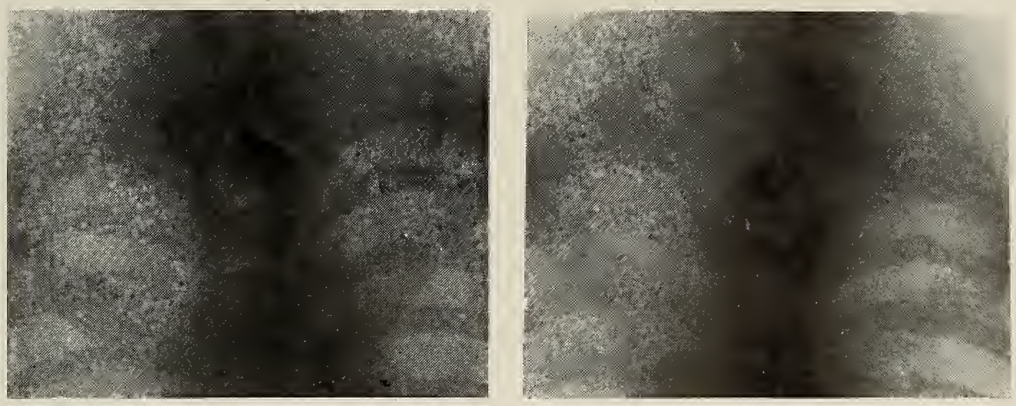


FIGURE 5—Appendix and colon.



A B

FIGURE 6.

(A) Paper with screen—best of two exposures.
(B) Plate without screen—best of five exposures.

is desired, the prints can be developed and fixed so rapidly that the first print may be studied while the third is being made, and if the position is not satisfactory it can be altered and another made without delay—it takes the place of a fluoroscopic examination and gives a permanent record.

# ARTIFICIAL DILATION OF THE DUODENUM FOR RADIOGRAPHIC EXAMINATION.

BY LEWIS GREGORY COLE, M. D., NEW YORK.

This is a preliminary paper on a method of examination which was described in an article entitled "The X-Ray Diagnosis of Pyloric and Duodenal Lesions," read before the American Association of Obstetricians and Gynecologists at Louisville, September 26, 1911.

The lumen of the entire duodenum can be determined by the following procedure: The patient swallows an Einhorn pyloric dilator. This is a small ball attached to a small rubber tube. Near this ball is a small rubber bag which collapses around the tube just behind the ball. This is as easily swallowed as the "old-fashioned pill" and may be administered with food the day before the examination, or given a short time before the examination when the patient assumes a position which will readily allow it to pass into the duodenum and jejunum.

The small rubber bag, which is surrounded by a silk bag about the size of the lumen of the duodenum, is then inflated with air and acts as an intestinal obstruction; bismuth and buttermilk is then given by mouth and passes readily into the duodenum. The temporary obstruction prevents the bismuth from passing on through the jejunum. The duodenum is dilated by the bismuth and buttermilk and a radiogram shows perfectly the contour of the dilated duodenum. If any portion of the duodenum is held down by adhesions either from duodenal or gastric ulcer, or gall bladder infection, it fails to expand and the constricted area is distinctly shown radiographically. This procedure may be done purely for diagnostic purposes, or the air may then be removed from the rubber bag and the bag withdrawn till it reaches the area of constriction, and that portion of the duodenum bound down by adhesions may then be stretched by inflating the bag with air;

this may be done under fluoroscopic examination. The same procedure is applicable to the pylorus. The advantage of this method is that all friction on the mucous membrane is avoided by not drawing the bag through the duodenum or pylorus while it is inflated with air.

I believe that the following modification of Einhorn's pyloric dilator will be of great value: A second tube slightly larger than the first surrounds it and terminates just behind the rubber bag. Through this tube bismuth and buttermilk, or bismuth suspended in some other fluid may be injected or aspirated directly from the duodenum, and the exact amount of distention of the duodenum thus controlled.

Besides showing adhesions from duodenal and gastric ulcers, and gall bladder infection, the head of the pancreas can be more perfectly outlined by the duodenum as suggested by Doctor Crane, and in some cases the canal of Wirsung may be distinctly shown.

## AMERICAN ROENTGEN RAY SOCIETY.

Proceedings of the Twelfth Annual Meeting held in Richmond, Va., September 20-23, 1911, at the Hotel Jefferson, under the presidency of Dr. Percy Brown, Boston, Mass.

### First Day—Morning Session.

The Society assembled in the Auditorium of the hotel, and was called to order by the president at 9:30.

The secretary, Dr. F. H. Baetjer, read by title the minutes of the 1910 meeting as published in the Quarterly, December, 1910, and on motion, they were adopted as printed.

The Chair then called for the report of the secretary, and Dr. Baetjer responded as follows:

Mr. President and Members of the Society: Never before has the Society been so well organized as now, and never since its inception has the membership been so representative of the best in roentgenology as now. It consists largely of experts in this field of endeavor and men all of them of high professional standing, and who are possessed by a lively interest in this work. The society is to be congratulated on what it has accomplished in advancing the technical side of roentgenology, and in placing this work on a sound and rational basis as one of the greatest and most valuable specialties of medicine—valuable not only to the professional man but to the layman as well.

The time has come when membership in the society should be regarded as the highest possible reward for work done conscientiously and well. Therefore, I would suggest that some action be taken at this meeting to raise the requirements for membership beyond what they are now,—for instance, to require a thesis from each candidate.

(Signed) F. H. BAETJER, Secretary.

On motion the report was received and ordered published.

The secretary then announced that Dr. Alban Koehler, of Germany, had presented the society with a copy of his book on "Roentgen Procedures."

On motion, the secretary was ordered to convey to Dr. Koehler the thanks of the society for his kind remembrance.

The report of the treasurer was then called for, and Dr. Bowen submitted his report.

On motion of Dr. Stover the report was received, and the suggestions contained therein, as well as the suggestion made by the secretary were referred to a committee for consideration, said committee to consist of the members of the executive committee and two other members to be appointed by the Chair.

The Chair appointed Drs. Stover and D. R. Bowen to assist the executive committee.

On motion of Dr. Caldwell a rising vote of thanks was extended to Dr. P. M. Hickey for his valuable and efficient services as editor of the Quarterly.

Dr. E. H. Skinner here moved that the chair appoint a committee of five to consider the feasibility of the publication of a volume of Transactions of the annual meetings in addition to the Quarterly, the former to contain the proceedings in full, the latter to contain only the papers.

Seconded. Carried.

The Chair appointed on this committee Drs. Thos. F. Stewart, R. H. Boggs, C. E. Coon, P. M. Hickey and D. R. Bowen.

Dr. C. E. Skinner moved that immediately after each annual meeting an alphabetical list of the membership of the society be sent to each member, together with a list of the past and present officers of the society and the dates of their service.

Seconded. Carried.

The Society then arose from executive session and proceeded with the scientific program.

Dr. James W. Hunter, Norfolk, Va., contributed a paper on "The Roentgen Ray in Hypertrophied Prostate—A Therapeutic Study." The discussion on the paper was opened by Dr. Hollis E. Potter, and continued by Drs. Threlkeld-Edwards, Geo. E. Pfahler, A. Judson Quimby and J. W. Hunter.

Dr. Clarence E. Skinner, New Haven, Conn., followed with a paper on "Routine Postoperative Roentgenization in Cancer." The paper was discussed by Drs. Geo. E. Pfahler, Threlkeld-Edwards, J. H. Edmondson, Thos. F. Stewart, W. S. Newcomet, W. H. Eagar, H. W. Dachtler, J. H. Selby, F. H. Baetjer and C. E. Skinner.

The Society then adjourned until 2.30 P. M.

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**Afternoon Session.**

The Society re-assembled and was called to order by the president at 2.30.

The Chair then appointed the following Nominating Committee: Drs. W. F. Manges, R. H. Hammond and P. M. Hickey.

Dr. Russell H. Boggs, Pittsburgh, then read a paper entitled "Carcinomatosis of Bones, Secondary to Growth in Some Epithelial Organ." The discussion of this paper was participated in by Drs. H. K. Pancoast, Geo. E. Pfahler, Kennon Dunham, F. H. Baetjer, Geo. H. Stover, C. E. Skinner, H. W. Dachtler, J. H. Selby and R. H. Boggs.

Dr. Arthur Holding, Albany, N. Y., followed with a paper entitled "Pathology Revealed by the Roentgen Ray in Cases of Neurasthenia, Neuroses and Other Cases of Indefinite Diagnosis."

Dr. Henry K. Pancoast, Philadelphia, contributed a paper on "The Importance of Dental Defects as Factors in the Etiology of Idiopathic Epilepsy." These two papers were discussed jointly by Drs. E. H. Skinner, Kennon Dunham, Geo. C. Johnston, Geo. E. Pfahler, D. R. Bowen, C. E. Coon, Threlkeld-Edwards, Geo. H. Stover, Arthur Holding and Henry K. Pancoast.

"Roentgencinematography" was then discussed by Dr. Sidney Lange, of Cincinnati, followed by Drs. Caldwell, W. F. Manges, Geo. H. Stover and Lewis G. Cole.

The Society then adjourned until the following day at 9:30 A. M.

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At 8 o'clock in the evening of this day, September 20th, the society and its guests assembled in the auditorium to attend an open session presided over by Dr. George Ross, president of the Richmond Academy of Medicine. Addresses of Welcome were delivered by the Honorable Wm. Hodges Mann, Governor of Virginia, for the State; Honorable D. C. Richardson, Mayor of Richmond, for the City, and Dr. Stuart McGuire, for the profession of Richmond.

Responses on behalf of the Society were made by Dr. Percy Brown and Dr. Geo. C. Johnston.

A reception and luncheon given by the City of Richmond concluded the festivities of the evening.

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### Second Day—Morning Session.

The Society convened at 9:30 and was called to order by the president, Dr. Brown.

A paper, entitled "Laboratory Notes" was read by Dr. D. R. Bowen, Philadelphia, and was discussed by Drs. P. M. Hickey and Geo. E. Pfahler.

Dr. George E. Pfahler, Philadelphia, followed with a paper on "The Variability of the Focus of the Roentgen Ray Tube and a Simple Means of Selecting a Picture Tube." The paper was discussed by Mr. H. Clyde Snook, Drs. H. W. Dachtler, Sidney Lange, F. H. Baetjer, E. W. Caldwell, C. L. Leonard, Lewis G. Cole, P. M. Hickey, A. J. Quimby, W. H. Eagar and Geo. E. Pfahler.

Dr. Pancoast, chairman of the committee appointed to consider the suggestions contained in the reports of the secretary and the treasurer, reported as follows:

Your committee has carefully considered the suggestions made by the secretary and the treasurer in their reports to the society read yesterday, and begs leave to report that it is the opinion of the committee that hereafter applicants for membership in the society shall subscribe to the following rules:

MEMBERSHIP.

1. Form of application blank suggested.

Date........................

Name ........................................

Birthplace ........................................

Age ........................................

Residence ........................................

Medical Degree obtained at ........................
Collegiate or other degrees ........................
Served as interne in the following Hospitals: .........

.................................................

.................................................

Years in practice of medicine ........................
Knowledge of Roentgenology obtained where.........

.................................................

Years of practice of Roentgenology ................
Extent of practice outside of Roentgenology .........

.................................................

Other specialties practiced ........................
Present Hospital and Medical College connections......

.................................................

Membership in learned Societies ...................
Bibliography ....................................

Signed by two members in good standing and acquainted with applicant.

Accompanied by letters of recommendation from—(*a*) Those who sign. (*b*) At least one practicing physician or surgeon in good standing residing in applicant's immediate vicinity.

### REQUIREMENTS FOR MEMBERSHIP.

1. Applicant must have been a graduate in medicine and have been engaged actively in X-Ray work for at least two years after his graduation, and must submit a scientific paper on Roentgenology to Executive Committee, which, if approved, may be published in the Proceedings of the Society.

2. Send to Chairman Executive Committee at least six months before next meeting at which it is to be acted upon.

3. Publish names and signers' addresses in Quarterly or by letter at least twice before meeting at which they are to be acted upon. Objections sent to Chairman Executive Committee as soon as possible for filing.

4. Read names and proposers before meeting before they are acted on by Executive Committee.

5. Executive Committee to hold over any applications for further consideration that are—(*a*) Not made public according to above. (*b*) Not entirely satisfactory or insufficient data at hand.

6. Executive Committee to have power as heretofore to reject.

7. Voted for by secret ballot.

8. Applicants are privileged to attend meeting as guests.

On motion of Dr. Manges, the committee was empowered to print its report for immediate distribution to the members present at the meeting, and that the consideration of the report be made a special order of business at 10 A. M. on the following day.

Seconded. Carried.

Dr. F. H. Baetjer here proposed to amend Art. III, Section 3, to read so as to authorize the treasurer to drop from the membership roll all those who are delinquent six (6) months after the annual meeting.

Dr. E. H. Skinner proposed to amend Art. III, Section 3 as follows:

No member who is in arrears for annual dues shall vote, hold office or be entitled to receive the transactions. It shall be the duty of the treasurer to erase from the rolls of membership the name of every person who is in arrears for one year, thirty (30) days after the receipt of a registered letter by said member, such action to be reported at the next annual meeting for confirmation.

The Society then adjourned until 8:30 P. M.

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In the afternoon the members and guests were given an automobile ride through the city of Richmond by the local committee of arrangements and their friends. This was followed by a tea at the Country Club of Virginia.

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**Evening Session.**

The Society re-assembled and was called to order by vice-president E. H. Skinner at 8:30.

The president, Dr. Percy Brown, then delivered his address, entitled "The Interrelation of Roentgenology and the Law."

Dr. Eugene W. Caldwell, New York, followed with a paper on "The Roentgen Laboratory in the Hospital and Medical School." The discussion on this paper was participated in by Drs. H. K. Pancoast, Lewis G. Cole, F. H. Baetjer, Geo. E. Pfahler and E. W. Caldwell.

The president here took the Chair, and the Society then went into executive session.

Dr. Geo. C. Johnston, on behalf of the Board of Censors, presented the following report:

The Board of Censors of the American Roentgen Ray Society regrets to report that incontrovertible evidence has been submitted that Dr. J. Rudis-Jicinsky, of Cedar Rapids, Ia., has been guilty of gross intentional fraud, practiced on a patient, same consisting of the substitution of radiograms of dry bones and anatomical specimens instead of the real radiograms supposed to have been made by him of a patient under examination, later examination revealing entirely different pathologic conditions present. The prints submitted as evidence and given to the patient as true Roentgen pictures of himself are those of portions of the skeleton, the bones of which have been fractured artificially, and the skeleton that of a person of entirely different size and stature and sex. The prints do not represent what they are stated to be.

The Board of Censors therefore recommends that the above mentioned J. Rudis-Jicinsky be expelled from membership in the American Roentgen Ray Society and that notice of such action be sent to the Iowa State Medical Society with copies of the evidence submitted to the American Roentgen Ray Society.

(Signed) GEO. E. PFAHLER,
EUGENE W. CALDWELL,
GEO. C. JOHNSTON.

On motion of Dr. Dunham the report was accepted and the secretary instructed to carry out the wishes of the society as expressed in the report. Carried.

The question of incorporating the society was then brought up for discussion. On motion the entire matter was referred to the Executive Committee with instructions to report at the next annual meeting.

The society then adjourned until 9:30 A. M. the next day.

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A lantern slide demonstration by various members, with informal discussion, followed.

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### Third Day—Morning Session.

The society re-assembled at 9:30 and was called to order by the president.

Dr. A. Judson Quimby, New York, read a paper entitled "Some Observations on the Multiple Spark Gap in Series with the Roentgen Ray Tube."

Dr. Joel E. Goldthwait, Boston, followed with a paper entitled "The Importance of the Proper Understanding of the Relation of the Anatomic Viscera in the Treatment of Autointoxication and Autoinfection." The discussion was participated in by Drs. Percy Brown, Geo. E. Pfahler, Arthur Holding, C. L. Leonard, F. H. Baetjer, C. E. Coon, P. M. Hickey, K. Dunham, W. H. Eagar, R. H. Hammond and J. E. Goldthwait.

On motion of Dr. Leonard, a vote of thanks was extended to Dr. Goldthwait for his splendid contribution.

On motion, the society then went into executive session.

Dr. Holding moved the consideration of the report of the committee on the reports of the secretary and the treasurer. Seconded. Carried.

This was done, and the report was adopted.

On motion of Dr. Holding the Executive Committee was instructed to act on the applications received prior to this time on the basis of the former requirements for membership.

Dr. F. H. Skinner's amendment to Art. III, Section 3, was then read and adopted as presented.

This action made unnecessary a vote on Dr. Baetjer's amendment of the same Article, therefore Dr. Baetjer withdrew his amendment.

Dr. P. M. Hickey then offered the following amendments:

Article V, Section 5: Add, "The new member of the Executive Committee to be elected by ballot, the polls to be open at the registration bureau for twenty-four hours; the one receiving the highest number of ballots to be declared elected."

Article V, Section 5: Add, "and shall transact the business of the society."

Article VI: Add, "and there shall be one executive session."

Dr. Leonard moved that the Chair appoint a Committee on Index from a group of volunteers. Seconded. Carried.

The society then arose from executive session and proceeded with the scientific program.

Dr. P. M. Hickey, Detroit, contributed a paper on "The Roentgen Diagnosis of the Position in Pregnancy," which was discussed by Drs. W. F. Manges, Geo. E. Pfahler, J. H. Selby, H. W. Dachtler and P. M. Hickey.

Dr. Chas. F. Bowen, Columbus, read a paper on "The Use of the Fluoroscope as a Guide for the Bronchoscope and Esophagoscope in the Removal of Foreign Bodies." The paper was discussed by Drs. Geo. C. Johnston, K. Dunham, C. L. Leonard, Geo. E. Pfahler, W. F. Manges, P. M. Hickey, W. S. Newcomet, Lewis G. Cole, J. H. Selby, Sidney Lange, Geo. C. Johnston, H. E. Potter and C. F. Bowen.

The society then adjourned until 2:30 P. M.

## Afternoon Session.

The society reassembled and was called to order by the president at 2:30.

The Executive Committee recommended that the next annual meeting of the society be held at Niagara Falls, N. Y.

On motion, this recommendation was accepted.

The Executive Committee then proposed to amend Article IV of the constitution by adding the word "librarian" after the word "treasurer."

A motion by Dr. Johnston to the effect that at the next annual meeting no evening sessions be held was both seconded and carried.

Dr. Chas. L. Leonard, Philadelphia, then presented a paper on "The Compensating Displacements of the Thoracic Viscera in Pulmonary Tuberculosis." The paper was discussed by Dr. Sidney Lange.

Dr. W. F. Manges, chairman of the Nominating Committee, submitted the following report:

President: Frederick H. Baetjer, Baltimore; vice-presidents, H. W. Van Allen, Springfield, Mass., G. M. Steele, Oshkosh, Wis., J. H. Edmonson, Birmingham, Ala., W. H. Eagar, Halifax, N. S., and Hollis E. Potter, Chicago; secretary, H. K. Pancoast, Philadelphia; treasurer, Chas. F. Bowen, Columbus, Ohio; member of Executive Committee, Alfred L. Gray, Richmond, Va.; Publication Committee, P. M. Hickey, Detroit, Sidney Lange, Cincinnati and D. R. Bowen, Philadelphia.

On motion, the report was accepted, and the president instructed to cast the ballot of the society for the election of the nominees, which he did, and they were declared duly elected.

Dr. Kennon Dunham, Cincinnati, then read a paper on "Studies of Roentgen Ray Chest Plates of Tuberculosis."

Dr. Geo. H. Stover, Denver, read a paper on "Roentgenographic Diagnosis of Ureteral Kinks causing Hydronephrosis."

Dr. J. Hunter Selby, Rochester, Minn., followed with a paper on "Collaboration Essential in the Diagnosis of Surgical Conditions of the Kidney and Ureter."

Dr. Stover's paper was discussed by Drs. Selby, Brown and Stover.

Dr. Selby's paper was discussed by Drs. E. W. Caldwell, Percy Brown, C. L. Leonard and J. H. Selby.

Dr. Edward E. Skinner, Kansas City, Mo., contributed a paper entitled "Duodenal Diagnosis." The paper was discussed by Dr. Pfahler.

Dr. Threlkeld-Edwards. So. Bethlehem, Pa., then exhibited a portable stereoscope and a convenient, practicable plate marking system by means of aluminum tags.

The society then adjourned until the next day at 9:30 A. M.

In the evening the society was entertained at a reception held at the Commonwealth Club. A very pleasing program contributed in large measure to the pleasure of the evening.

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**Fourth Day.**

The society re-assembled and was called to order by the president at 9:30.

The Executive Committee reported favorably on the applications for membership of the following:

E. T. Brady, Roanoke, Va.; Lester W. Cunningham, Jacksonville, Fla.; Anna K. Davenport, San Francisco; Paul Eisen, Milwaukee; James S. Eldredge, Kansas City; Arthur C. Heublein, Hartford, Conn.; George Winslow Holmes, Brookline, Mass.; Charles Wentworth Hoyt, Rochester, N. Y.; O. H. McCandless, Kansas City; Hugh J. Means, Columbus, Ohio; Alfred G. Nadler, New Haven, Conn.; John E. Short, Canton, Ohio; Albert Soiland, Los Angeles, Cal.

On motion the report was accepted and the secretary instructed to cast the ballot of the society for the election to membership of the applicants named, which he did, and they were declared duly elected.

Dr. Thos. F. Stewart, chairman of the reference committee on publication, reported that the committee suggested that the committee on publication be instructed to publish the proceedings of the society as soon as possible after the meeting, that the Quarterly be continued and also contain abstracts of the leading roentgenologic papers published in other journals.

On motion, the report was accepted and the committee on publication instructed accordingly.

The amendment proposed by Dr. Hickey with reference to the election and duties of the Executive Committee was again read and on motion of Dr. Pfahler was adopted.

The amendment introduced by Dr. Hickey entrusting the Executive Committee with the transaction of the business of the society was then read, and adopted on motion of Dr. Dunham.

The amendment introduced by Dr. Hickey providing for one executive session at each annual meeting was also read, and on motion of Dr. Pancoast was laid on the table.

The amendment introduced by the Executive Committee creating the office of librarian was read, and on motion of Dr. Stover was adopted.

The Nominating Committee, through its chairman, Dr. Manges, proposed the name of Dr. H. W. Dachtler for the office of librarian, and on motion of Dr. Pancoast, the secretary was instructed to cast the ballot of the society for the election of Dr. Dachtler to this office, which he did, and Dr. Dachtler was declared duly elected.

Dr. Chas. L. Leonard: We have been the participants of hospitality here during this meeting which is unique in the history of the society. It was hospitality typical of the South. We have partaken of all the sweets of a Southern welcome—to say nothing of the sora. Sora soar high—but far above them will soar our appreciation of the hospitality of Richmond and its warm-hearted people. We cannot express our thanks fittingly. Words fail me; but we have tried to show our appreciation by the measure of our enjoyment. Now, I move you, Sir, that we extend to the local committee of arrangements, to the local members of the profession and to the people of Richmond who contributed so freely and heartily to our pleasure a rising vote of thanks. (Applause).

The motion was duly seconded and carried with cheers and applause.

After a few well chosen words on his own behalf, expressing his pleasure and appreciation of the valuable and willing aid given him by the members of the society, the president, Dr. Brown, introduced the president-elect, Dr. F. H. Baetjer, to the society. (Loud applause.)

Dr. Baetjer: Mr. President and Members of the Society: In selecting me as your president from among so many men more worthy of the highest office in your gift, you have overwhelmed me. It is, indeed, an unexpected honor, one which, I fear, I little merit, but I shall endeavor to live up to your expectations and, if possible, emulate the splendid example set by our retiring president, Dr. Brown. I appreciate this honor more than I can tell you. (Applause.)

Dr. Stover moved a rising vote of thanks to Dr. Brown for his untiring and efficient services on behalf of the society.

Seconded and carried with ringing rounds of applause.

