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Subject Index

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Owing to the fact that pages of volume two of The Journal are not numbered consecutively it will be necessary to note the month of publication in connection with the number of the page. For example, the figures "2:63, Sept. '21" following the subject heading indicate that the article will be found in volume two, page 63 of the September number; "2:63, Oct. '21" indicates that the article will be found in volume two, page 63 of the October number. Hereafter each volume of The Journal will be paged consecutively to conform with standard rules.

The letter "E" is used to indicate editorials, the letters "ab" to indicate abstracts.

Author Index

The names of authors whose articles have appeared in The Journal in full have the asterisk following the subject heading. The letters "ab" indicate an abstract. Where a clue is sufficient indication of the nature of the article the title in full is not given.

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CONTENTS

THE NEWER METHODS OF MEASURING AND APPLYING THE ROENTGEN DOSE

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On my recent trip to Europe I had the opportunity to observe the researches carried on in roentgen and radium therapy. Two things impressed me as being of great importance, namely, the perfection of an instrument for the exact measurement of radiations, and the bearing such measurements have on the development of a radiation technique.

The measuring instrument is the iontometer of Kroenig and Friedrich. To explain its application it will be necessary to recapitulate certain factors and definitions, as, the intensity of the rays, the surface energy, the hardness of rays, and the roentgen dose.

The intensity of the rays (I) is the quantity of radiation energy (E) divided by the unit area (f) = (1 sq. cm.) times the unit of time (t) = (1 second). It is expressed in the formula $I = \frac{E}{f.\,t.}$

The surface energy (F) is the product of radiation energy (E) and unit of time if the radiation is projected perpendicularly upon the surface, *i. e.*, $F = I\,.\,t.$

The last two formulae must be modified if the radiation strikes the surface obliquely by adding the factor $\cos\phi$. Phi is the angle formed by the axis of the ray beam with the surface. The formulae are then $I = \frac{E}{f.\,t.} \cos\phi$ and $F = I.\ t.\ \cos\phi$

The hardness of the rays depends on their wave lengths. The higher the voltage, the greater is the velocity of the electrons, the shorter are the wave lengths of the rays and the greater is the penetrability. Penetrability is expressed by the absorption coefficient. If all the rays, entering and leaving a given layer or sheet of material, are homogeneous, *i. e.*, of the same quality, then the rays are absorbed exponentially by the layer and successive similar layers of material absorb equal fractions of what they receive. If d is the fraction of intensity which is absorbed in the layer of the thickness d (in cm.) then $I_1 = I_0 \cdot e^{-\lambda d}$. I_0 is the intensity of the radiation beam when it enters, I_1 the intensity when it leaves the layer, d is the thickness of the layer, e $=(2.72)$ is the base of the hyperbolic system of logarithms, λ is the linear absorption coefficient. It follows that $\lambda = \frac{2.3}{d}$ (log I_1 — log I_0). The logarithms are to base 10. If in a set of observations with homogeneous rays log I_1 is plotted as ordinate against d the graph is a straight line and is 2.3 times the slope of the line.

The law of absorption can only be applied to rays of the same wave lengths. A roentgen ray beam is always composed of rays of very different wave lengths. It is a heterogeneous or inhomogenous radiation. Therefore it is impossible to correctly compute the absorption coefficient. Some workers prefer to think in terms of the thickness h, in which layer the intensity is absorbed one-half. Christen introduced the half absorption value layer and defined it as the layer of h (cm) of a substance which has absorbed one-half of the radiation. The law of absorption is expressed thus: $I_1 = I_0 \left(\frac{1}{2}\right)^{\frac{d}{h}}$ I_1 is the surface intensity of the beam, I_1 the intensity remaining after leaving the layer, d the thickness of the entire object and h the layer which absorbed one-half of the surface intensity. If d equals h, then the intensity has decreased one-half. In the successive similar layer of h the intensity I again decreases by one-half, *i. e.*, ½ . ½ I = ¼ I, and in the third layer to ½ . ¼ I equals ⅛ I and so forth.