The scientific program was then taken up.

Dr. Roland Hammond, Providence, R. I., read a paper entitled "The Control of Fracture Work by the Roentgen Rays." The paper was discussed by Drs. A. Holding, Lewis G. Cole, F. H. Albee, Geo. C. Johnston, Cotton, C. E. Coon and R. Hammond.

Dr. Fred H. Albee, New York, followed with a paper on "The Roentgen Ray in Certain Hip Conditions."

Dr. Hollis E. Potter, Chicago, contributed a paper on "The Neuropathic Spine (Charcot); Pulmonary Metastases from Papillomatous Cysts of the Ovary," which was discussed by Drs. Baetjer, Ashbury and Potter.

There being no further business to come before the society, it adjourned, subject to the call of the Executive Committee.

PERCY E. BROWN, M. D.,
President.

FREDERICK H. BAETJER,
Secretary.

# ABSTRACTS FROM FORTSCHRITTE AUF DEM GEBIETE DER RONTGENSTRAHLEN BAND XVI NO. 4 & 5 BAND XVII NO. 2.

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## Influence of the Roentgen Ray upon Pus-Formers from the Horse.

BY DR. WALTER BAYREUTHER.

The following conclusions are drawn:

1. Contrary to most experimenters, the author was able to produce slight inhibition in the growth of staphylococcus aureus and albus, bacillus pyocyanus by ordinary therapeutic doses of the X-ray.

2. To produce similar effect upon streptococcus pyogenes six times the erythema dose was required.

3. Whether the virulence of the bacteria is affected is doubtful.

4. Doses up to fourteen times the erythema dose failed to kill the germs.

5. There was no latent period between exposure and maximum effect.

6. Close to the tube, electrical discharge and secondary rays are probably bactericidal.

7. Fluorescent light has no effect upon bacteria.

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## First Report of the Recognition of the Different Heart Cavities upon the Radiograph during Life and Calcareous Deposits in the Heart Outline.

BY F. M. GROEDEL.

A radiograph of a woman twenty-nine years of age is presented in which the outline of the left auricle and left ventricle can be distinguished. Also a large calcareous plate which the author believes represents a degenerative process in the pericardium.

## Compression Fracture of the Ossification Nucleus of the Tarsal Scaphoid.

BY DR. STUMME.

Compression fractures of the scaphoid bone of the foot are a common observation in adults. In children, however, the condition is not common and is often overlooked because the injury produces usually a flattening of scaphoid nucleus and not a distinct fracture. The condition was first described by Kohler (Kohler's bone-disease), the present report being the fourth case on record.

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## The Early Stage of Spondylitis Deformans.

BY DR. ERICH PLATE.

Concerning this condition which is met with so frequently in routine X-ray work, the author concludes that:

1. Many cases give rise to no symptoms.

2. Trauma plays a great part in developing and continuing this condition, especially when the spine has not its normal movements, when static relations are changed, or when the protection of a powerful musculature is absent.

3. Since it is possible to recognize it early by the X-ray we must look for it even under fifty years.

4. Symptoms tend to disappear and recur.

5. Heat, counter-irritation and a supportive corset are important in the treatment.

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## Tuberculous Lung Involvement upon the Radiogram and Its Anatomic Basis.

BY DR. VON DEHR.

In order to make comparison between the shadows upon the radiograph and the findings upon dissection of the lung, the author made a series of observations upon cadavers, first radiographing the chest and then verifying the shadows by autopsy. Some discrepancies were found. In one case what appeared to be small calcified nodes proved to be deposits in the costal cartilages, while enlarged glands in the lung hilus failed to show on the plate. He found that cancer nodes and fibrous scars can give a diffuse shadow resembling fresh infiltration. Because of the superimposition of tissues and summation of shadows, the significance of the hilus shadows may be doubtful and anthracitic glands may give the same shadow as tubercular glands. While taking cognizance of the fact that the physical conditions in the living chest differ greatly from those in the cadaver, yet the author warns against regarding the radiograph as absolutely reliable in incipient and latent tuberculosis.

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## Estimation of Size of Stomach by X-Ray.

BY DR. KLAUS HOFFMANN.

A comparison of the bismuth method with that of inflation was made. Fluoroscopic tracings were made with the trochoscope in both erect and recumbent positions, first with stomach inflated and then with the bismuth meal.

As standards of measurement, the following were adopted:

1. Greatest vertical diameter.
2. Greatest horizontal diameter.
3. Distance of lower pole above umbilicus.

Considerable differences were found in the estimations by the two methods.

In the recumbent position inflation gave a better idea of the stomach outline than the bismuth meal since with the latter the pyloric portion was often unfilled. In the erect position the bismuth filled out the stomach best and of course showed the lower pole and pyloric portion best. The author found that occasionally the bismuth would not fill out the entire stomach, especially if large but would settle in the pyloric portion and would not distend the upper pole so well as inflation. He concludes that both methods should be used conjointly.

## Effect of X-Rays upon Garden Earth.

BY DR. ALBERS-SCHONBERG.

Flower pots containing ordinary garden earth were exposed to 18 X (Kienbock units). Immediately thereafter peas, beans and cress were planted in the various pots. At the same time control seeds were planted in unexposed pots.

Without exception the growth in the exposed earth was stimulated. The sprouts appeared several days earlier and in greater number in the exposed earth than in the controls. The plants in the exposed pots were for the most part larger and bloomed earlier than in the controls.

Another pot of earth was then exposed more vigorously, turning the earth over during the exposure. The seeds planted here were retarded in their growth as compared to the controls.

The author (while recognizing that the experiments require further confirmation) suggests that moderate doses stimulate and heavy doses diminish the fertility of the soil. The effect of the X-ray he believes to be either chemical or upon the bacteria of the soil since he showed that the exposed earth did not become radio-active.

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## Milliamperemeter and X-Light.

BY WERTHEIM-SALOMONSON.

The experiments were undertaken to determine the accuracy of the milliamperemeter as a measure of dosage. In using the milliamperemeter reading as an indication of intensity of the ray we presuppose that:

1. The current is carried through the tube entirely by electrons.

2. That each electron produces only one ether impulse, suppositions that have not been proven.

The results of the experiments may be tabulated as follows:

1. When using a 5 M. A. current, 13.3 milliampere-seconds were required to blacken a photographic plate to a certain

degree. When using 1.9 milliamperes of current, 13.8 milliampere-seconds were required to affect the plate to the same degree. Thus there is an error of 3.7% in the milliampere reading when using comparatively large amount of current (5 M. A.) as compared to the reading when a small current (1.9 M. A.) is used.

2. The effects of 2 M. A. of current from a coil and 2 M. A. of current from a transformer were compared. It was found that with a coil and mercury interrupter (27 pulses per second) 30% more X-rays were generated than with a transformer where the impulses were 110 per second, the milliamperemeter reading 2 M. A. in each instance.

3. In this series of experiments the penetrating power of the tube was measured to avoid the possible source of error in the previous experiment. With the tube of same degree of hardness it was again found that with a milliampere reading of 2 M. A. 25% more X-rays were given out by the coil (slow interruptions) than with the transformer (rapid interruptions).

The author therefore concludes that the milliamperemeter as a measure of dosage must be used with caution. When used under conditions in which the rate of interruption is constant and in which the current reading varies not more than from 1 to 3 or 2 to 5 milliamperes the instrument is fairly reliable.

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## Intermittent Hour-Glass Stomach.

BY F. M. GROEDEL AND A. LEVI.

The authors speak of the frequency of the occurrence of pseudo-hour-glass contraction of the stomach due to excessive peristaltic activity. From a thorough study of one such case, however, they believe that the condition may be secondary to some perigastric abnormality such as adhesions. In the case quoted, it was apparent that the hour-glass contraction was due to adhesions with colon and liver. Condition appeared when the stomach was empty or partially so and disappeared when fully distended.

## Anatomic Subtraction of Hilus Shadows.

BY DR. KUPFERLE.

As a result of 40 experiments upon cadavers the following conclusions are drawn:

1. The shadows are due to both vessels and bronchi at periphery as well as at hilus.

2. The peripheral shadows which are well marked are due to a summation of vessels and bronchi.

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## Gallstones Diagnosed by X-Ray.

BY DR. F. DE QUERVAIN.

The author reports a case in which gallstones were shown clearly upon the radiogram. Analysis showed the stones to be almost pure calcium carbonate, which is a very uncommon occurrence. By experimental comparison it was shown that the usual types (cholesterin with slight admixture of calcium carbonate and calcium bilirubin stones) are very transparent to the X-ray.

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## Roentgen Cancer.

BY OTTO HESSE.

Up to 1911, Hesse collected 94 cases of X-ray cancer and allied conditions, 54 were true cancer occurring 13 in Germany, 13 in England, 2 in France, and 26 in America. Only 4 cases followed acute burns or therapeutic exposures. Of the remaining 50, 26 occurred in physicians and 24 in technical workers.

The other cases making up the 94 were 13 doubtful cases and 27 cases of lupus developing carcinoma following X-ray treatment.

The time from beginning of exposure to development of malignancy varied from 4 to 14 years.

Pain was prominent in all cases differing from the pain of the X-ray burn in being more neuralgia-like.

Metastases were less common in X-ray cancer than in the usual type occurring in only 26% of cases.

The mortality in the 54 positive cases was 20%.

The histology of the tumor is given in detail.

The treatment is of course radical removal and the prognosis is not necessarily bad since early operation can usually be done.

The usual protective measures, if carefully observed, may be considered efficient in preventing such injury.

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## Influence of Roentgen Ray upon Testicles of Rabbit and Rooster.

BY DR. S. HIDA AND K. KUGA.

The following conclusions are given:

1. X-ray acts entirely on the sperm-forming cells producing intense degeneration.

2. The degeneration commences in the cells nearest the tube and progresses irregularly.

3. The degeneration begins in the spermatogenic cells and affects the spermatocytes and spermatids later.

4. The spermatozoa are very resistant and disappear only after the spermatogenic epithelium is degenerated.

No accurate dosage is given. Only the total time of exposure is recorded.

S. LANGE.

The American Quarterly of Roentgenology

*Editor, P. M. Hickey, M. D., Detroit*
*Associate Editor, F. C. Zapffe, M. D., Chicago*

Vol. III MARCH, 1912 No. 4

# THE GASTRIC MOTOR PHENOMENA DEMONSTRATED WITH THE PROJECTING KINETOSCOPE

BY LEWIS GREGORY COLE, M. D., NEW YORK

Early last spring, through the invitation of Dr. Wm. G. Lyle, I had the pleasure of seeing the Roentgencinematographic films which had been made by Rosenthal, projected on the screen. These films were later reproduced to illustrate an article by Kaestle, Rieder and Rosenthal, entitled, "Bioroentgenography of the Internal Organs," published in the Archives of the Roentgen Ray, June, 1910. An immense amount of credit is due these men for accomplishing a feat, which a few years ago, seemed visionary to the most ardent radiologists.

In the first paragraph of this article, the authors justly called attention to the fact that a true cinematographic reproduction of the movements of an organ is made up of a series of radiograms taken of successive phases of a single cycle, and that when the successive phases are made up of different cycles, no logical claim should be made to the term "Roentgencinematography." Later in their article, they stated that twelve of the radiograms were made during a single respiratory phase of twenty-two seconds, which, they say, is the normal duration of a single peristaltic contraction.

Note—Dr. Cole's paper was read Oct. 1910, and represented work accomplished before that time but did not appear in the last number of the Quarterly owing to the fact that the illustrations which accompany it were mislaid in the turmoil incident to moving of the printers to their new quarters.

The term single peristaltic contraction of the stomach is so new that it may be well to consider its meaning. I believe it should be applied to the formation and duration of a single antrum or the terminal wave. And it seems to me that a better term would be "single peristaltic cycle." We should be careful not to confuse this with the progression of a contraction from its origin near the fundus to its termination at the pylorus.

While the duration of a peristaltic cycle (as above described) varies within wide limits, the average duration is not over two or three seconds. My statement for this is based on repeated fluoroscopic examination and a few double exposures on a single plate, making two exposures of one-tenth of a second each about one-fourth of a second apart. These plates show that the peristaltic contraction travels along the greater curvature about one-fourth inch in one-fourth of a second, or at the rate of an inch per second. Therefore, the duration of a single peristaltic cycle as described above, does not exceed two or three seconds; and the time it takes any individual contraction to pass from the fundus to the pylorus is not over ten seconds. I shall lay no claim to the term "Roentgencinematography" until I have succeeded in obtaining at least four radiograms per second.

After seeing the wonderful set of radiograms made by Rosenthal, projected on the screen, I realized the scope of this method of diagnosis and went to work immediately to produce it. No information whatever was then available concerning his technique, etc., whether an intensifying screen was used or what sort of plate changing device was adopted. My first efforts were without a screen, with a double coated sigma plate, making one-half second exposures. This was too long in the majority of cases, to obtain the necessary detail. With one-fourth second exposures, while we obtained a faint image of the stomach, the plates lacked sufficient density for reproduction. At about this time my attention was called to the calcium tungsten screen which proved to be the most important of all the factors that culminated in the production of this type of radiograms. Provided it be properly dusted, this screen shows so little grain that the only way its use can be detected is by a slight blur in the bony structure. The density of the plate thus became increased from ten to twenty times, and the fact that it allows the use of a soft tube accounts for the increased contrast in these plates. Not being able at that time to obtain any information concerning the plate-changing device which was used by Rosenthal, I designed the principal parts of two plate and film changing devices. One of these very closely resembles the one later described by Kaestle, Rieder and Rosenthal, and the other I will demonstrate to the Society.*

**Technique:**—The preparation of the patient is similar to that for an ordinary radiogram of the stomach. The clothing of the patient, who comes in the fasting condition, is removed from the abdomen, and markers are placed over the umbilicus and ensiform process. Two glasses of buttermilk and two ounces of bismuth subcarbonate are then given by mouth. The patient lies, or stands, with the abdomen flat against the opening of the box, and by fluoroscopic examination the stomach is centered so that it is over the opening in the box. The tube, preferably a seasoned one, having a focal point one-eighth inch in diameter, backing up a four-inch parallel spark, without requiring regulation, is arranged about twenty inches from the film and diaphragmed so that it just covers the opening in the box. Exposures of about one-tenth second are made, passing from 40 to 50 M. A. through the tube. During the intervening nine-tenths second, between this and the next exposure, the film is changed as described above. A fluoroscopic examination can be made during the time all these exposures are under way. The films are then developed on a rack, similar to the method used for the regular cinematographic films. The regular cinematographic exposures are then made of these films, care being taken

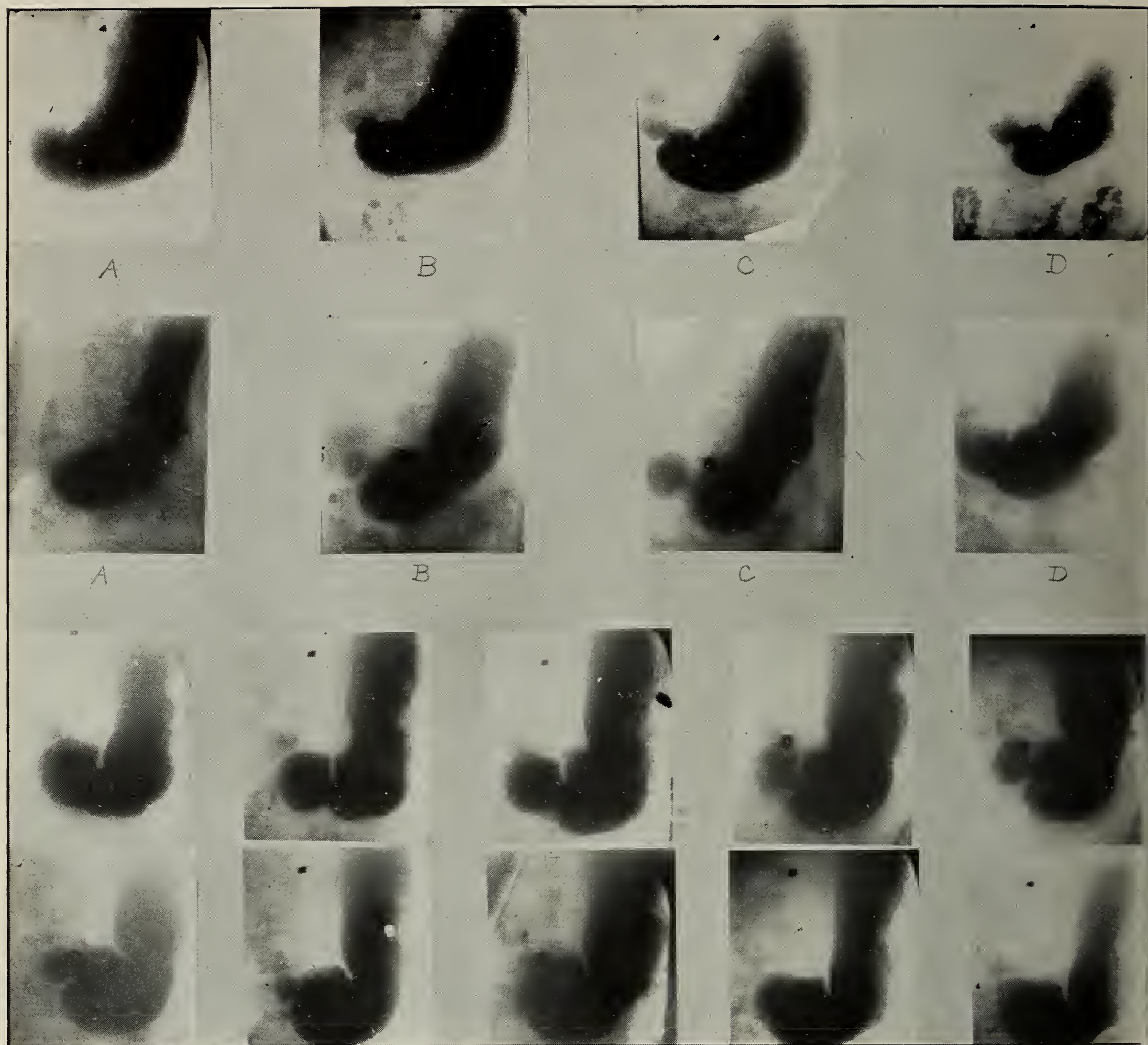
*Note—I am indebted to Dr. Harry Waite for material assistance in the designing and construction of this apparatus.

to have them centered according to the disks, which appear as markers. About two or three cinematographic exposures are then made of each film. This gives a duration to the peristaltic contraction which corresponds approximately to the actual duration of the contraction, but unfortunately, in the films I have to demonstrate, the radiograms were not sufficiently numerous to give a perfectly smooth appearance to the contractions.

In order to understand the peristaltic contraction of the stomach as observed in a series of instantaneous radiograms, it might be well to have some conception of a fairly normal contraction before investigating the abnormal. Mindful of the chaos, however, which has existed in the minds of physicians in general, and radiologists in particular, since Rieder gave his first bismuth meal and proved that the majority of stomachs do not lie in the abdomen in the old text-book fashion, I hesitate at the mere mention of normal peristaltic contraction. The description of the normal peristaltic wave was avoided by Kaestle, Rieder and Rosenthal, who refer in their article to the peristaltic contraction of abnormal stomach. This is a perfectly fair statement, because the girl whom they radiographed undoubtedly had a normal stomach. But in view of the variation in size, shape and position of the stomachs that functionate in a normal manner, so far as can be determined by all other methods of examination combined, the peristaltic contractions of these stomachs may be assumed to vary in even wider limits with the quantity and quality of the food and the mental condition of the patient.

The series of radiograms which I am about to show and the fluoroscopic observations, which the construction of my table allows me to make, immediately before, during, and after each exposure, lead me to confirm to a large degree the observations made by Kaestle, Rieder and Rosenthal, whom I shall quote as follows:

"Our investigation shows that during digestion there is no such division of the stomach into two distinct parts, and that a strongly differentiated antrum pylori in the old acceptance of the term does not exist. As our tracings show,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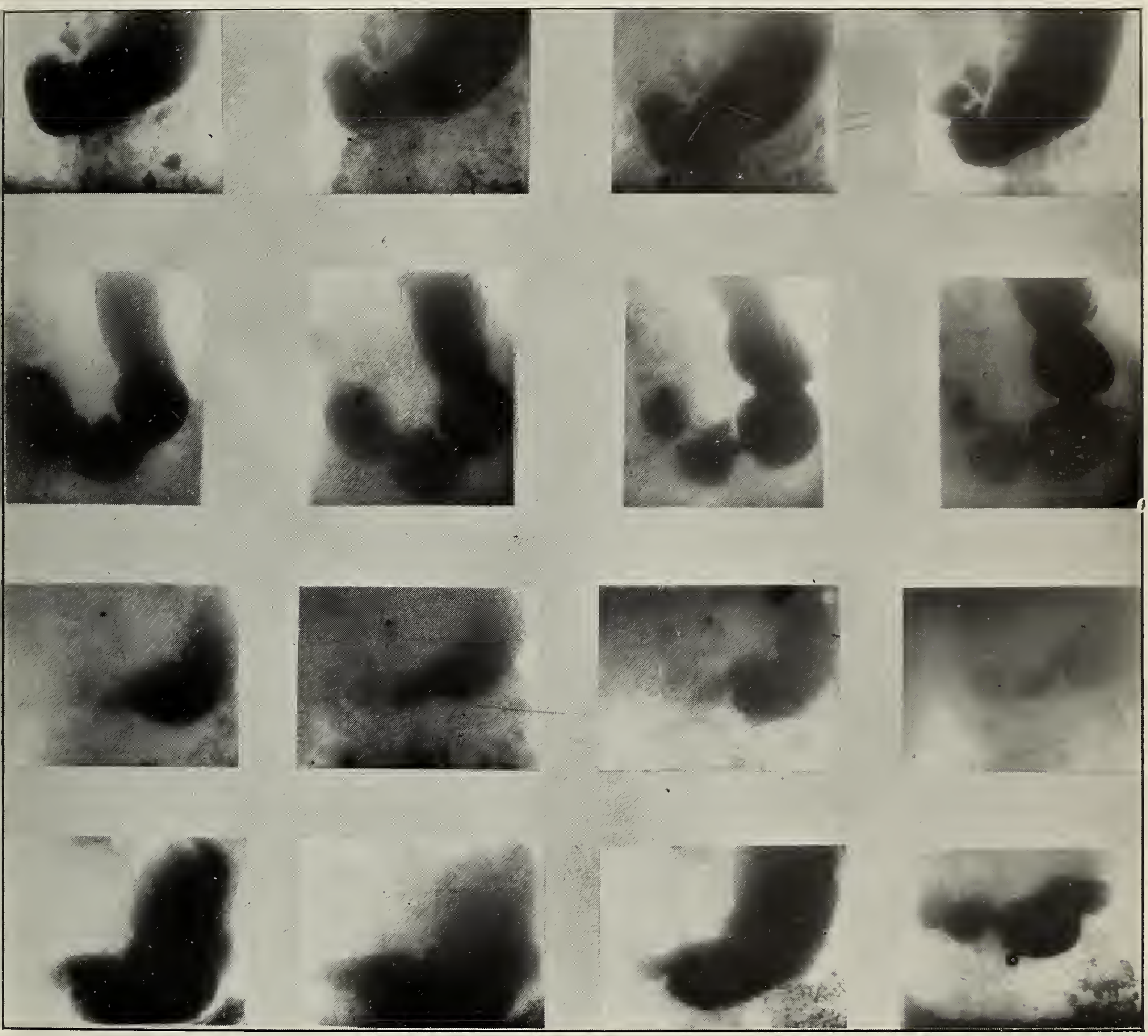


the formation of the new antrum does not commence at the spot where the final emptying of the stomach occurs, and is, therefore, not a mere relaxation of the contracted walls. If we adhere to the idea of an antrum pylori, then it is necessary to speak of two such antra existing side by side and at the same moment. We must speak of an old and a new antrum, as we have done for clearness of expression in the foregoing pages. As the old antrum disappears a new antrum is developed from the wall of the body of the stomach. This new antrum passes pylorusward, and ultimately exactly takes the place of the old antrum, whilst another new antrum begins to form. Moreover, if we wish to adhere to the term, our idea of the antrum pylori must be modified. In our opinion there is no true antrum pylori, any more than there is a sphincter pylori, in the sense of the older observers; 'What we see in the regio pylorica is an increase in the energy of the gastric peristalsis and an increase in the height and depth of the wave summits and depressions.' "

On the other hand, my observations have confirmed to a large degree Gradel's criticism of Kaestle, Rieder and Rosenthal's article. Gradel states that a large number of observations have shown him, that, at any rate, these observations are by no means constant. I do not know whether these observations made by Gradel are based on fluoroscopy or a series of radiograms. Personally, I have been unable to detect these small contractions along the wall of the body of the stomach in a fluoroscopic examination, although a radiogram, made at the same instant when I observed the stomach fluoroscopically, shows them to be present. But in some of the cases, even the radiograms have failed to show the presence of these contractions.

Figure I shows four radiographs of a stomach in different stages of digestion. In this case, when the stomach was first filled with buttermilk and bismuth, there was little or no attempt at peristaltic contraction (A). In the next radiogram of this case (B), made about three or four minutes later, there was a very slight peristaltic contraction. This contraction was so slight as to be hardly discernible on fluoroscopic examination. Radiogram (C) shows a peristaltic contraction which was caused by external stimulus, namely: an attendant slapping the patient just before the exposure was made.

Instantaneous radiograms were made at intervals, and the fourth radiogram of the set (D) was made about one-and-a-half hours after the administration of the buttermilk and bismuth. When the stomach had partly emptied itself, these peristaltic contractions became more active, or at least were more clearly demonstrated on the plate. This series of radiograms shows that when a stomach is over-distended, the peristalsis is not so active as when it is partially filled. Whether, aside from the diminished quantity in the stomach, the production of hydrochloric acid is a factor in the increased peristaltic action of this particular stomach or not, I am not ready to state, but I believe this to be the case on the basis of other observations.

Figure II. This series of radiograms demonstrates the motor phenomena of digestion as described by Holzknecht in the Munchener medizinische Wochenschrift, and quoted by Kaestle, Rieder and Rosenthal in Archives of the Roentgen Ray of June, 1910.

"The motor phenomena of digestion, as seen by Roentgenoscopy, are as follows: While there is no active movement to be seen in the cardiac portion of the stomach, the lower portion of the greater curvature exhibits deep contractions. These depressions travel towards the pylorus, gradually getting deeper during their passage, till they get their maximum depth at the sphincter pylori, a point three or four fingers' breadth above the pylorus. The maximal point of depression is characterized by the length of time it remains in a state of tonic contraction, and by the fact that the contractions here are the most energetic of any part of the stomach wall.

"Opposite to this deep constriction of the greater curvature appears a similar depression of the lesser curvature, of almost equal depth. There is no movement of the lesser curvature visible in the upper part of its contour. Eventually the depression of the smaller and that of the greater curvature meet, so that on the screen there is seen a clear line between the shadow of the contents of the corpus and of the antrum. Soon afterwards the shadow of the antrum disappears, its contents being emptied into the duodenum by a process of concentric contraction.

"The constriction three or four fingers' breadths above the pylorus, mentioned above, has the effect of a sphincter antri which periodically cuts off the antrum pylori from the body of the stomach. The circular constriction at this point is comparable in breadth and extent with the pylorus itself. The button-like reduction of the antrum is brought about by a process of concentric contraction. It is doubtful, however, whether there is a simultaneous peristaltic movement of the circular contraction toward the pylorus, or whether the circular depression remains stationary and the evacuation is brought about by a contraction of the longitudinal fibres alone."

Figure III. Seventeen radiograms have been made of this case and all show the peristaltic contraction in various stages, ten of which are selected for reproduction. This set of radiograms corresponds with the type of contraction which Kaestle, Rieder and Rosenthal consider normal. There are two distinct peristaltic contractions which may be seen in all the plates in different stages. The formation of the new antrum as the old one disappears is clearly demonstrated in this set of radiograms. These have been made so recently that there has not been time to center them properly and to prepare cinematographic films; if this had been done, the cinematographic reproduction would have shown a very much smoother and perhaps more normal peristaltic action of the stomach than the one which I am about to show. This set of radiograms, however, studied in detail and individually, affords the diagnostic aid which is required and proves that a projecting apparatus is not necessary for diagnostic purposes. Every one of the seventeen plates prepared in this case shows the detail which was present in the ten radiograms reproduced.

Holzknecht refers to one peristaltic contraction, Kaestle, Rieder and Rosenthal to two peristaltic contractions, but there are many cases in which three or even four distinct peristaltic contractions can be demonstrated by this manner of examination.

Figure IV demonstrates a one-and-a-half wave type of peristalsis which is intermediate between the one-wave type described by Holzknecht and the two-wave type described by Kaestle, Rieder and Rosenthal. Studying this case fluoroscopically, one would observe only the one well-marked peristaltic contraction and consider it as the type described by Holzknecht, but when studied radiographically there is clearly discernible a small secondary wave on the lesser curvature and Kaestle, Rieder and Rosenthal would claim it as a slight modification of their type of motor phenomena.

Figure V shows one of these cases where four distinct peristaltic contractions are demonstrable. The radiograms, unfortunately, do not include the entire fundus, but the peristaltic contractions are seen on the greater and lesser curvatures, well up toward the fundus of the stomach. These contractions become deeper as they move pylorusward and in radiogram (C) Figure IV, we have the button-like contracted antrum, the formation of a pre-antrum, and two or possibly three antra yet to come. I think these plates particularly emphasize the point referred to by Kaestle, Rieder and Rosenthal, namely, that it is unwise to preserve the term, "antrum pylori," and advisable instead to interpret what is seen in the region antrum pylori as an increase in the energy of the gastric peristalsis and as an accentuation in height and depth of the wave summits and depressions, only that the well-marked contractions in this case are not limited to the pyloric region. I do not claim that this last case was normal, being aware that it was a case of hyperchlorhydria. The peristaltic contraction is certainly more active than usual, bearing out the observations of Brauning regarding the relation between the tone of the stomach and its production of hydrochloric acid.

It seems to me that the simplest way is to consider the stomach as a sac in which there may be all degrees of peristaltic contractions, passing pylorusward. In extreme cases of atony of the stomach, the contractions are so few and so slight as to be indiscernible, either fluoroscopically or radiographically. Where there is more tone to the stomach, a single peristaltic contraction occurs, passing pylorusward, and when there is still more tone to the stomach, two contractions are demonstrated by instantaneous radiography where only one was discernible fluoroscopically. Progressively, a still better tone to the stomach is associated with three or even four contractions and waves, or antra. I believe that the most common is the stomach with two contractions and two waves or antra, but am not prepared to state that a single wave on the one hand, or three or even four waves on the other are beyond the normal limitations.* This point, I think, can only be decided by making a great number of radiograms of cases free from gastric symptoms, and after all other tests have shown the function of the stomach to be perfect. While these cases are interesting from a physiological and scientific standpoint, the particular application of this method of examination depends on a study of the interruptions of the contractions or waves as they progress pyloricward. Considering only the body of the stomach, Figure V illustrates a stomach of the two-wave type of motor phenomena with deep contractions like those described in Figure III, but when they are about two and one half inches from the pylorus they suddenly cease both on the greater and lesser curvatures. The failure of the pyloric end of the stomach to expand and contract in proportion with the body and cardiac end indicates some pathological process which prevents the normal dilatation of this portion of the stomach. There is, however, a slight variation in the lumen of the pyloric end of the stomach and the deepened rugae indicate that this is caused by adhesions encircling this portion of the stomach. This case was verified by operation and

*Note—More recent observations have shown that the stomach with three or four waves is the most common.

the entire pyloric end of the stomach was encircled by extensive adhesions.

Figure VI represents a similar condition where there are well-defined peristaltic waves along the lesser curvature until they reach a point about three and one half inches from the pylorus; here they cease suddenly and there is a perfectly flat surface which corresponds in shape and position with the lower surface of the liver. On the greater curvature the contractions become much deeper as if trying to compensate for their absence on the lesser curvature.

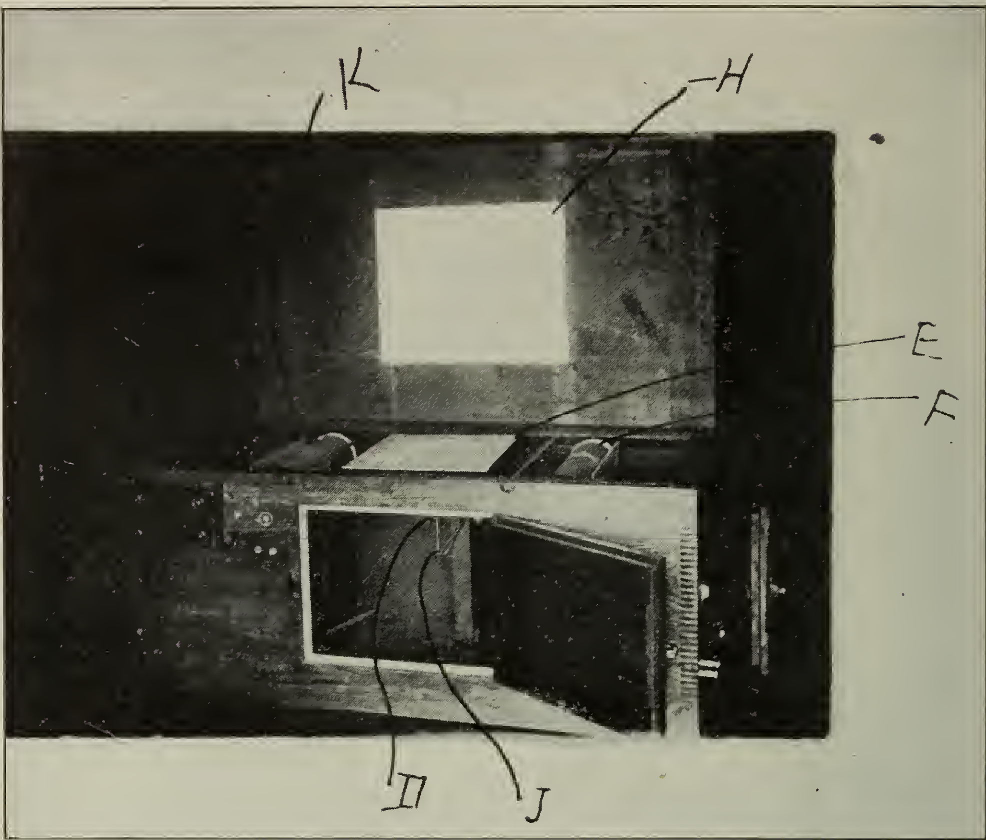
This case has not, to my knowledge, been verified by operative procedure, but the history of an operation on the gall bladder through this route tends to confirm the radiographic diagnosis.

The radiograms which are about to be cinematographically demonstrated are not made sufficiently frequent to give a perfectly smooth appearance to the wave, and the fact that they are not well centered on this film gives a very vivacious appearance to the stomach, but it will serve to illustrate a motor phenomena of the stomach and the great scope of this method of examination.

**Resumé.**—In closing I wish to give credit to Kaestle, Rieder and Rosenthal for the excellent work which they have done along this line, but would call attention to the fact that even their wonderful set of plates does not correspond to their rigid but correct definition of Roentgencinematography. I would also call attention to the difference between wave, contraction and cycle and the progression of the contraction from its origin to its termination. The duration of a peristaltic cycle is about two or three seconds, and at least ten or twelve radiograms should be obtained of different phases of peristaltic cycles.

There are various types of peristaltic contractions which are best described as the one, two, three, and four-wave types of contraction with an intermediate type between the one and two-wave type which might readily be claimed either by Holzknecht or Kaestle, Rieder and Rosenthal, as representing the normal gastric phenomena. These types of peristalsis I will refer to as the unobstructed types of peristalsis in contradistinction to obstructed types of peristalsis where the contractions or waves are interfered with by new growths or adhesions near the pylorus.

The author makes no claim that these are true Roentgencinematographs as defined by Kaestle, Rieder and Rosenthal, but he does claim that from a practical diagnostic standpoint, a series of eighteen or twenty instantaneous radiograms made of different phases of different cycles, studied individually and collectively, is of great value in the diagnosis of new growths and adhesions at the pyloric end of the stomach and these may be made by any radiographer without the use of an expensive yet imperfect plate, or film-changing device. Therefore, this work is within the reach of any radiologist, and the author will lay no claim to Roentgencinematographic reproductions until he succeeds in making four radiograms per second of gastric peristalsis.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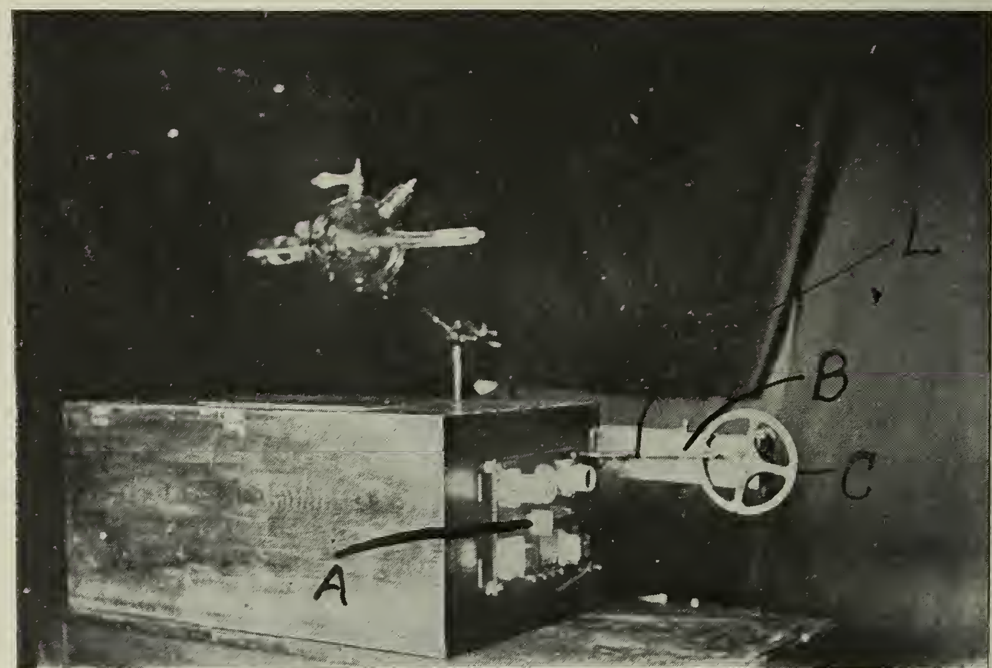
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# DESCRIPTION OF APPARATUS FOR MOVING PICTURES OF THE STOMACH.

BY LEWIS GREGORY COLE, M D , NEW YORK

This apparatus is made up in a box 30″ long, 18″ wide and 12″ high. It is lined with sheet lead ⅛″ thick. The cover is made of clear soft white pine and is covered with lead except an open space 8x10 which is in the center of the cover. Directly under this in the center of the box is mounted a closed magnetic circuit type of electro-magnet "D," having an aluminum plate 1/16″ in thickness 8x10 and mounted on the plunger of the electro-magnet and on top of this aluminum plate is placed the intensifying screen "E." The electro-magnet is adjusted by "J" so that the plunger moves 1/16″ and when this movement takes place, the intensifying screen is brought up so that it presses firmly against the sensitive film above it. At each end are mounted two pasteboard tubes "F." On one of these is rolled the sensitive film. This is drawn across the intensifying screen and attached to the roll at the other end. The bearings of each of these rolls are mounted on an arrangement for adjusting the tension so that they turn rather hard. This is so that there will be no slack to the film when it is in operation.

On the end that has the roll that winds up the film "K" there is an arrangement with a ratchet (this is inside of the box and cannot be shown on photograph) so that as the handle of the device makes a half turn the pasteboard tube "K" makes a full turn which just winds up 8 inches of film.

On the other end of the apparatus there is an electro-magnet "A" having a silver contact mounted on the plunger and another silver contact mounted on an adjustable screw. This electro-magnet is placed in series with the electro-magnet "D" that throws the intensifying screen up against the sensitive film so that they both work at the same instant.

On the connecting rod "L" between the ratchet arrangement that winds up the film is placed a spring contact "B" which closes the current through both electro-magnets. The current from the primary of the X-Ray apparatus is closed when the two silver contacts operated by "A" come together.

Both electro-magnets are operated by the same set of storage batteries or dry cells.

The apparatus operates in the following manner:

The first half-turn of the crank winds the film. When the crank is turned three-quarters round, the spring contact "B" is closed which operates the electro-magnets "A" and "D," closing the current through the primary of the X-Ray apparatus, at the same instant pressing the intensifying screen firmly against the sensitive film above it. Then just before completing the revolution of the handle the battery circuit through the above electro-magnets is broken so that the current from the X-Ray apparatus is turned off and the intensifying screen drops back away from the sensitive film.

The above cycle of events takes place with every complete revolution of the handle which can be operated by hand or an electric motor. The apparatus, of course, has to be loaded in a dark room or the rolls well covered with black paper, similar to the regular film roll, used in an ordinary camera.

# THE VARIABILITY OF THE FOCUS POINT OF THE X-RAY TUBE AND A SIMPLE MEANS OF SELECTING A PICTURE TUBE.

BY GEORGE E. PFAHLER, M. D.
Clinical Professor of Roentgenology in the Medico-Chirurgical College, Philadelphia, Pa.

Every experienced Roentgenologist recognizes that the most important part of his apparatus is a good tube. We all recognize too that comparatively few of the tubes sent to us are really good "picture tubes." In the past we have had to exclude the bad tubes by producing a series of poor negatives, and after eliminating all other possible errors conclude that the fault is in the tube. Such knowledge is usually obtained at the expense of much material, and at times with the embarrassment of having made a faulty diagnosis.

Walter, Willey, Caldwell and others called attention to the various factors that enter into the production of a good tube, and to some of the causes of faulty tubes. In this brief paper it is not my purpose to enter into a discussion of the production of a good tube, nor to explain the factors which produce a faulty tube. I simply wish to record what I believe to be an original observation of the *movement of the focus point in an X-ray tube, during an exposure of a half second, without variation in the current strength or in the vacuum*, and that this occurs in some tubes more than in others, but that none are perfect.

In some tubes the variability of this focus point is so great as to make them worthless as "picture tubes." In such instance a fracture of a bone may be overlooked and a foreign body not be demonstrated. Tube No. 68, Fig. 10, was one of these extreme types, and yet when observed in my office by two leading Roentgenologists, who were judging the tube by its fluorescence and penetration, they said, "That is a fine tube." In the illustration, Fig. 10, which was a picture made with this tube, you will see that all shadow lines are practically obliterated. In order to test its actual picture value, I placed two cross-pins upon the thigh of one of my assistants and made a plate. The shadow of the pin which lay in the direction of the longitudinal axis of the tube is obliterated, while the one lying transversely to the longitudinal axis is but faintly shown. This picture as a whole is poor in photographic effect and lacking in detail.

In this tube, the focal point moved in all directions, but more in the transverse than the longitudinal. For this reason the longitudinal pin is obliterated while the transverse is faintly shown.

In most of the tubes, in which the focal point is distinctly variable, it moves more in the transverse than the longitudinal, while in a few there is practically no movement in the transverse, but distinct movement in the longitudinal direction.

I find this variation in all makes of tubes; I do not know the cause. To all appearances, and judged by the fluorescence and by the size of the "burned point" on the target, the tubes may be identical, yet when put to the test there is great variation.

The tubes which show very little variation in the focal point make fine "picture tubes," and I find that they remain good "picture tubes" from the beginning until some accident happens to them.

I have made observation on over two hundred tubes, but have photographic records of the last sixty. I find a good "picture tube" in one out of four or five. I reserve the "picture tube" for diagnostic work, and find the others satisfactory for treatment. There is, of course, no objection to the variability of the focus for treatment.

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## TECHNIQUE OF THE TEST.

*Fluoroscopic Method*—Take a compression cylinder; stretch across the upper aperture two lead wires or bands, such as fuse wire, one wire corresponding to the longitudinal axis of the tube and the second crossing at right angles; place the fluorescent screen beneath the cylinder; then in a dark room excite the tube until it takes the amount of current that the operator customarily uses in making exposures. The shadow of the wires will be thrown upon the screen, with some tubes sharply, with others very dimly. One can often see the shadow of the wires move a half inch (with the screen 18 inches and the cross wires 4 inches from the target of the tube) without varying the current, and without any apparent variation in the vacuum. Such a tube will, of course, not make any satisfactory picture.

A good tube, on the other hand, will give sharp cross lines and one can see no movement. Such a tube will make excellent pictures.

*The Photographic Method*—Just as a photograph will record more than the eye can see in other matters, so it will record finer variations than can be shown fluoroscopically. The same cross lines can be used, but I believe heavy wire large (⅛ to ¼) mesh is better. I usually test four tubes at one time, using ¼ of an 8x10 inch plate for each tube. This allows me to make good comparison and select the best tube. I make each exposure exactly the same length, timing it automatically. I use a comparatively slow plate, and time it exactly one-half second.

I always set my rheostat exactly the same and always use exactly the same amount of primary current—the amount that I usually use in making pictures. I then record the amount of milliamperage that will flow through each particular tube with this definite quantity of primary current and also the vacuum of the tube as measured by the Benoist Scale.

In this way I learn which tube has the most stable focus point, which has the highest penetration with the least resistance, and which gives the most photographic effect.

Fortunately the three effects generally, but no always, go together. It might be inferred that the stability of the focus point depended upon the vacuum, but this is not true. It

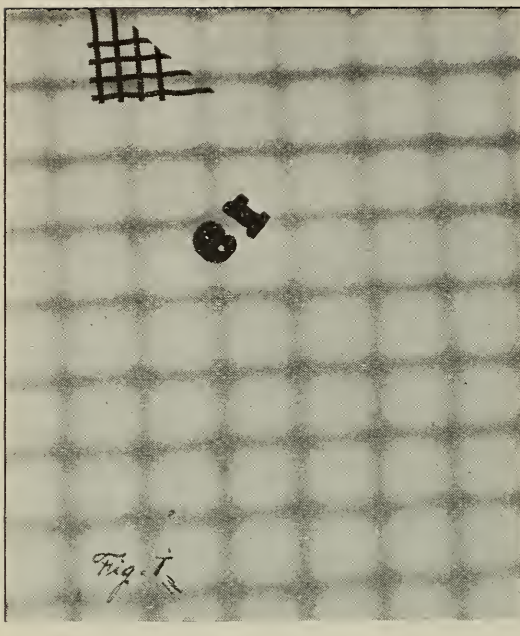


*Fig. 1.* Good picture tube (a six-inch bulb) shows practically no movement of the focal point. 45 m. a., one-half second 18 inches, Benoist 6. See small fragment of netting on the plate.

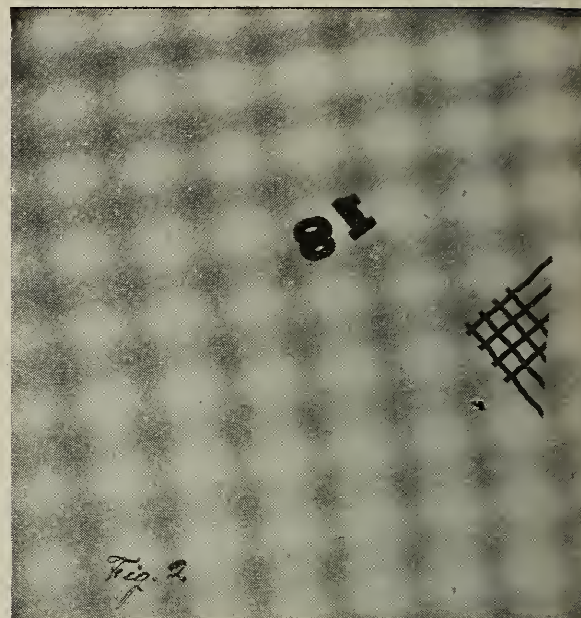


*Fig. 2.* Poor tube (six-inch bulb). See the double transverse lines and fairly sharp vertical lines, showing that the focus moved only in the direction of the long axis of the tube. Benoist 6; 35 m. a.