Inhomogenity or heterogenity (H) is defined as the quotient of the first two half value layers. Should the surface intensity decrease to ½ after penetrating a layer of 2 cm., and the remaining intensity decrease ½ after passing through a layer of 3 cm. then $H = \frac{3}{2}$

Dosis comprises the quantity of radiation energy absorbed in a biological or test object. If E_1 designates the energy striking the surface of a biological object of a known volume V and E_2 the energy when it leaves the object, then the difference between E_1 and E_2 is the roentgendose.

The unit of the roentgendose is defined as the roentgen-energy absorbed per unit of volume (1 ccm.) of the biologic object. If a given part of a body that is being treated has the volume V then the dose in this part is $D = \frac{E_1 - E_2}{V}$

This dose is only a mean one, because the surface of the body V receives a larger dose than the very thin lowest stratum in the depth of the body, because the intensity or energy is gradually reduced by absorption and diffusion as the beam of rays advances from the surface to the deeper layer. We, therefore, speak of surface and depth doses. The surface dose is the ray energy absorbed in a very thin layer of the surface per unit of volume (*i. e.,* 1 ccm.) and the depth dose the energy absorbed in a very thin layer at the base per unit volume. If F_0 indicates the surface energy and F_1 the depth energy, then $F_0 = I_0 \,.\, t$ and F_1 eqauls $I_1 \,.t.$ The point source of the radiation beam is so far distant from the body, usually from 30 to 50 cm., that the decrease in intensity according to the law of the inverse ratio plays a negligible rôle. The intensities of F_0 and F_1 are practically the same and $\frac{F_0 - F_1}{V} = D$. If we further suppose that the height of the prism V equals the half value layer h, then the intensity at the depth layer is one-half the intensity at the surface layer: $I_1 = \frac{1}{2} I_0$ and $D = \frac{\frac{1}{2} F_0}{V}$

The volume V is 1 . h, hence $D = \frac{\frac{1}{2} F_0}{h}$

Expressed in words we may state: The dose is defined by the surface energy and the half value layer. It is directly proportional to the surface energy and indirectly to the half value layer. The half value layer can be replaced by the absorption coefficient.

Measurement of Intensity, Hardness and Dose

The measuring of the intensity of the rays is exclusively performed with the ionization method. The necessity of measuring the intensity of the rays at every possible point of the radiated object required a modification of the apparatus. The ionization chamber was given a form which enabled one to insert it into the object like a sound. The measurement depended on the discharge of an electroscope charged with a known capacity. Friedrich used the Wulf two-leaf electroscope, the deflection of the leaves was determined with a reading microscope provided with a scale in the occular. The electroscope was connected by a copper wire imbedded in a dielectric cable of a length of ten feet with the ionization chamber which has a unit volume of 1 ccm. The instrument was carefully protected from all undesirable radiations or high frequency currents by grounding the various parts. (See Fig. 1.) Secondary radiations or electrons were obviated by using a chamber made of cow horn covered inside and outside with graphite. All measurements were determined with such an apparatus. The results obtained are relative ones. This is deemed perfectly accurate if the apparatus, the source of radiations and the quality of the rays remain the same. Radiations of different qualities cannot be compared as the varying intensities result in varying readings.

The hardness of the radiation is determined by measuring the intensity of the radiation with the electrometer at the surface as well as at the depth of the object or body to be radiated. The intensity differs according to variations in distance of the source of rays from the object, the focal distance, the kind and thickness of the filter and the size of the field or portal of entrance.

The measurement of the hardness of the rays presupposes the use of known radiation beams. In therapy rays of various hardnesses are used to obtain definite therapeutic results. The variations of hardness are obtained by using varying focal distances, voltages, and filters. The different radiations used were as follows: (1) Unfiltered rays, (2) rays filtered through 3 mm. Al., (3) rays filtered through 10 mm. Al., (4) rays filtered through 1 mm. Cu. equalling 18 mm. Al., (5) Gamma rays of radium filtered through 1.5 mm. of brass and 5 mm. of celluloid, and (6) Gamma rays of mesothorium filtered through 1.5 mm. of brass and 5 mm. of celluloid.

Aluminum and water were used as absorbing test objects. I am giving the results obtained in water, as the absorption material equalling the absorbability of the composition of the human body. Fig. 2 presents the arrangement of the tube, filter and the position of the ionization chamber within water.