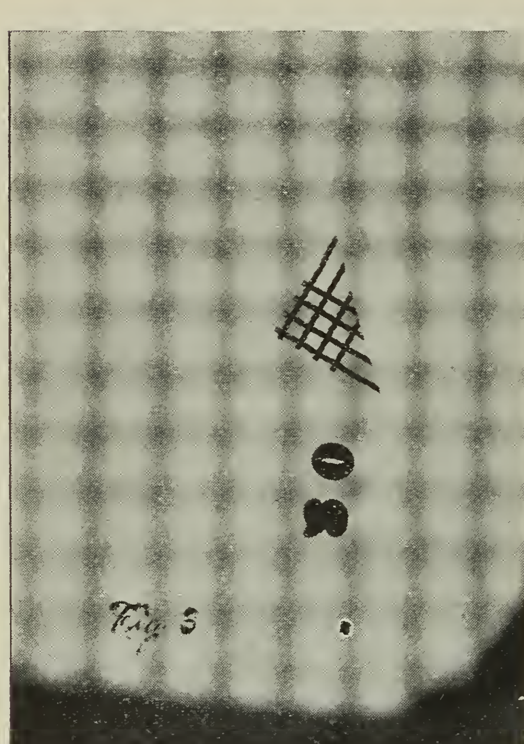


*Fig. 3.* A good tube showing slight movement of the focal point in the longitudinal direction. Benoist 6; 45 m. a.

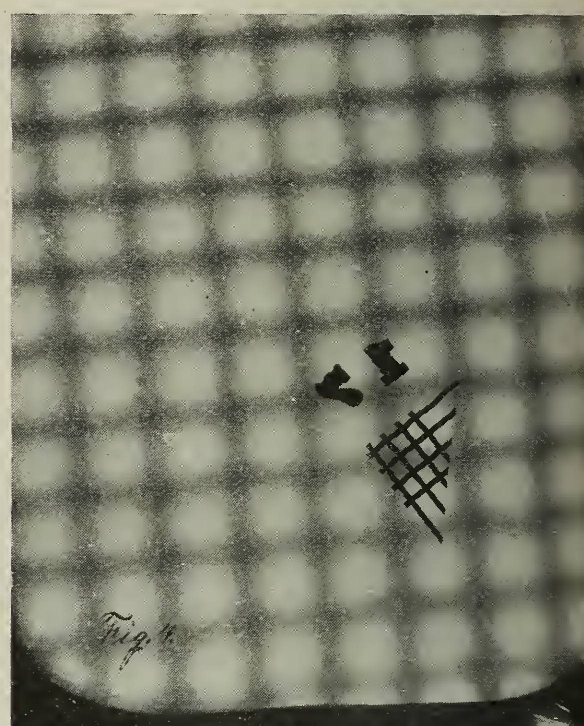
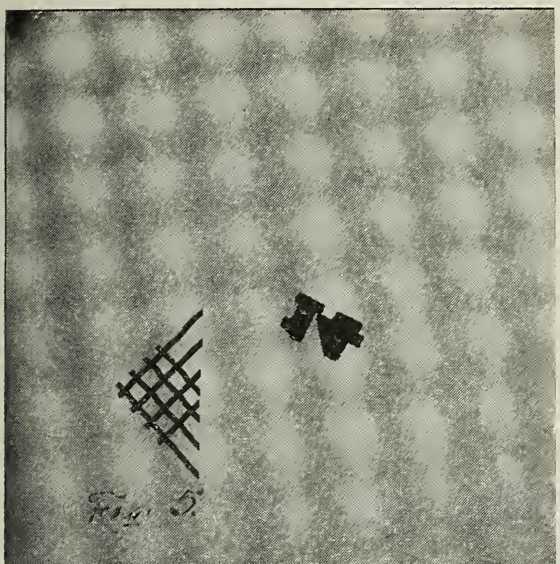
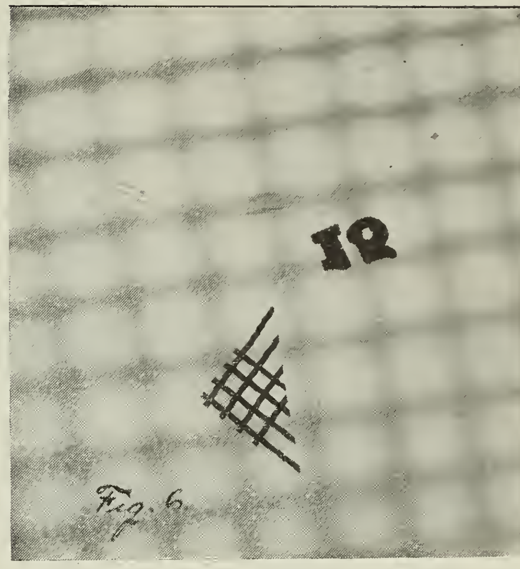
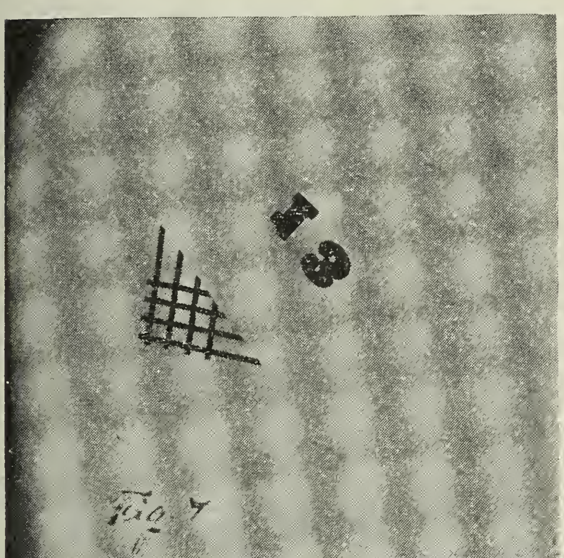


*Fig. 4.* A good tube (six-inch tube). Benoist 5; 60 m. a.



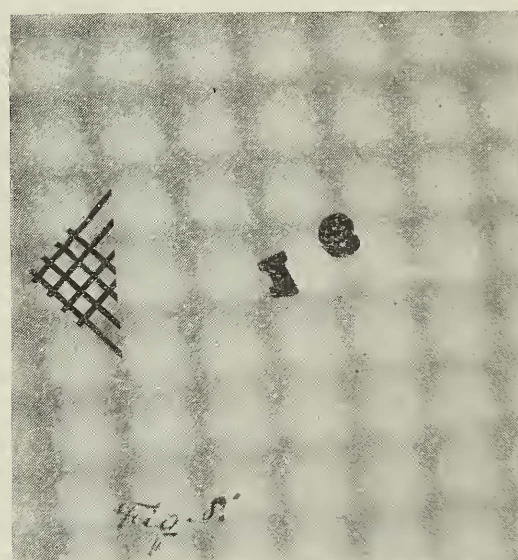




*Fig. 5.* A very poor tube (six-inch tube) showing movement of the focal point in both directions, but more in the transverse. Benoist 6; 40 m. a.

*Fig. 7.* A very poor tube (eight-inch bulb) showing movement of the focal point in all directions. Benoist 6; 45 m. a.

*Fig. 6.* Good tube (six-inch bulb). Benoist 6; 45 m. a.

*Fig. 8.* A poor tube (six-inch bulb). See the double transverse lines indicating movement of the focal point in the longitudinal direction. Benoist 7; 35 m. a.

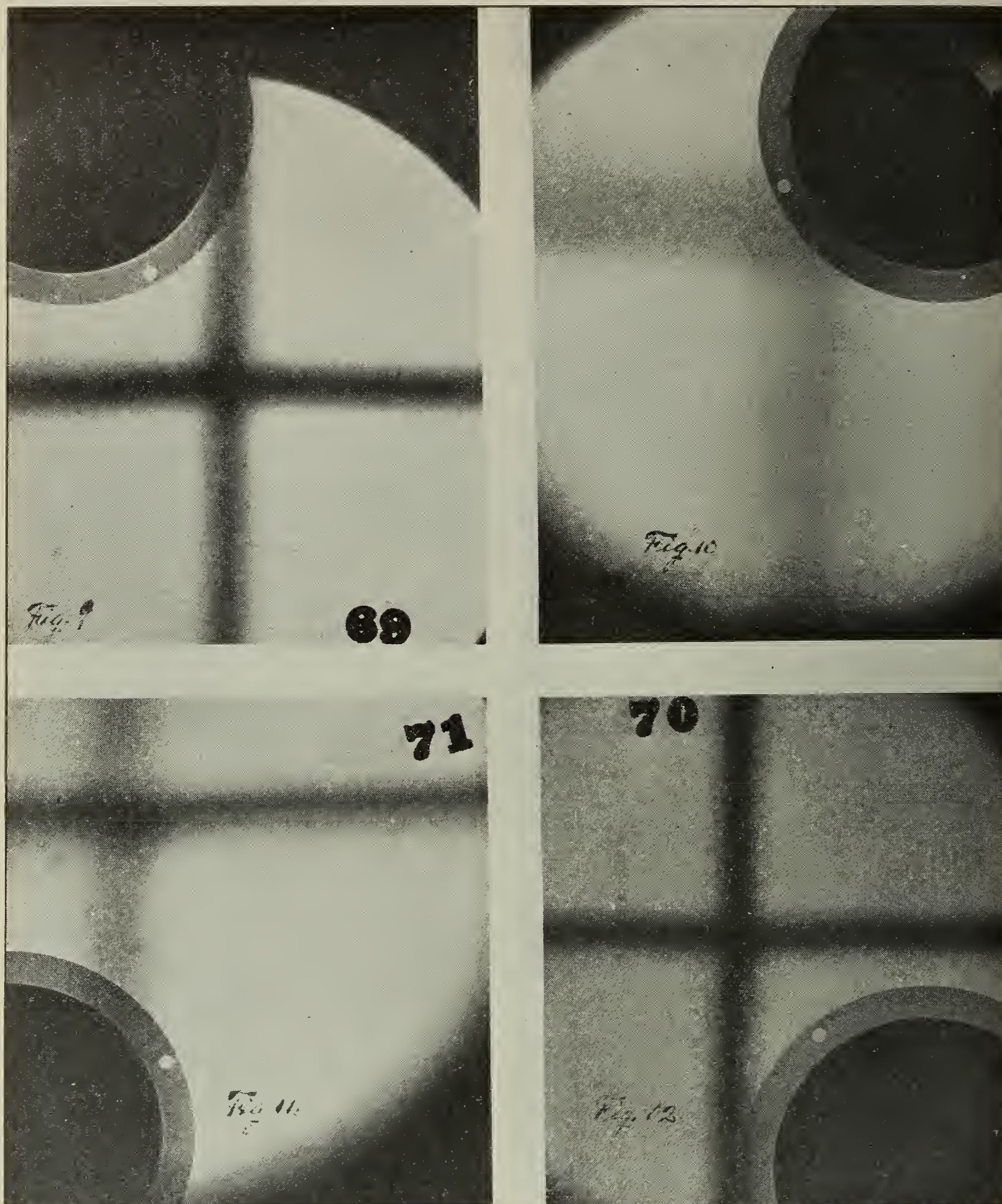



*Fig. 9.* Very good tube (six-inch bulb) showing a slight movement. Benoist 6; 40 m. a.

*Fig. 11.* A poor tube (seven-inch bulb). Benoist 5; 35 m. a.

*Fig. 10.* A very poor tube (seven-inch bulb). Notice that the shadows of the fuse wire are practically obliterated.

*Fig. 12.* A very good tube. Benoist 5; 45 m. a.

In all tests the focal point was 18 inches from the plate, and in each instance the tube was first tested until it would take the full current smoothly.

might also be inferred that a low tube would have a more stable focus, but neither the low nor the high are likely to be stable. In fact, I believe that the stability of the focus has no connection with the vacuum, although most of the good tubes register about Benoist 6. On the other hand, many tubes may register Benoist 6 and still be miserable tubes.

I have been especially impressed with the striking variation in so short a period of time. I noted it even in my highest priced imported tube to a moderate degree, even with an exposure almost instantaneous, the exposure being made with an automatic magnetic switch which broke the current the instant the main switch was closed.

Since one gets this variation in even an instantaneous exposure, it is easy to understand that the selection of a proper tube is of as great or greater importance than great speed in Roentgenography, for it matters little whether the patient moves or whether the focus of the tube moves, either producing a lack of sharpness of outline.

This may seem like a little thing to write up, but I can say that no single point in technique has been so helpful to me.

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## CONCLUSIONS.

1. The focus point of a tube is distinctly movable in nearly all tubes, but it is practically negligible in a selected few.

2. This variation can occur in a momentary or almost instantaneous flash.

3. It is the cause unknowingly, at times, of poor detail in plates.

4. "Picture tubes," with a focus point that is practically stationary can be selected both fluoroscopically and photographically.

5. If these tests were made by manufacturers, they would probably learn to make more uniformly good tubes.

## DISCUSSION.

Mr. H. Clyde Snook, Philadelphia: The Society is certainly in debt to Dr. Pfahler for this very valuable and timely discussion. I am sure that none of us realized the great variability in the focus of the X-ray tube until we heard this paper. Some of us have known something about this matter, and undoubtedly other members of the society will be able to throw more light on the cause of this variability than I can. I have been somewhat familiar with this probability knowing that the focus usually travels in an ellipse. This information is common knowledge and a number of articles have appeared in the foreign journals relative to this elliptical path of the focus on the target of the tube.

I believe that it is exceedingly difficult to determine the exact cause of this elliptical path. It sometimes assumes the approximate shape of a circle. It is my opinion based on work I have seen and some which I have been privileged to do that one of the causes of this trouble in the focus in the tubes is the probable electrostatic field that exists on the surface of the X-ray tube. To be able to control this electrostatic field, which, of course, is caused by the generator furnishing the current, it is necessary to modify the shape of the electrodes and the shape of the glass walls of the tube.

Some little work has been done in this direction with this idea in mind, but I am sorry to say that so far as I know nothing definite has been obtained from these experiments, although it is very reasonable to believe that this electrostatic field profoundly exerts an influence on the shape of the path. A dirty cathode or a dirty electrode or target will certainly cause an elliptical path or a movement of the focus of the tube during the time the current passes through it. The variation in the current strength causes a variability in the conductivity of the gas resting on the surfaces of the electrodes at various points and that changes the conductivity. The conductivity produced on the surface of the cathode is greater with a high current than with a low current, because there is a larger amount of rays given off from one part of the electrode than from another. In other words, a cathode with small particles on its surface will cause a shifting of this focus as the current rises and falls in its delivery to the tube by the machine. A dirty target will do the same thing.

The shape of the face of the target and the shape of the walls of the tube certainly has something to do with this, and the experiments in this direction have not yielded very good results.

The exact cause of the phenomenon is a combination of a number of things, and I am sorry that it is unknown to me. The only practical way I know of selecting a tube is by some method like Dr. Pfahler's.

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DR. H. W. DACHTLER, TOLEDO, OHIO: For a number of years I have been using a scheme to test tubes that has proven very satisfactory to me, but I do not go far enough. I have been using a bank of fine needles set one inch apart in a block of cork. The last needle is six inches from the plate and the first one inch away. I use them in one direction, however, which is not going far enough because the focus may be off in one direction and not in another.

I would like to ask Dr. Pfahler whether he carried on experiments to show whether a tube after it has been running for some time will show the same variation found present when the tube was first excited. There is often a shifting of the focus point, but some tubes settle down after they take the load. They become much more steady. I would also like to bring up the point whether some of the tubes which shifted when they were new would settle down after they had been used on his apparatus for a while and become regular and better tubes.

Of course, he used extremes. He placed the screen four inches from the target and the plate eighteen inches from the target. A number of manufacturers have been making tubes with a larger focus to withstand the heavy currents now in use. If in practice we will keep our tube at a comparatively long distance from the plate, it will really not be a disadvantage in practical work.

The most important thing that comes up in connection with rapid exposures which we desire to make is the fact that when the load is first thrown on the tube is not constant. What the changes are in the tube I am unable to say. I have recently had a lot of tubes from a certain manufacturer and found that they would not carry the current. They were tubes made with an osmosis regulator. When the tubes were first excited, they were low and after a few seconds they would not carry the current through the tube. Put a low tube to rest and when you start it again low, it would apparently change rapidly. In rapid exposures when the load is first thrown on there would be a rapid change in the condition of the tube. Some of this can, perhaps, be overcome with new tubes by strengthening them and adapting them to our types of machines.

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Dr. Sidney Lange, Cincinnati: This is one of the most important single technical points ever brought before the society. We have all been selecting tubes and weeding out the bad ones, but this method is simple and effective.

My method is much slower and not to be recommended. I find that a tube which has been used fairly hard for a number of exposures, half a dozen or more, depending on the composition of the anode, will show the defect in some way. Even when the focus point has not moved, the tube will be marred in some way. If you have used the tube for some time and you cannot see any indication of the focus point, set the tube in a glass shield marked to indicate center, and if you have any such little defect in the surface of the anode to tell where the focus is, it shows that the focus is either too large or it is moving.

I used to think that it was an indication when tube did not mark in any way that the surface of the anode was especially hard, but I discovered that such tubes would be best for detail picture work because the focus was either too large or the focus point was moving.

In looking over tubes as I have done since, I have weeded out tubes on which I could not see some defect in the finish at the focus point. Dr. Pfahler's method certainly is better because it gives us an immediate test of a tube. You can try it out and, if necessary, return it without first using it, as I have to do in my method.

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DR. F. H. BAETJER, BALTIMORE: I do not think that Dr. Pfahler has given us anything new as to the variability of the focus point of the tube. What he has succeeded in doing is to give us a simple and easy method to demonstrate this variability. This is the most valuable paper ever presented before the society. It is a thing which we all had to learn by bitter experience.

These tubes which in the first place do not mark sharply do so after they have been toned up. Dr. Dachtler brought out the point that the tube would be irregular at first and then settle down. Mr. Snook's point as to the dirty cathode, I do not know that I agree with him as to dirty anode affecting the variability of the focus point. That has been my own experience. Then, I thought that there is another factor that entered into that. In the tube there are larger particles. You know that you can deflect the cathode stream. As the stream goes across it is charged in a definite way, but I think that each one of these particles deflects this cathode stream. In a high tube the impact on the anode is harder and we get greater penetration. My experience has been that in some tubes in which at first we get this elliptical focus point these particles of air are not equally divided. At least, that has been my idea. In other words, in place of having each particle of air as an elemental ion, we have groups of them. Naturally we have a greater force acting in one direction than in another. I have noticed that some tubes were turned into fairly good picture tubes after they were used for some time. Is it possible that something of that kind could produce this?

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MR. SNOOK: This is one of the most interesting subjects, and I will answer Dr. Baetjer's question directly. This condition does exist. The tube at the beginning of its operation possesses a state of affairs entirely different from the state of affairs existing at a later time. Before the current starts to pass through the tube there is present a condition which is never again repeated. There is a residuum of gas in one spot or in one portion of the tube which is changed from that position so that at no subsequent time does that body of gas reside in the same particular spot in the same way.

The conductivity in the vacuum of the tube is a very queer thing. One particular point I wish to call to your attention is the fact that not only the cathode particles emanating from the cathode have an influence on the conductivity of the tube but also the positive particles coming back from the anode influences the path of the cathode particles themselves. A simple experiment may be made by introducing some material between the cathode and the anode. It casts its shadow on the focus produced at the anode as well as upon the cathode. The insertion of a piece of material between the two electrodes stops the discharge between the two in a path in which the particles of discharge should be issuing. The conductivity between the two electrodes does not exist prior to the making of the electrostatic field between them. During the time that there is practically nothing in this space, there is residing on the surface of both electrodes a layer of gas. There is a layer of gas all around the negative surfaces of the electrodes also, —a great deal of gas also resides on the inner surface of the walls of the tube.

The percentage of free gas in the tube at this time is perhaps less than one per cent.,—that is, on the electrodes and the walls of the tube. If you have an induction coil which gives you a big current passing through the tube or a wave of current with a long period of silences between, just at the time that the current begins to rise and the electrostatic field is produced, there is produced a conductive carrier on each electrode, and they travel opposite each other. The one coming from the cathode has a mass generally about 1/1000 of the mass of the particle that starts from the anode. The number of little carriers that pass across through this space is proportional to the flow of the current at each instant as it rises and falls.

The electrostatic field varies also in proportion to the current that passes through between the electrodes. And if these particles that travel between the two electrodes are influenced by the electrostatic field and can be deflected, and if the electrostatic field is influenced by the shape of the walls of the tube, it is reasonable to assume that this electrostatic field would cause particles to impinge on the face of the target at different points as compared with another varying with the intensity of the current. This varies with each cycle.

It is easy to understand, then, that never is the state of affairs reproduced in the tube; that it is different at the beginning of the excitation of the tube and later on.

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DR. EUGENE W. CALDWELL, NEW YORK CITY: I want to thank Dr. Pfahler for his method. I have used another method consisting of making a pin-hole radiograph of the plate itself. This can be done by making two lead boxes with fine holes, 1/16 of an inch on one side, the plate on the inside, the tube on the outside, and in that way you get a pin-hole photograph of the focus point of the tube. It moves and shows the shape. Incidentally, the same process enables you to show other sources of X-ray from the walls of the tube.

I quite agree with Mr. Snook that electrostatic charges on the surface of the tube probably play an important part in this shifting of the focus. It can be done in two ways,—one by shifting the cathode stream, and the other by shifting the cathode itself. Therefore, a good way to test this is to shake the tube, and if the cathode rattles it is fair to assume that it will move under the influence of the charge and thus shift the cathode stream. I have seen this occur but I do not believe that it is always the process. That is also a good test.

The point at which the charge can have the most effect on the cathode is at the cathode neck where the distance between the edge of the cathode and the plate is small. I think that most of these tubes in which the focus point shifts will be found to have a lack of concentricity between the neck of the cathode and the glass walls of the tube.

Dr. Chas. L. Leonard, Philadelphia: It is possible that this whole subject is one which is bound up entirely with the use of very heavy currents as we are now employing as compared with the older currents. I used to use a wire screen to test tubes in the early days when we were using low currents.

I do not find such great variation among tubes and it seems, too, that Dr. Caldwell's point of variation of fixation of the cathode has much to do with this, and that the high currents that pass through the tubes produce a variation through the influence of the electrostatic field on the cathode and make it movable, as well as the effect that the static charge itself has. Has Dr. Pfahler found any difference in the size of the tubes in relation to this variation of focus; that is, have the larger tubes, eight and eight and a half inch tubes, any difference in this factor from the smaller tubes, and that is the distance of the static charge on top of the residual gas has it produced any effect in the variation of the focus point? Has a larger tube having a static charge and residuum in tube farther from the cathode or anode any marked effect on the focal point?

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Dr. Lewis G. Cole, New York City: At the Niagara meeting of this Society I presented a paper somewhat along these lines, and since then I have been using the pinpoint opening very much the same as Dr. Pfahler has been using the lines for selecting picture tubes. Whether this focus changes either in position or in size is relatively immaterial so far as we are concerned. Personally, I have considered the focal point as varying in size increasing from a small point to a large one rather than moving from side to side, or, as Mr. Snook said, in an eccentric position. It is immaterial, however, whether it moves from side to side, goes around or goes from a small point to a large one, or vice versa. Dr. Pfahler should be given a vote of thanks for bringing out these points.

Many of us have recognized this variation and have gotten at it in different ways, but after all it is immaterial. Another advantage of the pinpoint is that aside from studying the size and shape of the focal point on the anode, you can determine by that method the relative amount of direct and indirect rays which are given off from the tube; that is, the direct rays given off from the focal point and the indirect rays given off from the wall of the tube. By the pinpoint you get the image of the tube in addition to the pinpoint of everything else.

While Dr. Pfahler referred definitely to the movement of the focal point, I think that it is unimportant whether it moves or not. But I would like to have him tell us for technical reasons only why he thinks that it moves from side to side or elliptical rather than being definitely changed in size one way or the other.

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DR. P. M. HICKEY, DETROIT, MICH.: I would like to ask Dr. Pfahler whether this condition of a movable point on the target has any relation to the size of the burning point. I would also like to know whether he has noticed any connection between the results of his experiments and the condition of the cathode as we sometimes see it. Looking at the cathode from the point of the target we sometimes find a tube where the burning part of the cathode is quite round, and then we see that the dipping down of the burning point is sometimes down and sometimes over to one side. Personally I have been accustomed to judge something of the tube by the condition of the burning part of the cathode after the tube has been used.

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DR. A. JUDSON QUIMBY, NEW YORK CITY: I believe that this change is due to the warping of the metal under the heat produced, and also, as Dr. Caldwell said, by a loose terminal. We know that metal warps when heated, and this warping may become permanent while the manufacturer heats the terminals when exhausting the tube. In our exposure we heat the tube to a high degree of temperature, and the warping becomes permanent and then we have a fixed target. The spreading of targets as I have seen them occurs when we use more current than that tube can stand. If a tube is exhausted to carry approximately a milliamperage of a certain degree and you increase that too much you force the cathode stream forward because it increases the repulsion of the particles from one another, and it spreads out. I have also seen this point shift when the tube is transferred from one machine to another.

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DR. W. H. EAGAR, HALIFAX, N. S.: I have been working under a great deal of disadvantage with my tubes and apparatus, and I have found with even the very best tubes that if I turn my current on into the tube with the regulator set I do not get as good results as if I charge my tube before endeavoring to regulate it. I do not know why that is so. When I turn on the current in the tube it as a rule is high. Without the regulator we get blurring. I have always attributed this blurring to inverse current in the tube, but it may be due to variability in the focus probably the result of deflection of the cathode stream; therefore, I think that charging my terminals first gives me a better and truer picture.

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MR. H. CLYDE SNOOK: I would like to have Dr. Pfahler tell us what difference he finds in this movement of the focus point of tube when he makes the test on the coil, the transformer and on static machine.

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DR. PFAHLER, CLOSING THE DISCUSSION: I appreciate this discussion very much. Most of the questions can be answered by reading the paper. I have opinions, too, but I did not care to give them. There are a number of things which I can answer, however.

In the first place, I found that the size of the tube itself did not make any difference. You get more good ones in large bulbs and as many bad ones in the small ones. In all of these tests I got the tube in as good condition as I could get it, just as I would do if I were going to make a picture. I endeavored to duplicate the conditions I would have if I were to make a picture. The whole thing is directed toward that end.

With regard to the relative variation in the static machine and coil and transformer. I have not made careful tests as to that, except that I feel that the result would be the same no matter what the source of the current. I have used the tubes which I discarded on the static machine for treatment work and in one or two instances I have made plates and there is no difference. In other words, the tube is bad no matter where or how you use it.

As to seasoning the tubes, we all know that certain tubes get better after usage, but all tubes will not do this. However, the object of my paper was to select a good picture tube at the start, and I found that the tubes I selected are good tubes and remain good tubes no matter how much current I use. They are good tubes in themselves.

I think the trouble is around the cathode, either in its shape or its relation to the neck of the tube. But that is only a guess. As to the markings on the cathode of the tube, I mean the size of the burnt area, I suppose that we have all noticed a difference in the shape of the burning point, but there again one must use a tube quite a while before you know the area of the burning point and that is beyond the scope of my paper.

As to this being new, I can only say that it is not, but I have tried to work it out in a new way. The variability of the focus point is not new, but that it varies in the infinitely short time of a flash, 1/12 of a second, and that it varies to this high degree is, I believe, new.

As to the moving or spreading of the focal point, I think that if you had paid attention to my pictures you would have seen that that is not the case because you would have seen sharp shadows of the movement which you could not get in any other way.

# COMPENSATING DISPLACEMENTS OF THE THORACIC VISCERA IN PULMONARY TUBERCULOSIS.

BY CHARLES LESTER LEONARD, A. M., M. D.
PHILADELPHIA.

The laws of physics render it essential that the lungs shall follow the thoracic walls and the diaphragm in their movements. This is because the lungs are distensible flaccid organs, open to the inrush of air, placed within a closed and semi-rigid bony and muscular case, which is capable of increase and decrease in its volume by muscular movements. Any alteration in the capacity of the lungs must be compensated for, or the excursion of the walls surrounding them must be decreased.

Compensation for the loss of expansion in the lungs takes place through an increase in the capacity of their normal area, or through the interposition between the visceral and parietal pleura of an area filled with air, or fluid, or both. These changes must take place in proportion to the volume of the lungs involved in a pathological process. They are in a measure appreciable by the ordinary methods of physical diagnosis. The changes which can be noted by inspection and mensuration are, however, less marked in ratio with the extent of the disease, than those within the thorax, which produce displacements or alterations in the position of the viscera.

Tuberculous disease must be far advanced or an acute pneumo-hydro- or pyo-thorax of large volume must be present before the limitation of the thoracic movements can be noted by inspection. Marked alterations in the position of the inter-thoracic viscera occur in the earlier stages of tuberculous disease, without visibly changing the excursion of the thoracic walls. These displacements occurring early in the disease have been generally overlooked. Until recently it was held that the heart and greater blood vessels were so finely attached by ligaments to the skeleton and diaphragm that they could not be displaced except under extreme conditions. These views were apparently upheld by the post-mortem findings.

Since they have been recognized by the Roentgenologist in the living subject, it has become evident that the post-mortem changes hid the true condition. The correctness of this conclusion was shown as the result of a discussion which I had in 1909 with an internist connected with one of the largest institutions for the special study of tuberculosis. He did not believe that displacements of the viscera could occur so frequently in the earlier stages of the disease. He said that in some hundreds of post-mortems conducted at the institute they had failed to find such displacements. Some months later he told me that in the subsequent one hundred post-mortems they had found twenty-five or thirty displacements in the less advanced cases.

These pathological variations in the position of the thoracic viscera can be clearly shown only by the rapid Roentgenograms that eliminate the heart's motion. Their exact position and interthoracic relations can only be fully appreciated by the rapid stereo-roentgenogram.

The twelve cases used in illustrating the subject of this paper are taken from a series of one hundred cases studied by the rapid Roentgenogram. These cases were for the most part referred for examination from the State Dispensary for Tuberculosis through the kindness of Dr. A. P. Francine, and a part of them formed the basis of a paper read by me before the British Medical Association in 1908 (B. M. September 12, 1908). Many, however, including some of the more interesting pathological cases, were from private practice.

In the entire series of one hundred cases twenty-six displacements of the heart and aorta were found with three cases of pneumo-thorax. In seventeen cases the heart was displaced to the right; in four to the left; and in five a rotation took place with an upward displacement of the heart and aorta, so that the heart assumed an antero-posterior position. In two cases a superficial pneumo-thorax was found overlying the lower left lung and in one case an acute hydro-pneumo-thorax of tuberculous origin was shown.

It is practically impossible to reproduce the Roentgenogram in ordinary printing with sufficient clearness to make its interpretation valuable. The twelve cases cited as illustrations of the subject of this paper have therefore been reproduced in tracings made directly from the individual Roentgen negatives. Varying types of line drawing have been used to diagramatically represent the different stages of the pathological process. An increased number of lines in one direction represents the line of contractile force. The tracings are accurate in detail and can be more readily appreciated by the reader. The accompanying stereo-roentgenograms, if viewed through the ordinary parlor stereoscope, will show in a measure the wealth of detail which can only be fully appreciated by the study of the original negatives on the large stereoscope.

The sharp outline of the heart, seen in these plates, shows that the exposure must have been sufficiently rapid to eliminate its motion, that is, they must have been taken in a fraction of a heart's beat. The time between the stereoscopic pains, required to shift the plates and tube, was one-half second. The total time for both exposures was, therefore, less than one second.

A review of the cases, in the entire series, shows that those cases in which no displacement of the viscera was present were early lesions, in which no fibroid change had taken place, or that the lesions were not extensive and symmetrical, or that the heart was bound down by adhesions between the pericardium and the diaphragm.

The unequal elevation of the two halves of the diaphragm, Williams' sign, was present in less than one-half of all the cases, and was not present where displacements of the inter-thoracic viscera had occurred.

The irregularities of the diaphragm seen in the cases illustrating this paper are due to adhesions between the pulmonary and diaphragmatic pleura.

The pathological displacements of the thoracic-viscera in pulmonary tuberculosis are the result of compensation for the destruction of expansive normal lung tissue by the disease.

The displacing force is the result of one or two changes or the combination of both, or as in the case of acute pneumothorax from the rupture of the lung. The consolidated lung area may undergo fibroid change and contraction, the contracting tissues drawing the heart and aorta with them, while the emphysematous lung on the opposite side assists in their displacement. That these two causes can act separately or together is shown in the illustrating cases. In some the heart and aorta are displaced in a direction entirely different from that of the pressure exerted by the emphysematous lungs or even where a marked emphysema is absent. Again a displacement is present and an extensive emphysema alone accounts for it.

In the surgical treatment of ordinary abscesses, evacuation and drainage are followed by compression, by the external dressing, to bring about coaptation of its walls and healing. Since external pressure can not be exerted within the thorax, the same result is achieved in the natural healing of abscess cavities in the lungs by the displacement of the viscera to produce compression.

In addition to the displacements which cause compression of the diseased portion of the lung, there is present in many cases an ossification of the costal cartilages and an approximation of the ribs over the affected area. As I have suggested in a previous paper the ossification of the cartilages may be a process of ankylosis to limit the motion of the ribs and place the parts more nearly at rest.

The compensating displacements may be divided into four groups: Displacements of the lung by superficial pneumo-thoraces; displacements of the heart upward and into an antero-posterior position; displacements of the heart and aorta to the left; and displacements of the heart or heart and aorta to the right.

DISPLACEMENTS DUE TO PNEUMO-THORACES.

In both the cases of superficial pneumo-thorax, the physical examinations which preceded the Roentgen examination failed to detect them, but their presence was confirmed by subsequent physical examinations. In both cases the primary lesion was of the left upper lobe, with no involvement of the right lung. It is noteworthy that in none of the similar lesions of the entire series which involved the upper right lobe did a pneumo-thorax occur. The accompanying stereo-roentgenogram of Case 1 shows the lower lobe of the left lung hanging like a lace curtain within the thorax, conforming to the curve of the thoracic wall and separated from it by an area clearly devoid of all lung structure. The upper left lobe shows distinct lines of fibrosis in the infiltration, while peri-bronchial lymph nodes are seen in both lungs. A later stage of a similar lesion is shown in Case 2, but with an entire absence of peri-bronchial enlarged glands. In this case the entire left lung is involved. The cavity seen in the upper lobe shows that the older lesion was there. The lower lobe is compressed but not entirely consolidated and is covered with a distinctly thickened pleura, which can be seen in the Roentgenogram. In marked contrast to the succeeding case of acute hydro-pneumo-thorax, the heart and aorta are displaced to the left, probably entirely as the result of the compensating emphysema of the entire right lung.

The next case (3) was of particular interest, as it was an acute tuberculous hydro-pneumo-thorax. This Roentgenogram was taken with the patient in the erect position, because of the fluid, which is seen as a level line just below the seventh rib. The lung is compressed upon the mediastinum and the heart and aorta are displaced to the right. This condition was readily recognized by the physical examination, but the position of the heart and aorta were not definitely determined. In this case both the lung and the heart with the aorta are displaced to the right.

ANTERO-POSTERIOR AND UPWARD DISPLACEMENTS.

This displacement was found in five cases of the entire series as illustrated in this paper by Tracings 4 and 5. The tuberculous lesions in all these cases were symmetrical and involved both upper lobes. The heart was not only rotated but with the aorta was drawn upward, showing that a decided force was exerted by the contracting fibrous tissue in the upper lobes. It is possible that the decreased superficial area of the heart presented to percussion in these cases, may account for an old opinion that the heart is small in tuberculous subjects. This opinion was not confirmed by the comparison between the size of the heart and the body weight of the patients in the entire series.

In Case 4 the heart is drawn up and rotated, so that as it rests upon its apex it presents a peculiar aspect as a wide band occupying the mediastinum.

In Case 5 the rotation is not so complete and the hand of mediastinal shadow is broader. In the stereo-roentgenogram of this case it will be seen that the heart lies within a very much thickened pericardium upon the left side particularly which accounts for the peculiar straight line shown as its left border. The heart, however, can be distinctly seen within the pericardial shadow. The stereoscopic picture also shows very clearly a dilated bronchus forming a cavity in the right upper lobe with the surrounding infiltration and fibroid change in both upper lobes with commencing softening and cavity formation in the left upper lobe.

In the entire series of cases the displacement of the heart to the right was four times as frequent as the left, in direct opposition to the opinion expressed by some authors. Of the greatest importance to the clinician is the fact, first demonstrated by the Roentgenologist, that the aorta is also displaced in almost every instance. It is possible in most cases to demonstrate by percussion the border of the displaced aorta that lies outside the line of the sternum, but almost impossible to show the one that lies beneath it. This fact has undoubtedly led to the diagnosis of aneurysm in many cases of displaced aorta. In only one case of the entire series was an aneurysm found. It was suspected from the symptoms presented but could not be demonstrated by physical examination. The Roentgenogram showed an aneurysm buried in a mass of tubercular consolidation that occupied both upper lobes and a part of the lobes below them. In contrast to this is Case 8 to be spoken of later, in which the symptoms suggesting aneurysm were found to be due to a displaced aorta.

## DISPLACEMENTS OF THE HEART AND AORTA TO THE LEFT.

In addition to Case 2 of superficial pneumo-thorax where the heart and aorta are displaced to the left, this group of displacements is illustrated by Case 6. Here there is an extensive involvement of the left lung. There is a cavity with surrounding consolidation and softening in the upper lobe, while consolidation and marked fibrosis have taken place in the upper portion of the lower lobe. The heart is drawn well over to the left but the arch of the aorta is in its normal position.

## DISPLACEMENTS OF THE HEART AND AORTA TO THE RIGHT.

The extent to which the heart and aorta can be displaced upward and to the right, by fibrosis and contraction of a diseased area limited to the right upper lobe, is clearly illustrated in the stereo-roentgenogram of Case 7. The heart and ascending aorta are drawn up so far that the arc of the arch is increased and the separation from the decending aorta is so great that one can see through the arch. The right lower lobe is evidently emphysematous and presents upon its lower surface a dome-like protrusion of the diaphragm, evidently due to a localized adhesion of the pleura. The left lung shows no compensatory emphysema, but lines of infiltration and foci of tuberculous disease can be seen scattered through it, especially on stereoscopic examination.

The displacement of the heart and aorta in Case 8 gave rise to symptoms which led the laryngologist to suspect the presence of an aneurysm in an evidently tuberculous subject. In addition to a paralysis of the left vocal cord the case presented other very interesting features, and has been reported in detail by Dr. E. L. VanZant, by whom it was referred for Roentgen examination. The Roentgen plates showed that no aneurysm was present but that the heart and aorta had been displaced far to the right. The tuberculous lesion was confined chiefly to the right upper and middle lobes, where consolidation, fibrosis and cavity formation had taken place.

The multiple lesions of a rapid tuberculous process, as well as a moderate displacement of the heart and aorta to the right, are shown in Case 9. Here we have infiltration, consolidation, fibrosis, an old walled cavity, the breaking down of tissue to form a cavity, a cavity in the left upper lobe without a thickened wall, and an area of the lower right lobe covered by thickened pleura.

The remaining cases are illustrations of displacements to the right of the heart or heart and aorta, and are the types of cases readily recognized and termed dextra-cardia. Displacement of the aorta to the right is also present, but had not been determined by the physical examination, while Case 12 is the only case in the entire series in which displacement of the aorta did not occur with the displacement of the heart.

The moderate displacement of the heart and aorta to the right in Case 10 can be accounted for by the adhesion of the pericardium to the diaphragm and the general fibrosis which has accompanied the miliary tuberculosis.

The small masses of miliary tubercle are seen distinctly, especially in the original negative and the lantern slide, scattered throughout both lungs accompanied by bands of infiltration. The upper right lobe is consolidated, with fibroid change and cavity formation.

The wide displacement due to consolidation of the entire right lung with fibroid contraction and emphysema of the left lung is illustrated by Case 11. The original seat of the disease is shown by the advanced fibroid change in the right apex and the cavity formation. The heart and aorta are drawn far over to the right and slightly upward. The spread of the disease to the left lung is seen in infiltration and early cavity formation in the left upper lobe.

Another illustration of dextra-cardia with advanced fibroid change is shown in Case 12. The apex of the heart is displaced nearly to the median line. In this case, however, we find the arch of the aorta in its normal position. This absence of displacement is probably due to the general fibrosis which is evident throughout both lungs and the absence of consolidation and extensive fibrosis of the right upper lobe. This is the only case where the aorta was not displaced and also the only one of displacement to the right in which the right upper lobe was not extensively involved by the disease.

In all the cases illustrating this paper, and in the entire series from which they are taken, the clinical findings have been compared with the Roentgen diagnosis, and the points brought out alone by the Roentgen examination have been subsequently confirmed by a physical examination.

The Roentgen method of examination has been shown to add to the knowledge obtained by other methods of physical diagnosis, by detecting superficial areas of pneumo-thorax, by showing that the aorta is generally displaced with the heart and by making evident the effect of fibroid change in displacing the viscera through its contraction. In addition, it is a valuable mechanical method of observing and recording the changes, and displacements produced within the thorax by tuberculous lesions of the lungs. It also assists in the understanding of the processes of repair which take place in the closing and healing of old cavities, while it forms a permanent record for comparison with that obtained in later examinations, thus showing the progress of the disease or of the process of repair. It is self-evident that Roentgenoscopic examinations of the thorax and lungs, that is, the visual examination by means of the Roentgen rays and the fluoroscope, can not afford accurate permanent data such as are secured by the rapid Roentgenogram and particularly the stereoscopic Roentgenogram. There can be no doubt that viewing with the fluoroscope is a cheaper method and that it is less accurate since it gives data that are only visible to the eye of one observer. It possibly affords an advantage in viewing the movements of the diaphragm, but it can not eliminate the effect of motion produced by the heart's beat and does not show the minute detail essential to a careful diagnosis. An examination sufficiently long to enable the observer to gain any valuable information must necessarily expose the patient to the rays for a far greater period than the second or two required for the rapid stereo-roentgenogram.

The series of cases illustrating this paper in tracings, stereoroentgenograms and lantern slides shows the contribution which Roentgenology has made to the knowledge of the pathological displacements of the thoracic viscera produced by the lesions of pulmonary tuberculosis.

# COLLABORATION ESSENTIAL IN THE DIAGNOSIS OF SURGICAL CONDITIONS OF THE KIDNEY AND URETER.

BY JOHN HUNTER SELBY

It may be stated safely that few Röntgenologists have escaped the grave situation in which an erroneous interpretation of an X-ray plate has been responsible for operative procedures and the surgeon demands a postoperative or perhaps postmortem explanation. In such an event it is comforting to be able to prove that the error was unavoidable, and not the result of inaccurate technic. All Röntgenologists of experience have, at times, interpreted plates incorrectly, and only with the utmost care and earnest endeavor do they avoid errors in most cases. However, with improved technic, and a closer cooperation with their fellow practitioners, the percentage of failures should be reduced to a minimum.

In no branch of X-ray work are there greater opportunities to work out refinements in differential diagnosis, of such vital importance to patient and surgeon than in the field of surgical diagnosis of the urinary tract. The urgent need for a more complete and systematic Röntgen examination of the kidney and ureter cases, than that which is afforded by the work of novices should be realized by all specialists as well as by general practitioners. Physicians are too often called upon to deal with inaccuracies in Röntgenographic work, and many of them show unusual patience in their toleration of unsatisfactory and, frequently, misleading examination.

In explanation of the present unsatisfactory and inaccurate condition of much of this work, one should consider (1) the comparative newness and rapid development of this branch of X-ray work; (2) insufficiency of clinical material, proper equipment, and detailed technical information, and opportunity for systematic instruction; (3) the failure of the physician to anticipate the necessity for an adequate initial outfit, and the cost of its installation and maintenance; (4) the presence within the field of Röntgenology of so many amateurs and transients whose experience in the interpretation of plates is insufficient.

We have a right to regard with suspicion all diagnoses based on data known to have been obtained under such conditions.

The methods commonly employed by the inexperienced X-ray worker in the diagnosis of genito-urinary conditions are about as follows: A cathartic may or may not be given the day before. One or more exposures of the abdomen and the pelvis are made. The plates commonly used are slow, and the exposure prolonged. Shadows of various kinds are frequently met with, and, depending largely upon whether a given shadow is in the line of the ureter or in the region of the kidney, a "snapshot" diagnosis is made. The second examination is rarely deemed necessary to confirm the first, and a cystoscope is seldom employed to "check-up" the findings. Such procedures must necessarily result in inaccurate interpretations, since it is very difficult to identify many of the suspicious shadows which appear in most plates of the bony pelvis.

I will not here name the various objects capable of casting shadows, which must be ruled out. In some instances the passing of a stylet, particularly where a clear set of stereoscopic plates can be obtained immediately, will aid us materially in localizing a shadow. But, as has been emphasized by Braasch, the stylet alone does not always localize a given shadow. A small calculus in a ureteral diverticulum is one instance where it might fail. Again, a phlebolith may lie so near to the ureter, or a calcareous deposit in the wall of the ureter may occupy a position so close to the stylet as to make it impossible to be positive of its exact location or nature. We have encountered this condition many times, and in several instances, at operation, have witnessed the practical demonstration of our errors in interpretation. These failures should stimulate us to renewed effort to work up a more accurate technic.

Phleboliths occur either singly, in strings, in groups, sometimes unilaterally placed, or on both sides in the bony pelvis. Their distribution is irregular in many instances. They not infrequently occur in conjunction with ureteral calculi from which their shadows alone are indistinguishable. In appearance they vary so widely that recognition and identification are often attained with the greatest difficulty, particularly in those cases where the shadows occur upon the side where we strongly suspect trouble. Here again it is absolutely necessary to remove all possible doubt and make every effort to be positive in our findings. For example, we should not be content to say of a given "suspicious" shadow, "It is most likely a phlebolith, but it happens to be situated on the side where we expect a ureteral calculus." In over half of the cases that are referred to our laboratory for examination phleboliths give more trouble than any other three groups of objects that necessitate "proving up."

There is, however, a method of examination at our command by which we can clear up all doubt in at least 95 per cent of these cases. The first essential in this method and its success depends on absolute co-operation between the cystoscopist and the Röntgenologist. Each specialist has his separate and distinct work to perform. It is manifest, therefore, that at the outset a combined technic must be carefully worked out by the two examiners so that the various details may be employed in harmony.

This co-operative examination opens up additional possibilities, especially in that large group of abdominal cases seen in daily practice, which exhibit an indefinite line of symptoms referrable perhaps to the appendix, gall-bladder, stomach, duodenum or spine, but with a strong possibility of involvement of the genito-urinary tract. Such cases require careful study, and some of them tax every means at our command before we can approach an accurate diagnosis.

In St. Mary's Hospital (Mayo Clinic) all such cases are referred to the Röntgen laboratories for examination. The routine examination in this clinic is as follows: The clinician in charge takes a full history and makes a physical examination. A 24-hour specimen of urine is analyzed and perhaps a gastric analysis made. These may throw considerable light on the case and yet not fix the diagnosis. The case is then referred to the Röntgen Laboratory after the proper preparation of the intestinal tract. A set of stereoscopic plates of the upper abdomen, and a second set of the lower abdomen and pelvis are made by the rapid method, that is, while the breath is held. Rapid plates (10x12) are used routinely. The exposures range from a fraction of a second to, in rare cases, three seconds. Intensifying screens are seldom needed. Should this examination fail to reveal any abnormality of the genito-urinary tract the diagnosis is still in doubt. The patient, therefore, goes through a second preparation of the intestinal tract and is referred to the cystoscopist the following day. In the meantime, the original plates are studied and a consultation is held between the physician in charge, the Röntgenologist and the cystoscopist. This, at times, furnishes the cystoscopist with much needed information, and establishes a new working basis for the Röntgenologist, should subsequent events indicate a second X-ray examination. The cystoscopist now makes his thorough routine examination. This alone may clear up the diagnosis and thus eliminate the necessity for the "combined examination." It may confirm the original X-ray findings or disprove them. Again, it may give evidence of trouble not heretofore suspected. Therefore the indications for the combined examination depend upon the *original X-ray findings* plus the findings at the cystoscopic examination.

At this stage in the examination the procedure must vary with the individual case. Voelcker in 1906, demonstrated that a solution of silver colloid (collargol) injected through the ureteral catheter would produce a shadow outline of the renal pelvis on the X-ray plate. He demonstrated several cases of hydronephrosis and suggested further possibilities of the method in renal diagnosis. Early in 1909 Braasch applied the method in this clinic. Since then it has been used here in over 600 cases and its value amply proven in the diagnosis of numerous pathologic conditions of the urinary tract. Silver colloid solution possesses a relatively high power of absorption for

X-rays, as compared with the surrounding tissues. If used while fresh in a strength of not over 10 per cent., an effective diffusion with the urine present avoids precipitation of colloidal silver. The density of the shadow cast depends upon several factors: (1) the skill of the operator who makes the injection; (2) the amount injected; (3) the thickness of the overlying tissues and their consistency; (4) the quality of rays in use.

The injection should be done by the cystoscopist, who is familiar with the peculiarities of the case. The patient, being more or less nervous under such circumstances, is apt to look with suspicion on any additional manipulations. The patient must be kept perfectly still and the exposures should be as short as possible in order to secure clearness and density. All of these factors must be taken care of simultaneously. In the hands of a skilled examiner the procedure is usually attended with but little discomfort.

There are two efficient methods of injecting the kidney and ureter with silver colloid: (1) the *gravity* method and (2) the *syringe* method. The important factor in each is to avoid over-distending the renal pelvis, its calyces, and the ureter. Should over-distention occur, a renal colic may cause a violent contraction which prevents getting an outline of the pelvis in repose. The shadow of the pelvis in contraction is misleading and valueless. During the attack of colic the patient is restless and even if the exposure be short we are apt to get a blurred image which is also confusing.

Should, for example, the original plates show a shadow at the region of the uretero-pelvic juncture on the right side,—perhaps shown distinctly in both plates of the stereoscopic set—we should record its presence, appearance, and apparent location, and call it a "suspicious shadow" to be investigated. The case is referred to the cystoscopist for further examination. We do not dare to risk making a diagnosis on the original plates alone, even when the history and symptoms would seem to justify it. Experience in a large number of these cases has taught us that the most careful interpretation, in many instances, is unsafe. Therefore, we are content to call these shadows "suspicious" until we have established their identity and their approximate location.

At the subsequent or *combined examination* we seek not only to locate and identify the calculus, if present, but we endeavor to gain additional information, such as demonstrating the possible presence of an associated ureteritis, constriction or local dilatation of the ureter, hydroureter, hydronephrosis, pyonephrosis, or deformities. Should the above procedure exclude the "suspicious shadows" as a possible source of trouble and fail to demonstrate any other deviation from the normal, the genito-urinary tract may be eliminated from the examination. But the combined examination may have demonstrated any one of a number of important surgical conditions; for example, an anatomic or pathologic stricture, kink, constriction, tortuosity, an anomaly of the ureter, nephroptosis, pyonephrosis, hydronephrosis, tuberculosis or chronically inflamed renal pelvis, variation in the shape and contour of the normal pelves and calyces, the presence of organized or amorphous deposits in the kidney, or a renal neoplasm.

Oftentimes one is called upon to rule out the kidney in the case of an abdominal tumor with which it may easily be confused. Here the combined method of examination is of the greatest value. We cannot only locate the position of the kidney and thereby ascertain the relative position of the tumor, but experience, gained by the study of a large number of plates outlining the renal pelves has shown that where the kidney itself is involved to any extent by a tumor one can usually find distinct evidences of it in a clear X-ray plate of a skillfully injected renal pelvis.

None of the above mentioned conditions occur so rarely as to be ignored as a possibility in a given case. All of the conditions mentioned above have been demonstrated in this clinic within the past two and one-half years, and some of them many times.

These observations are based upon a study of 1986 abdominal cases of the type referred to above, radiographed during the past eighteen months in St. Mary's Hospital (Mayo Clinic). Of these, 300 were examined by the combined method, colloidal silver being used.

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References.

Braasch: Surgery, Gynecology & Obstetrics, April, 1911; Annals of Surgery, Apr. and Nov., 1910; Jour. A. M. A., Dec., 1911.

Voelcker: Beit. z. klin. Chir., 1906, lii.

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## DISCUSSION.

DR. EUGENE W. CALDWELL, NEW YORK CITY: I doubt whether anywhere in the world there can be gathered together such a large collection of interesting cases of this kind. The history of Roentgen diagnosis began long ago. It is divided into distinct periods. Dr. Leonard ten or twelve years ago did a great work for us by making some wonderful plates showing stones in the urinary tract. Dr. Selby has shown us how necessary is the co-operation between the roentgenologist and the urologist in this work. In the beginning of this work we were very much delighted when we were able to show a stone. Often we failed to show it when it was there. This was followed by a period of over-enthusiasm and it was claimed that every stone could be shown by the ray.

Then we became more conservative, and we said that we had found a shadow which might be caused by a stone, or when we failed to find it, we said that it might be there. Then came the argyrol injections to help us in this work.

Dr. Selby works under unusually favorable conditions. To do this collargol and argyrol work promotes the development of the highest degree of skill in this work and this can be done best only in a hospital. It is exceedingly difficult in private practice. One day you will have a surgeon who pays absolutely no attention to asepsis, and the next you will have the man who is over-zealous in his attempts to secure asepsis.

We must encourage this teamwork. Without a high degree of co-operation between the urologist, the surgeon and the roentgenologist you cannot get such results. At least, we cannot hope to get the best results in this line until we get teamwork.

I am glad that Dr. Selby spoke about the stereoscope, although I am not quite in accord with all he said. He says that he does not look at these plates stereoscopically. The kidney region, it is true, does not offer a favorable field for stereoscopic work, but the region of the pelvis is quite favorable for such work. Stereoscopic examination of these plates will, I think, often make unnecessary further work with the cystoscope. I have in mind two cases, one especially, where two stones were superimposed. There were shadows which we thought were due to thickened places in the bone. The stereoscope showed them distinctly to be stones. It always takes a little time to look at these plates stereoscopically, but every once in a while we gain some exceedingly valuable information in that way.

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DR. PERCY BROWN, BOSTON: Every one must be prepared by this time to give the urologist two "don'ts,"—the pre-roentgenologic "don't" and the post-roentgenologic "don't." The pre-roentgenologic "don't" is, Don't mess around with your urology before the time that you finally make your cystoscopic examination for roentgenologic purposes. If you do that, you cannot get the patient to the roentgenologic laboratory. Just as little pre-roentgenologic activity on the part of the urologist as possible is eminently desirable.

The post-roentgenologic "don't" is, Do not squirt the patient too full of solution; do not ram the syringe in too hard; do not use too much collargol, because after the urologist has left, you will have to put the patient to bed and keep him there under morphine for several hours. He is having a fine renal colic which makes it impossible for him to leave your laboratory.

DR. CHAS. L. LEONARD, PHILADELPHIA: I want to congratulate Dr. Selby on this work, but I cannot refrain from saying that I wish he would look at his plates stereoscopically. He should do so at least once in a while and see how much can be learned from this method. I recently examined plates stereoscopically and located five stones in the lower ureter. The surgeon would not have found the fifth stone if I had not located it stereoscopically. I have a plate in which the stones can be seen stereoscopically very plainly when ordinary examination of the plate would not show them distinctly. A stereoscopic examination certainly gives more information than can be obtained from the plates.

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DR. SELBY, CLOSING THE DISCUSSION: I want to correct a misunderstanding. I hope that I did not so far forget myself as to say that I never examine these plates stereoscopically. I do not depend on it, but I frequently examine them. One of my points is, that if stone is there, well and good, but the important thing is to show where it is. I frequently read my pelvic plates stereoscopically.

Dr. Caldwell spoke about teamwork. There is no other term in the English language that expresses it so well or so accurately as the word "teamwork." Teamwork is essential and we must have it not only in this work but in all our examinations.

Dr. Brown calls attention to the difficulties after the cystoscopist has had the patient. That is the reason why in Rochester we make a routine examination with the Roentgen ray before the patient is sent to the cystoscopist. The patient comes to the Roentgenologic department first, so that one entrance of the cystoscope does the whole work. With Dr. Stover's method the patient does not have to lie there too long and he can stand up without being too tired.

If you over-distend a kidney, there is a little pain, and all operators have found that there is a point which will tell you when to stop. There is a little premonitory distress. Usually about 10 c.c. is the amount injected.

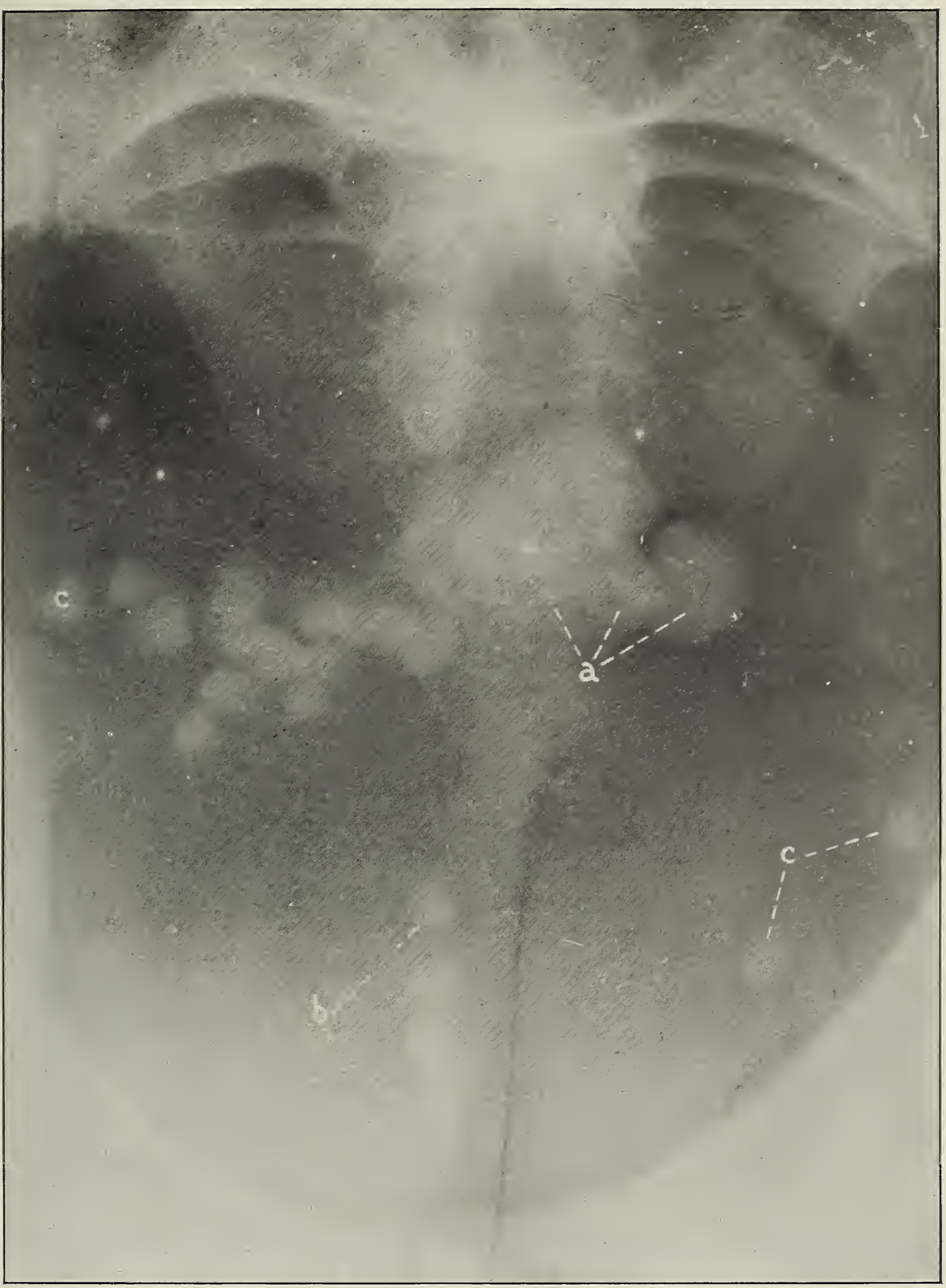


Fig. 1. X-ray No. 9658. Region: bony pelvis. Original plate shows multiple shadows of various sizes. These must be identified. Diagnosis: (A) several stones in bladder, (B) multiple calcareous deposits in the prostate, and (C) vein stones. Confirmed at operation.


Fig. 2. X-ray No. 9062. Region: left lumbar. Original plate, showing large square shadow presumably in renal pelvis and small shadows in lower pole. In such a case it is necessary to ascertain presence or absence of hydronephrosis, pyonephrosis, or any other associated condition. At operation large square stone removed from pelvis, stony calculus from lower calyx and parenchyma.

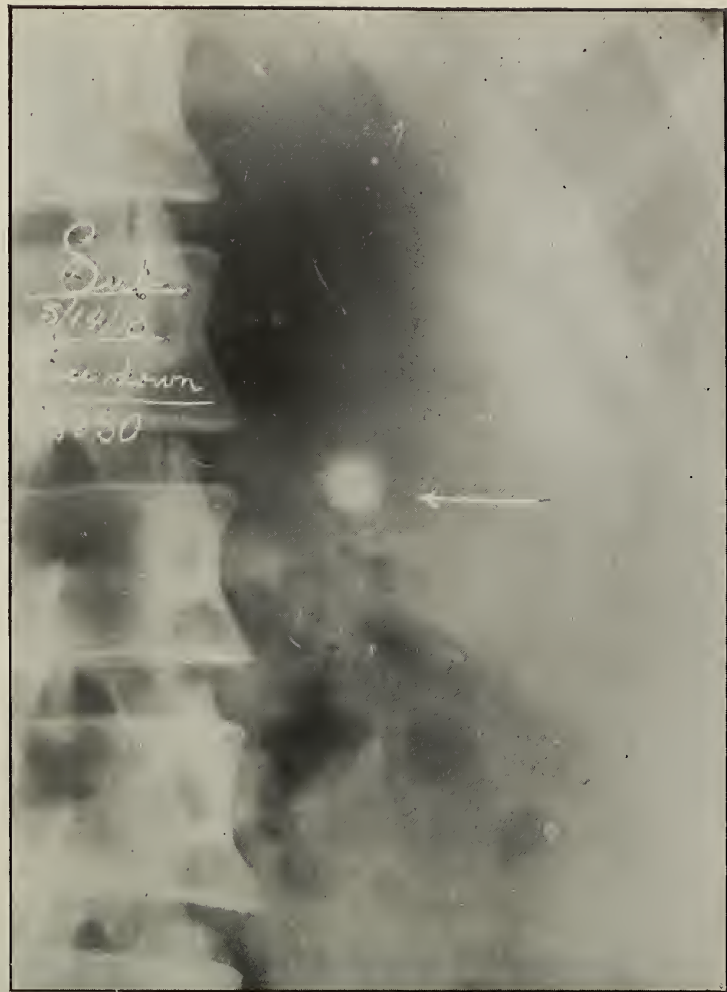

Fig. 3. X-ray No. 8630. Region: right abdomen. Position face down. Original plate showed suspicious shadow region of right kidney, suggesting gall-stone. This second plate, face down, strengthened the suspicion of gall-stone. An injection of the renal pelvis with colloidal silver showed the shadow to be three inches above position of the low-lying renal pelvis. Diagnosis: gall-stone. Removed at operation.

Fig. 4. X-ray No. 8050. Both lumbar regions. Original plate. Note enormous branched shadow on right side, and large fan-shaped shadow on left. In this case it was all important to determine whether one or both kidneys were functionating sufficiently to justify operation. Plate of the injected kidneys (not shown) revealed a pyonephrosis of left kidney, an absence of pyonephrosis and hydronephrosis in right kidney. Operative findings: a branched stone size of small orange in right kidney, multiple stones of various sizes and an associated pyonephrosis in left kidney.

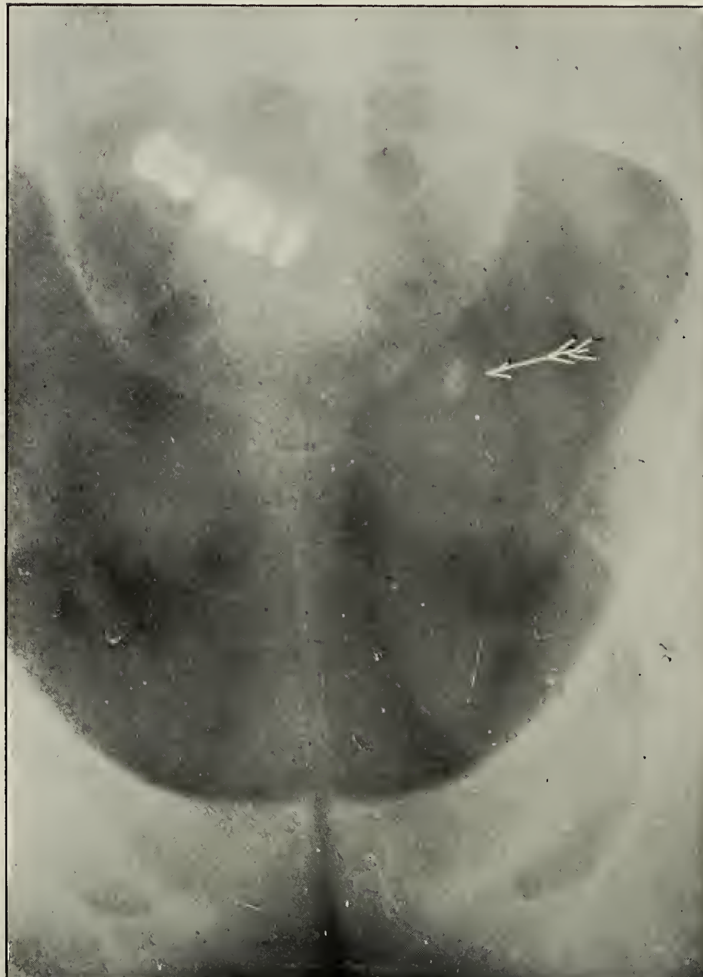

Fig. 5. X-ray No. 12288, a. Region: left pelvic. Original plate shows suspicious shadow in region of ureteral-pelvic junction.

Fig. 6. X-ray No. 12288, b. Colloidal silver injection locates suspicious shadow in ureter at ureteral-pelvic junction and demonstrates a dilatation of the ureter above the calculus.

Fig. 9. X-ray No. 10771. Region: right lumbar. Demonstrates a suspicious shadow over sacro-iliac joint. Note outline of ureter curving over shadow to low-lying kidney.

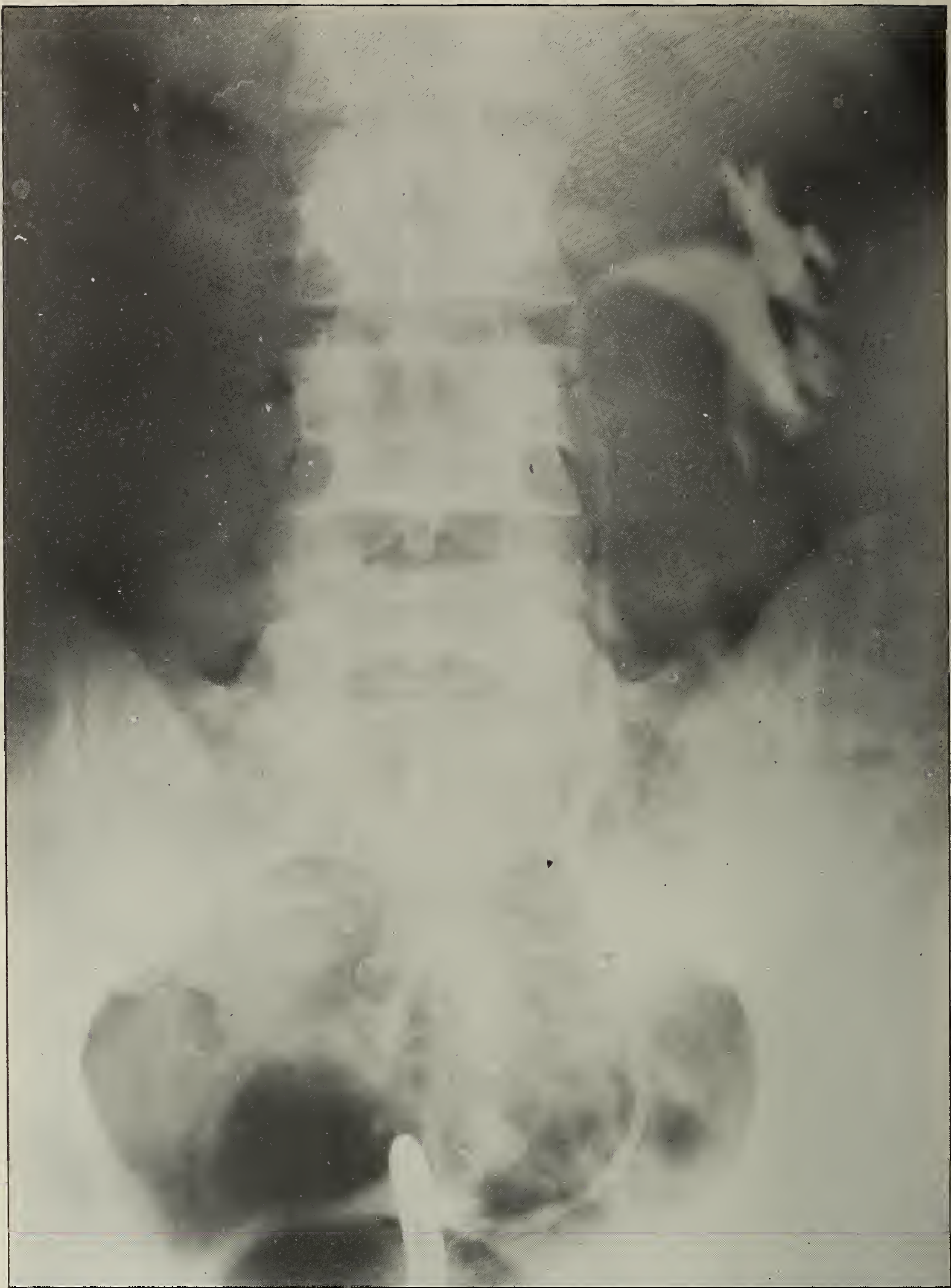

Fig. 10. X-ray No. 9679. Region: abdomen and pelvis. Colloidal silver injection outlines a carefully injected renal pelvis and ureter, with full but not over distention of either calyces, pelvis or ureter.

Fig. 11. X-ray No. 13018, a. Region: right lumbar. Original plate shows suspicious shadow in region of right kidney pelvis, also suspicious shadow opposite 5th lumbar.

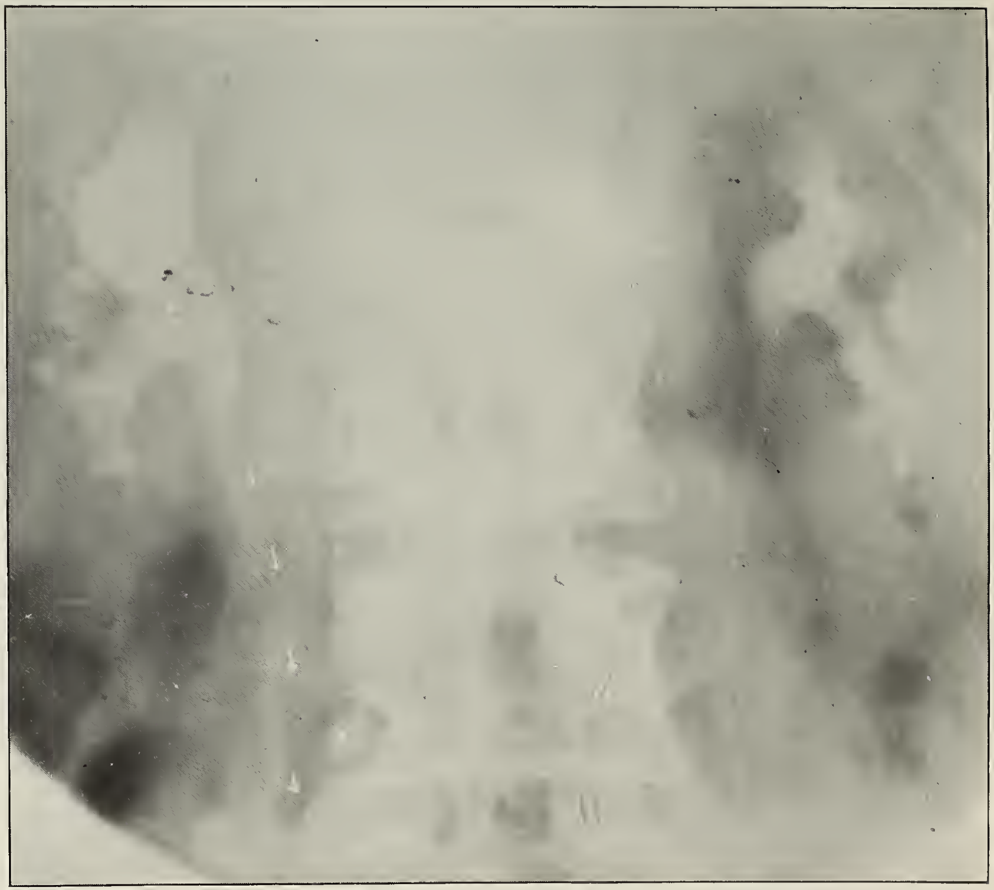

Fig. 12. X-ray No. 13018, b. Colloidal silver locates a shadow in the renal pelvis and shows distention of the upper calyx, also rules out lower shadow. Left kidney also injected and shows a normal pelvis.

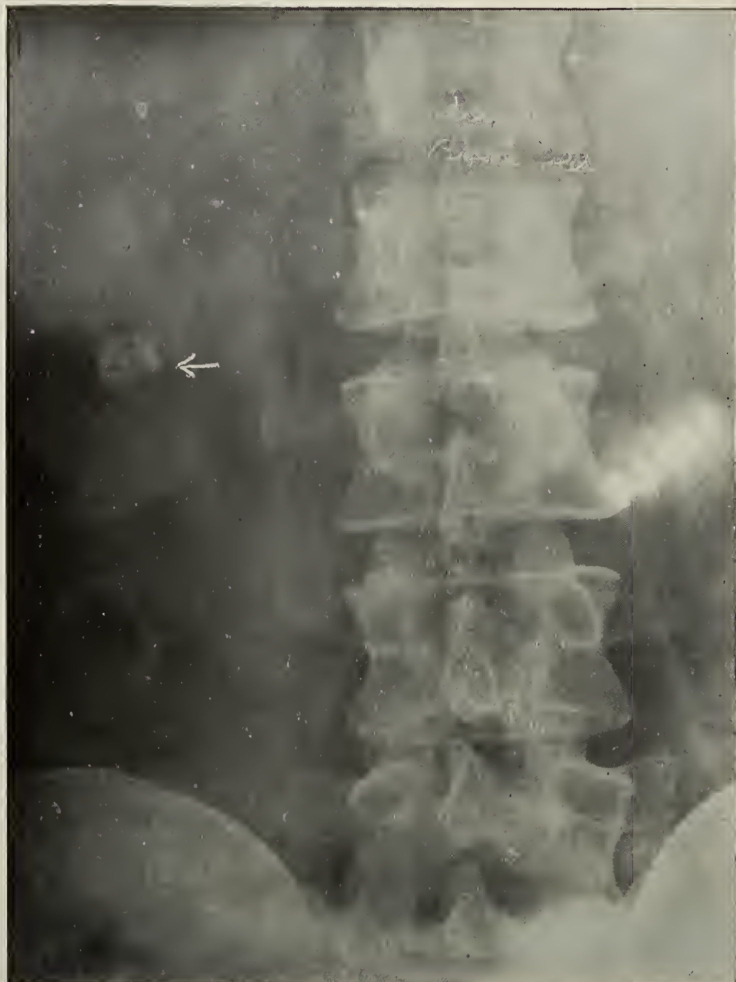

Fig. 13. X-ray No. 11044, a. Region: right lumbar. Radiograph shows composite shadow at level of second intravertebral disc.

Fig. 14. X-ray No. 11044, b. Colloidal silver injection shows moderate hydronephrosis with distention of both pelves and calyces. Note outline of renal calculus in renal pelvis. Confirmed at operation.

Fig. 15. X-ray No. 13128, a. Region: right lumbar. Original plate shows two suspicious shadows. These must be studied further.

Fig. 16. X-ray No. 13128, b. Colloidal silver locates suspicious shadows; shows larger one in middle calyx, other at ureteral-pelvic junction. Small distention of the upper calyx. At operation calculus removed from ureteral-pelvic junction.

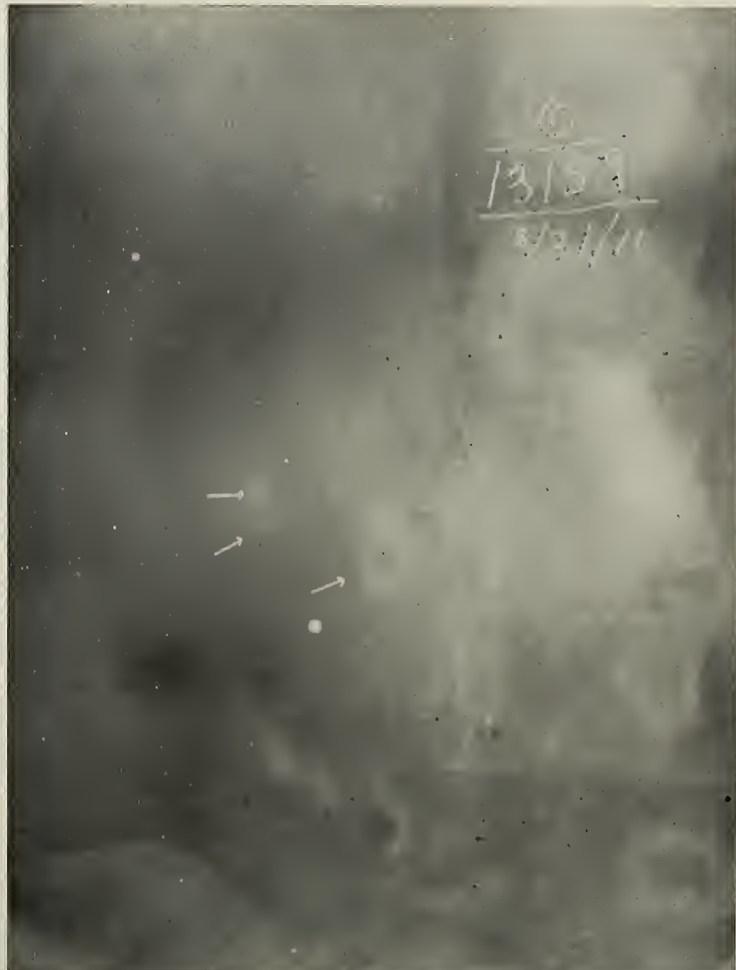


Fig. 17. X-ray No. 13159, a. Region: right lumbar. Original plate. Arrows indicate two small suspicious shadows and one much larger.

Fig. 18. X-ray No. 13159, b. Colloidal silver injection shows considerable hydronephrosis. Note change in position of large calculus, having been pushed up an inch by introduction of catheter. At operation larger calculus obstructed ureter at ureteral-pelvic junction. Two small stones removed from cortex of lower pole.


Fig. 19. X-ray No. 13167, a. Region: left lumbar. Original plate. Note outline of large branched shadow and compare with Plate b.

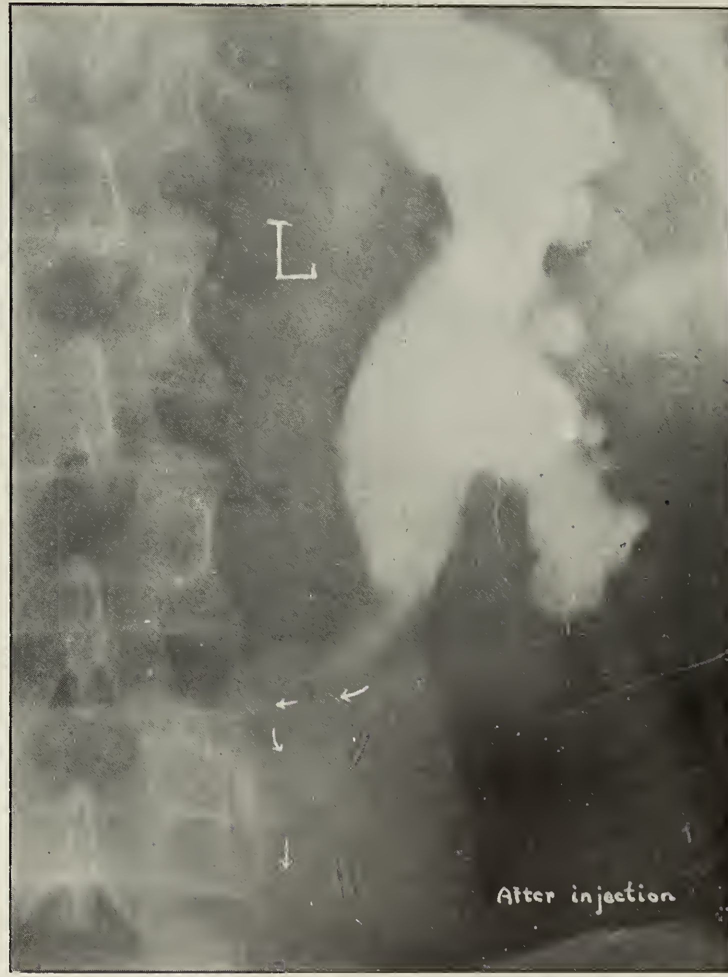


Fig. 20. X-ray No. 13167, b. Colloidal silver shows shadow to be a large branched stone filling kidney pelvis and calyces. No hydronephrosis or pyonephrosis is associated with it. At operation multiple stones removed from cortex and large branched stone from the pelvis. No hydronephrosis or pyonephrosis was present.

Fig. 21. X-ray No. 13447. Region: left lumbar. Colloidal silver injection shows pyonephrosis with multiple calculi in upper pole, single branched calculus in lower pole. Confirmed at operation.

Fig. 22. X-ray No. 11516, a. Region: left side of pelvis. Original plate shows a suspicious shadow at region of left ureteral-pelvic junction.

Fig. 23. X-ray No. 11516, b. Shadow of the catheter rules out possibility of the shadow being intra-ureteral. Evidence of inflammatory condition in right kidney obtained and right kidney and ureter therefore injected with colloidal silver. (See Plate c.)

Fig. 24. X-ray No. 11516, c. Both lumbar regions. Colloidal silver shows outline of a distended renal pelvis with irregular calyces, indicating a pyonephrosis. At operation a tuberculous pyelitis and a small pyonephrosis was found.

Fig. 25. X-ray No. 12826. Region: right lumbar. A calcified dead kidney. Absence of secretion. Not operated.

Fig. 26. X-ray No. 8517. Region: right lumbar. Colloidal silver injection of renal pelvis. Original plate showed a shadow size of a pigeon's egg over region of right renal pelvis. Arrows point to shadow overlappng renal pelvis. No evidence of obstruction or dilatation. At operation proved to be a large gall-stone covered with a deposit of lime salts.

Fig. 27. X-ray No. 10546. Region: left lumbar. Colloidal silver injection shows irregular distention of ureter throughout its length; kidney pelvis contracted, indicating an inflammatory condition. Diagnosis: tuberculosis of kidney and ureter. Confirmed at operation.

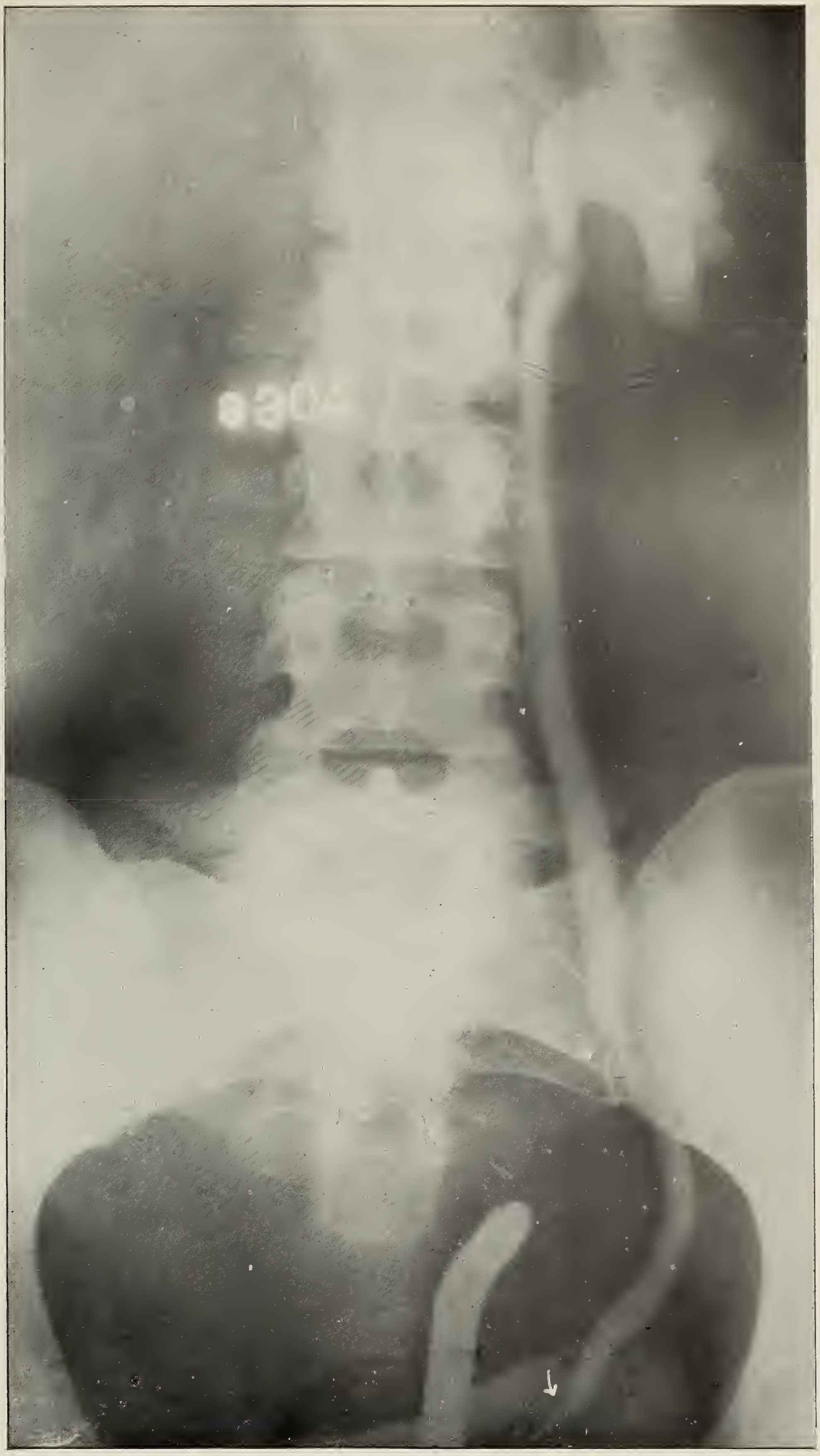

Fig. 28. X-ray No. 9304. Region: abdomen and pelvis. Uniform moderate dilatation of left ureter throughout its entire length with small hydronephrosis. Obstruction present at ureteral-vesicular junction. Shadow on original plate present at this point. Diagnosis: small ureteral stone. Not operated.

Fig. 29. X-ray No. 9076. Region: right lumbar. Colloidal silver injection outlines a normal renal pelvis in a low-lying kidney.

Fig. 30. X-ray No. 8399. Region: left lumbar. Colloidal silver injection demonstrating an enlarged renal pelvis with normal outline of calyces. No evidence of ureteral stricture or obstruction. Explored at operation for fibroids and found to be normal.

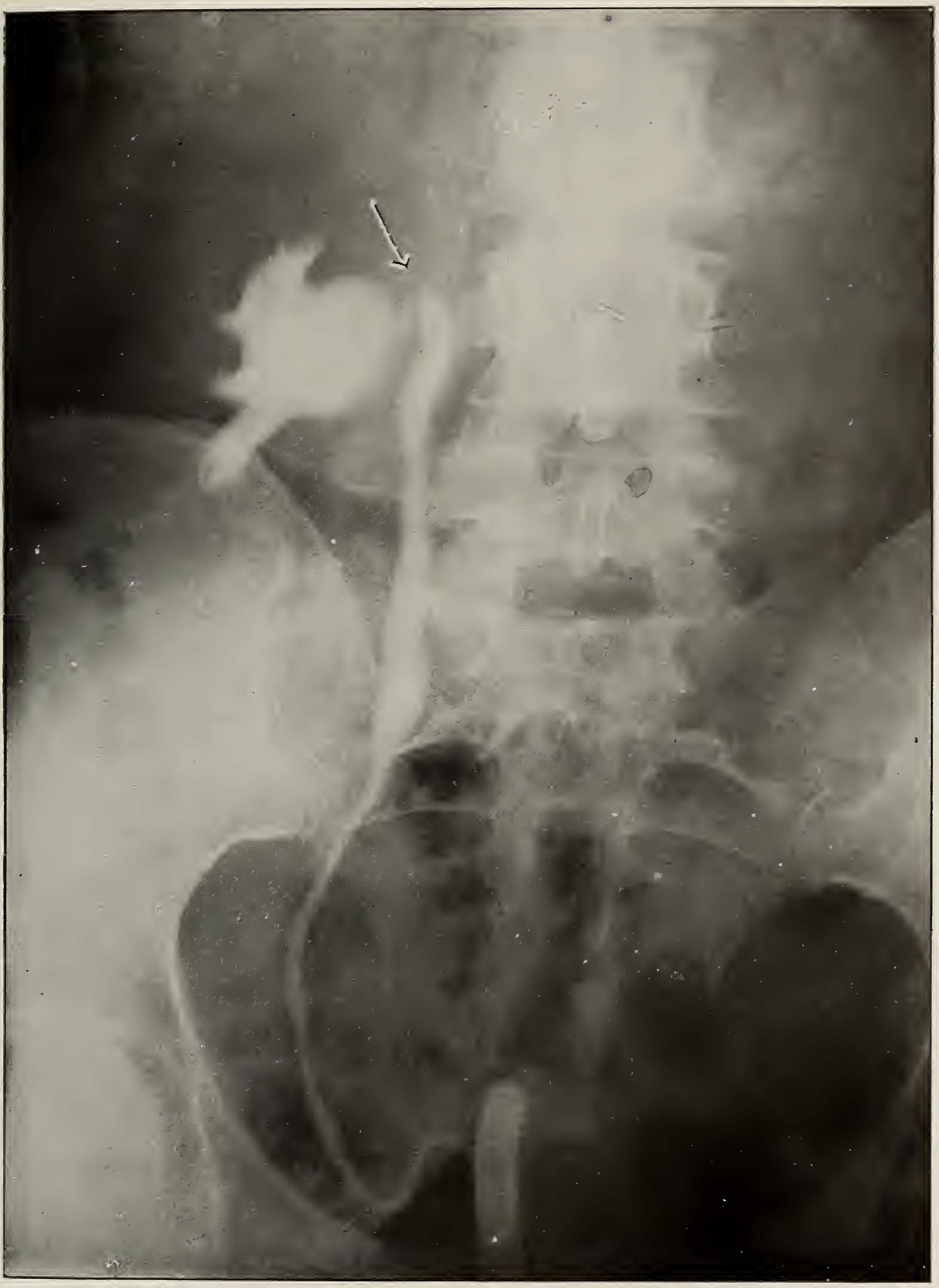

Fig. 31. X-ray No. 11082. Region: right lumbar and pelvis. Colloidal silver injection outlines distended pelvis of a low-lying kidney and a sharp kink of ureter at level of fourth transverse process with moderate hydronephrosis.

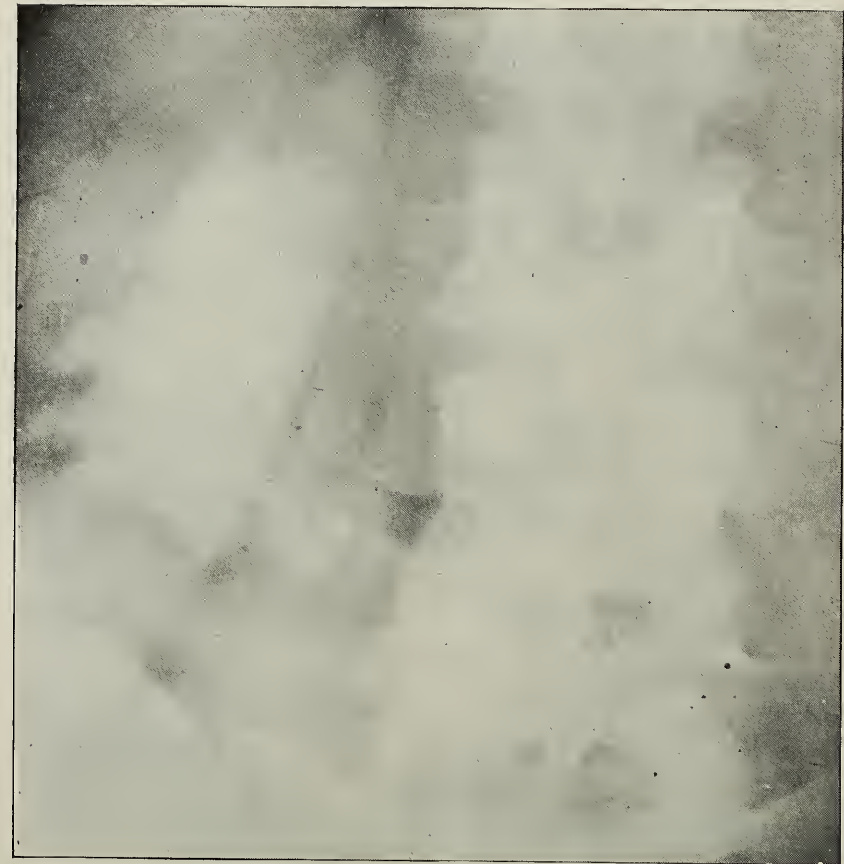

Fig. 32. X-ray No. 12674. Region: right lumbar. Intermittent hydronephrosis. Varies in size from a few ounces to size of a child's head. Note position of low-lying renal pelvis and tortuous condition of the ureter. Calyces not distended. At operation contained only three ounces.

Fig. 33. X-ray No. 13517. Region: right kidney. Colloidal silver injection shows a low-lying kidney with complete rotation of the organ on its long axis. A hydronephrosis is present. Arrows indicate position of ureter. Not operated.

Fig. 34. X-ray No. 8705, a. Region: right kidney and ureter. Original plate. There is no suggestion of the pathologic condition encountered at the cystoscopic examination. Confirmed by the combined examination and proved at operation. (See Plates b and c.)

Fig. 35. X-ray No. 8705, b. Colloidal silver injection shows a hydronephrosis with great dilatation of the ureter throughout its length. Compare with Plates a and c. Confirmed at operation. Congenital stricture of ureter at the bladder.

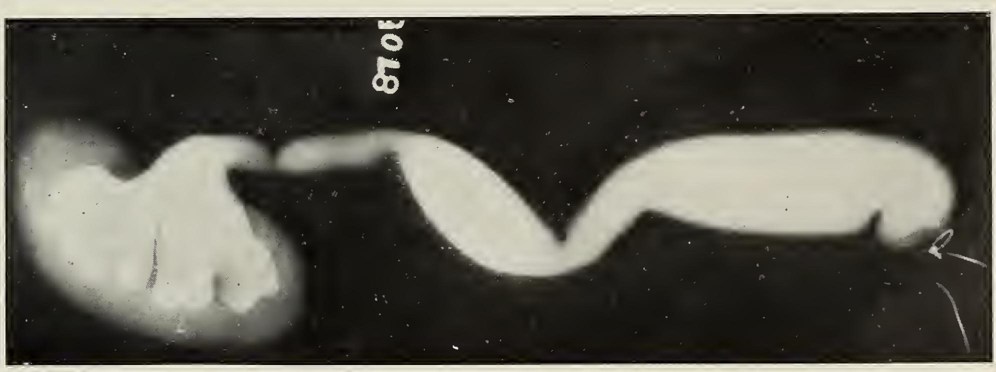

Fig. 36. X-ray No. 8705, c. Radiograph of pathologic specimen reinjected with colloidal silver immediately after operation.

Fig. 37. X-ray No. 10317. Region: left lumbar. A large hydronephrosis. A suspicious shadow in line of right ureter indicated cystocopic examination and this led to finding of the hydronephrosis. At operation an anomalous vessel was found constricting the ureter.

Fig. 38. X-ray No. 9105. Region: left lumbar. A huge pycnephrosis. Colloidal silver to be seen in scattered areas. At operation found to contain three pts. of pus.

Fig. 39. X-ray No. 10173½. Region: right lumbar. Huge hydronephrosis. Its position, outline and approximate size clearly demonstrated by colloidal silver. Note sharp bend in ureter indicated by arrow over spine. At operation found to be infected.

Fig. 40. X-ray No. 10215. Region: right lower abdomen. Colloidal silver injection of kidney and ureter. Shows a horse-shoe kidney with moderate distention of the pelvis in upper pole and great distention of the pelvis in lower pole (left pelvis). Confirmed at operation for appendicitis.

Fig. 41. X-ray No. 9139. Region: left lumbar. The presence of large tumor indicated a shadow plate of the renal pelvis to differentiate the tumor mass from kidney. Note shadow of tumor overlapping outer portion of kidney. Renal pelvis normal. At operation tumor proved to be spleen.


Fig. 42. X-ray No. 12972. Region: left lumbar Colloidal silver injection of kidney and ureter shows renal pelvis displaced in front of spine and shows distortion from pressure of large tumor mass shown to be extra-renal. At operation a large hematoma was encountered.

Fig. 43. X-ray No. 10073½. Right lumbar region. Colloidal silver injection shows renal pelvis to be constricted, its calyces either irregularly distended or elongated and narrowed. Diagnosis: mesothelioma. Confirmed at operation.

Fig. 44. X-ray No. 10962. Region: abdomen and pelvis. Colloidal silver injection of both right and left kidney and ureter; shows two separate ureters on the right leading to a kidney with double pelvis. A single ureter on the left.

# ABSTRACTS

SELECTED BY F. C. ZAPFFE, M. D.

## An Improvised Roentgen-Ray Apparatus.

BY HOSP. STEWARD H. A. HARRIS, U. S. N.

*U. S. Naval Med. Bull., July, 1911.*

The X-ray apparatus illustrated in the figure has been installed at the dispensary, navy yard, Mare Island, Cal. After more than six months' use it has been demonstrated that the apparatus is economical, practical, and now indispensable. It has been operated nearly every day during this period with complete success and is exceptionally well adapted for fluoroscopic examinations, as it requires no "tuning up." This is due to the fact that it has been possible to rectify the current without using an electrolytic rectifier. In therapeutic work it has been run 10 to 15 minutes without overheating any part.

The radiographs, for definition and sharpness, are considered excellent. The energizing system is composed of one Lodge-Muirhead 8-inch induction coil. The coil's primary is connected in series with the interrupter, inductance, and rheostat. The inductance was obtained from a discarded arc lamp and needs no further description.

It is well known that to operate an X-ray tube a current of one direction is essential; that is to say, a potential in one direction must predominate. The elementary sketch attached shows clearly the connections.

The rectifying interrupter deserves attention. It is known that the only current available in quantity at the yard dispensary is alternating, and no tube is free from transverse currents when energized with a sinusoidal current. To overcome this the elements iron and lead were placed in a 20 per cent solution of sulphuric acid in water, adding to this 3 ounces of ammonium phosphate. The glass jar containing the solution has a capacity of about one gallon.

The positive element iron—a stub steel rod about three thirty-seconds of an inch in diameter—is inserted into a tight-fitting rubber tube. This insulates all parts except the immersed end, the other end protruding above for external connection. The negative element is an ordinary lead plate.

This interrupter rectifies the A. C. current, increases the frequency and efficiency, and does away with the cumbersome chemical rectifiers now in use. The consequence is that the apparatus is very simple and therefore very reliable.

The frequency does not vary from two above to two below 120 cycles per second; therefore we may consider the frequency as constant. The current varies slightly with time, due to the deterioration of the positive element, but this variation can easily be adjusted in a few seconds. The tube glows brilliantly and a distinct division of the cathode and anode rays is seen when using a current varying between 9 and 7 amperes.

The total cost of the interrupter does not exceed $5; no element exceeds $2 in cost.

The solution has been used successfully on intermittent work for three months. The radiographic effects have been improved by the addition of a small amount of powdered alum. This modifies the peak of the wave and causes the tube to become more mellow.

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### Topography of the Ureter as Determined by the Shadowgraph Catheter.

BY L. E. SCHMIDT AND H. L. KRESTCHMER, CHICAGO.

*Surgery, Gynecology and Obstetrics, September, 1911.*

In carrying out this work the authors have employed the ordinary ureteral catheters, armed with fuse wire. In all the cases, the pictures were taken with the patients in the prone position. Judging from the work done, they believe that the shadows produced by the fuse wire are much more satisfactory than those obtained by injecting solutions of the newer silver salts, particularly for showing the course of the ureter. For the purpose of demonstrating the size, shape and position of the renal pelvis, solutions of silver salts, such as cargentos, argyrol or collargol, as a routine procedure, give far more satisfactory information than the fuse wire catheter. However, there are cases in which dilated pelves and other pathological conditions in the kidney have been diagnosed by the shadowgraph catheter. Fenwick's mid-ilio-costal vertical line divides the loin space into an inner and an outer division. It will be found that shadows outside the mid-vertical line are usually cast by contents of the bowel; shadows inside the mid-vertical line are usually urinary shadows, or rarely cretaceous gland shadows, occasionally they may be bowel. In this series of cases, without exception, the ureter and the kidney were well within the mid-ilio-costal vertical line. In five cases, the catheters, after having entered the ureteral orifices, rather abruptly passed outward from the median line toward the lateral wall of the pelvis, forming almost a right angle with an imaginary vertical line drawn through the center of the figures. In four cases the ureters, in their outward course away from the median line, formed a more or less acute angle with the above mentioned imaginary line. In following the course of the ureters upward, they bend inward and cross the sacro-iliac synchondrosis in seven cases, while on the other hand, in three cases the ureters can be seen lying external to the sacro-iliac synchondrosis. In one case, the two ureters are more or less parallel up to a point corresponding to the anterior superior spines, from which point they diverge from the median line. The iliac spines were marked by connecting them with fuse wire, which is shown in the pictures as a transverse line. In the same manner the position of the umbilicus was marked. Here the course of the two ureters is more or less parallel up to the level of the umbilicus, at which point the left ureter passes upward to the usual position of the kidney, whereas the right ureter stops just above the level of the umbilicus. Besides the difference in height the same picture shows a difference in the course of the ureters; on the right side the ureter, after crossing the sacro-iliac synchondrosis, passes upward and outward, and at its termination passes outward and away from the median line; on the left side the course of the ureter is steadily upward and inward toward the median line, so that at its termination it lies at the junction of the transverse process with the body of the vertebra. At its upper end the catheter has a general tendency to pass away from the median line in four cases. An S-shaped course is seen in the ureter in one case, while in two others it shows a serpentine course. Another case shows the two ureters very far apart throughout their entire course; at no time do they show any tendency to approach each other. In another case the difference in the course of the two ureters can be seen both above and below the umbilicus. At its termination above the umbilicus the left ureter passes upward, outward and then inward toward the median line, whereas the right ureter passes upward almost in a vertical direction. The authors recognize the possibility that the shadowgraph bougie may produce irregularities in and distortions of the course of the ureter. They have found that the fuse wire, because of its pliability, gives rise to less errors of this type than any other material.

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### Roentgentherapy of Ringworm.

BY J. HALL-EDWARDS.

*British Medical Journal, Oct. 14, 1911.*

In considering the various methods of treatment of ringworm now usually adopted, Hall-Edwards says there can be no doubt that the Roentgen rays have a large balance in their favor. When the treatment is efficiently and carefully carried out a cure can be secured in from six to eight weeks, as against twenty-seven months, which was the average as calculated by Sabouraud. The actual time occupied in treatment is shortened. The results of the treatment are certain. Reinfection can be more easily guarded against. Epilation comes about without any interference on the part of the parents, hence the neglect to carry out instructions is a matter of comparatively small importance. The treatment is free from danger. No case of permanent injury has been reported out of the hundreds of thousands that have been treated. Hall-Edwards has seen no ill effects produced other than those which have arisen from faulty technic, and these have, in every instance, been due to negligence or want of knowledge of the apparatus and its power. With the best apparatus now obtainable, epilation can be produced with ease and certainty. Cases have been recorded where the hair has failed to re-appear after a dose which could in no way be considered excessive. It must not, however, be forgotten that permanent baldness sometimes occurs after the ordinary methods of treatment have been used. Hall-Edwards doubts very much whether this condition is any more common after Roentgen ray treatment than it is after epilation brought about by other methods. In choosing apparatus for radio-therapy, it is of paramount importance that the group should be so arranged that the output of radiations shall be constant both in intensity and quality. Hall-Edwards prefers to use a coil of the non-intensified variety having a spark length of from 10 to 12 inches, provided with a break capable of giving constant and unvarying interruptions. The mercury-dipper break is the only one which, as far as he knows, will comply with these conditions, and then only when it is not run too fast. The break should have a tachymeter attached, and be provided with an automatic cut-out. A milliamperemeter and spark-gap (or some other arrangement for rendering the current undirectional) should be placed in the secondary circuit. The tube holder should be one which can be fixed in any desired position with ease, which protects the patient from indirect rays, which is provided with an arrangement for holding the Sabouraud pastille, and with attachment for holding adapters. It should be placed inside a lead-lined cubicle, and the remainder of the apparatus should so be arranged that it can be manipulated from without, the patient being watched through a rayproof lead-glass window. A point on which Hall-Edwards lays some stress is summed up in the question: Is there a difference—and if so what is it precisely—between the production of epilation in two minutes and in a quarter of an hour? Taking it for granted that the dose in each case is accurately measured, he thinks that there is a distinct difference. His own preference is to occupy five minutes at least in producing epilation. Another point to which he draws attention is this: If the operation is to be successful, one must not be too careful about the amount of hair that may be taken off. So long as the hair has to come off at all, what does it matter whether we take it off a considerable area, so as to allow an ample margin, or confine it rigidly to a small circle?

## Roentgentherapy of Malignant Disease.

BY REGINALD MORTON.

The author uses an "elderly" and well-seasoned tube having a water-cooled anticathode and a resistance equivalent to a 5-in. spark-gap or thereabouts. The distance from the anticathode to the skin is 9 in., and over the latter are placed two layers of the tungstated lint. The current through the tube varies from 1.5 to 20.0 ma., time of exposure ten to fifteen minutes, and this is repeated three times a week so long as the condition of the superficial tissues permits. Under these conditions he carries on treatment almost indefinitely, just keeping short of any active dermatitis. The relief of pain is, as a rule, very prompt, and provided the case is one that is amenable to this form of treatment, he gets the best results. The Roentgen rays have a definite inhibitory action on the growth of all cellular, living animal tissues when applied strongly and for a sufficient length of time, and under favorable conditions will bring about their destruction and removal; this does not take place to any appreciable extent after the rays have traversed a certain thickness of tissue, which is about half an inch. Cancerous and other diseased cells, having a lower vitality than normal cells, are more easily destroyed than the latter, and we can affect them at a greater depth. Morton does not believe in what some enthusiasts are pleased to refer to as "selective action." He says that the lower vitality of the diseased cell is ample to account for what takes place, and there is no need to strain our imaginations in the effort to attribute to a purely physical force a faculty more or less confined to sentient beings. The prospect of bringing about a definitely favorable influence on any particular case, he thinks, is very much a question of the thickness of the growth. If more than half an inch and advancing, Roentgen ray treatment is not likely to do very much good. It is the difficulty of efficiently acting on the advancing margin of a malignant growth that prevents our efforts being more successful than they are. The small lymphoid nodules so frequently found near the scar following an operation for cancer can be made to disappear very rapidly as a rule. The relief of pain, when present, is one of the most constant and satisfactory features about this method, and we can claim in addition that the great majority of the cases that come to us are definitely improved, locally and generally, for a time at least... In the present unsatisfactory state of our knowledge regarding the real nature and cure of malignant disease, these considerations amply justify the employment of the method to an even greater extent than it is employed at present. Postoperative Roentgen ray treatment is not so general as it should be, and, in addition, there is a tendency to wait too long before instituting it, even until there are definite signs of recurrence, which is not the best time. In operable cases, Morton considers that the site of the growth should receive a full dose of Roentgen rays before the wound is closed, the latter being held as wide open as possible. With modern apparatus this can be given in five minutes, if necessary, and there is no serious objection to this being done. This should do much to destroy any stray cancer cells that have escaped removal, and thus diminish the percentage of recurrences. As soon as the patient can bear it, postoperative treatment should be commenced, and at least twelve applications given on alternate days. After a month or six weeks a second course should be given, to be followed by a third after a second interval of two or three months. One of the weakest points about the treatment of malignant disease by the Roentgen ray or any other form of radiation is that it gives no control over metastasis. It is the object of the procedure he advised to make some effort to deal with this contingency. Morton wants surgeons to adopt postoperative Roentgen ray treatment in all cases as a matter of routine and see that it is done thoroughly; in cases deemed inoperable, he says, we want them to clear the ground for us, when circumstances permit, so as to give the method, and the patient, every possible chance. A full dose of the Roentgen rays should be applied to the open wound at every operation for the removal of a malignant growth.

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**Treatment of Certain Diseases of the Alimentary Tract by Roentgen Rays Combined with the Internal Administration of Metallic Silver.**
BY F. HERNAMAN-JOHNSON.

Thomson's statement that silver emits rays which, as regards absorption by animal tissues, were practically identical with the beta radiation of radium, lead Hernaman-Johnson to the conclusion that if silver, in a suitable form, could be introduced into the alimentary tract and made to cover an area of ulceration, the result of exciting the metal by hard Roentgen rays projected through the back of the ulcer would be a bombardment of the diseased surface similar in effect to that from a highly active radium salt. For the purpose in view an insoluble, finely divided preparation of silver was essential. He obtained some of the metal in a chemically pure precipitated form. Silver so prepared is a dark amorphous-looking powder, gritty in the mouth, but tasteless. He experimented on himself for a fortnight, taking quantities up to 8 grams (about a quarter of an ounce) per day. As no evil result followed he felt justified in giving it to his patients. The first case was one of suspected duodenal ulcer. The second patient suffered from disease of the colon. A careful consideration of the history and symptoms of the latter patient left no doubt that there existed chronic ulceration of the large bowel, with accompanying general toxemia. As the patient would not consent to see a surgeon, and as ordinary medical treatment was without effect, Hernaman-Johnson decided to try Roentgen rays. It was therefore necessary in this case to administer a preliminary bismuth meal, followed by a screen examination. This showed that food reached the cecum in five hours, and was delayed twenty-four to thirty hours in the ascending colon. Treatment was therefore commenced as follows: At 9 a. m., a "silver breakfast" was given, consisting of a pint of milk, with enough bread-crumbs to make a moderately stiff paste; about 8 grams of precipitated silver being intimately mixed with the whole. At 4 p. m. (seven hours later) an exposure was made, the conditions being these: A self-regulating tube (Müller pattern) was placed above the region of the cecum, the anticathode being 25 cm. (about 10 in.) from the skin. A current of 0.4 milliampere was passed for ten minutes, the penetration number of the tube under these conditions being 8 to 9 Wehnelt. An interval of five minutes for cooling was allowed at half time, and the milliampere readings remained practically constant throughout the sitting. An area of skin 7 in. (about 17 cm.) in diameter was left unscreened, and no filters were used. The anodal end of the tube was raised somewhat, so that its long axis made an angle of about 20 degrees with the surface of the body. The exact position of the ulceration could not, of course, be defined, and the bulb was therefore placed alternately above and below the patient. This procedure was repeated three times a week for four weeks. At the end of this time the constipation had considerably improved, headache was lessened, and the patient could bear more pressure over the affected portion of the gut. Hernaman-Johnson continued treatment for another two months, but reduced the number of sittings to two per week. Meanwhile, a gradual improvement took place, and the patient finally returned to work, having received in all thirty applications. He professed himself completely cured. No tenderness or rigidity remained in the abdomen, a painless action of the bowels took place every day, and ordinary food could be eaten without ill effect. No relapse has occurred up to the present, four months after the cessation of treatment. Hernaman-Johnson treated in all seven cases by the above method —one somewhat similar to the above, but with symptoms pointing to the ascending colon; three of suspected duodenal ulcer; one of gastric ulcer; and one of pyloric obstruction with tumor, possibly malignant. Of the series four are apparently cured; one, a duodenal ulcer, failed to show any improvement; the remaining two are still under treatment. The gastric ulcer patient ceased to attend as soon as her pain disappeared, which was in about three weeks. She has returned with a relapse. The pyloric tumor seems to be diminishing in size; there is less vomiting, and the patient feels much more comfortable.

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### Differences in the Appearances of Phthisical Chests as Shown Before and After Treatment.

BY W. BERNARD KNOBEL.

The use of Roentgen rays in phthisis, says Knobel, is to add to and corroborate the signs obtained physically. If one examines a case of what is called active phthisis with the fluorescent screen certain signs indicative of the disease may be observed. There may be on one side: 1. Limitation of the movement of the diaphragm. 2. Uneven movement of the diaphragm. 3. Alteration in the curve of the ribs with narrowing of the intercostal spaces. 4. Impaired translucency of an apex. 5. Definite shadow or shadows. The most infrequent sign, Knobel thinks, is uneven movement of the diaphragm. When this is present it is generally associated with cogwheel breathing, and it certainly seems as if one was the cause of the other; at the same time Knobel has found uneven diaphragmatic movement without cogwheel breathing, and vice versa. Limitation in movement of one side of the diaphragm is a frequent but not a constant sign. It is often well marked in quite early cases. Knobel has observed in many early cases drooping of the ribs on the affected side where there is no spinal curvature or other condition to account for it. Although not always present, especially in cases associated with emphysema, yet it is so frequent a sign that he regards it as an early sign of considerable importance. The one Roentgen ray sign which Knobel has always found to be present in cases of active phthisis is impaired translucency of an apex. It is observed in cases where no shadow is apparent on screen or plate. In a case where there was a definite shadow near the root of the lung and no shadow at the apex there was poor illumination of the apex, but very fair illumination of the rest of the lung. In some cases not only is there deficient illumination of the apex, but the whole of that lung does not light up as well on inspiration as the other side. Apart from shadows, the Roentgen ray signs of phthisis are all signs which are independent of the local tuberculous lesion. They are not directly caused by the lesion, but are signs of impaired function and the necessary consequence of increased airlessness of the lung which would particularly affect the apex. Therefore deficient illumination by the Roentgen rays is the most constant, and therefore the most important, sign of active phthisis. Moreover, when one is equally experienced with the fluorescent screen and the physical examination, it is easier to detect differences between the two sides by seeing than it is by hearing. Knobel finds that the charm of a screen examination in phthisis is that one is able to separate the signs due to the actual lesion, that is, the shadows, from those due to loss of function. One is able to see the lung working, and to compare one side with the other. With a physical examination one is not altogether able to determine the cause of all the signs. In his experience, the most marked change in the signs as the result of treatment is in the illumination of the apex, and perhaps the whole lung, by Roentgen rays. In cases where a definite shadow is present at the apex with poor illumination before treatment, at the end of the treatment the shadow is still there but with much better illumination around it. Even in much more advanced cases with considerable shadowing, with improvement in symptoms and general signs, there is improvement in the illumination of the portions of the lung not covered in shadow. The presence of a small shadow is by itself of no value whatsoever in the diagnosis of phthisis. If a shadow is present before treatment, it will be present after treatment when the patient is cured. It may be somewhat altered, but it will still be a definite shadow. If one examines a radiograph of a chest which shows a shadow in the lung, except in the case of certain comparatively rare conditions, one can definitely say that the patient of whom the radiograph was taken has or has had phthisis. But one could not possibly say what condition that patient was in as regards immunity to tuberculous infection. One could not say whether the plate had been taken before or after treatment. In the ordinary length of time—three to six months—in which one can "cure" moderately early cases of phthisis, Knobel has not seen much change in the shadows. After a longer time he has seen shadows get less opaque or more diffuse. In one case a patch of consolidation has largely disappeared after fifteen months' treatment. In more advanced cases one sees dense shadows become lighter in parts from the formation of cavities, and the walls of cavities become denser after treatment. The great value of radiographs in phthisis is to give one an accurate picture of the extent of the disease that is capable of casting a shadow. Every other sign of phthisis is better observed on the screen. Two radiographs taken of the same patient before and after, say, three or six months' treatment, may show slight differences in the shadows, and any alteration in the slope of the ribs, but it is not easy to show differences in illumination. The deficient illumination of an apex, which may be quite apparent on the screen, is often not shown on the plate owing to the more penetrative rays used for photographic purposes and the length of exposure. And, further, any alteration in the movements of the diaphragm can, of course, only be observed on the screen. For these reasons, Knobel thinks the most valuable method of using Roentgen rays for the diagnosis of phthisis and for determining the results of treatment is examination with the fluorescent screen.

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## ANNUAL MEETING, WESTERN SECTION

The annual meeting of the Western Section of the American Roentgen Ray Society was held Feb. 22, 1912, in the Flemish room of the Hotel Cadillac, Detroit, Mich.

On account of the severe storm which swept over the entire country, many were undoubtedly prevented from coming, but among those who braved the terrors of late trains were Dr. Arial George of Boston, Drs. Holding and Le Wald of New York, Drs. Lange and Dunham of Cincinnati, Dr. Bowen of Columbus, Dr. Reu of Buffalo, Dr. Selby of Rochester, Minn., Mr. Dachtler of Toledo, and Dr. Hill of Cleveland.

The afternoon session was devoted to the demonstration of plates and lantern slides. Each member furnished his proper quota of slides and a very free and aggressive discussion on the plates.

Among the topics discussed were roentgrams of cardiospasms, abscess of the lungs, mobile cecum and many questions incident to the gastro-intestinal tract.

The unanimous opinion of those who were present was that the meeting was very fruitful of results and all felt amply repaid for their expenditure of time. As only a comparatively limited number were present, a warm and spirited discussion took place which was very productive of a free exchange of ideas.

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**The next Annual Meeting will be at Niagara Falls, September 11, 12, 13 and 14, 1912**



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