The unfiltered rays were produced as follows: Filament current 3.45 amp.; Primary current 6.5 amp.; Secondary current 3 mamp.; Spark gap 12 inch = 30 cm. Filter none.

Fig. 3 shows the graphic projection of the measurements obtained. The first half absorption value layer is 1.8 cm. and the second 2.25. Hence the heterogenity of this quality of ray is $h_2 : h_1 = 1..25$.

The rays filtered with 3 mm. Al. were produced in the same manner as for unfiltered rays. The graphic projection of the measurements is shown in Fig. 4. The first half absorption value layer is 2.4 cm., the second 2.65. The heterogenity is 2.65 : 2.4 = 1.1.

The rays filtered with 10 cm. Al. had a spark gap of 35 cm. = 14 inch. The graphic projection of the results is seen in Fig. 5. h_1 is 3.25 cm. and h_2 is 3.3 cm. Hence $h_2 : h_1 = 1.02$.

The rays filtered through 1 mm. Cu. had a spark gap of 40 cm., *i. e.*, 16 inch. The results of the measurements are represented in Fig. 6. $h_1 = 3.7$ cm. and $h_2 = 3.75$ cm. Hence $h_2 : h_1 = 1.01$.

Gamma rays of mesothorium and radium were subjected to the same experimentations. The first half value layers of the different radiations are represented in Fig. 7. The differences in half value absorption layers are considerable.

The measurements of homogenity are the quotient of the first two half absorption value layers and the deflection of the logarithmical absorption curve from the straight. Since the homogenity of rays is so very important in therapy it follows from these experimentations that roentgenrays must be filtered through 10 mm. Al. or 1 mm. Cu. employing a voltage of 140 to 160 thousand respectively.

The unit of dose was defined as the radiation-energy absorbed per unit volume, *i. e.*, 1 ccm. of a biological object and was written in the formulae

$$D = \frac{E_1 - E_2}{V} = \frac{F}{h} = \frac{I\ .\ t}{h}$$

To measure the dose two presuppositions must be fulfilled: The test object must change by the action of the rays so that the change may be measured.

The test object must possess the same absorption laws for the different kinds of radiations as the biological object; only then equals the absorbed energy in the unit volume of the test object that in the unit volume of the biologic object.

Experiments were made to determine the difference in the degree of absorption in muscle, fat and osseous tissues as well as water and air. It was found that the differences between muscles, fat, water and air were negligible, so that water could be used as a test object.

To exactly interpret a dose it became necessary to establish a unit of dosage. It must be expressed in an absolute measure. On account of using an electroscope and the ionization method the unit of dose was defined as the quantity of radiation energy which by ionization transports in 1 ccm. of air a quantity of electricity equal to one electrostatic unit in a saturated current. An electrostatic unit is the quantity of electricity which saturates a conductor of unit length (1 cm.) to the potential of 300 volts. It is designated with a Gothic "e". The iontometer was correspondingly standardized.

It was deemed necessary to give the foregoing explanation. We may then conclude. 1. The measurement of radiations is performed with a specially constructed electroscope and ionization chamber. 2. By the use of this instrument an exact calculation of electrostatic units (e) of radiation energy can be made. 3. These calculations have only relative value but nevertheless are the same for the like quality of radiations.

The dosimeter enabled Kroenig and Friedrich not only to determine the dosis on the surface of the body but also in the interior of body cavities if they communicated with the outer world. In many cases it is not possible to insert the dosimeter chamber in the interior of the body where the dosis should be measured. In such instances it has been customary to compute the doses by determining the half absorption value layer or by the law of the inverse ratio.

Comparing the determinations of depth dose obtained with the dosimeter with those obtained by calculation marked differences in the results were observed. The difference between the measured and calculated dose was deemed to be due to secondary radiations. Hence the percentages of secondary and primary radiations were next determined by the use of the water phantom as illustrated in Figure 10. It is seen that the ionization chamber may be placed at any desired depths from the surface. A Lilienfeld tube was placed above the phantom at a focal distance of 50 cm. from the surface of the water. The rays were filtered through 1 mm. Cu., the size of the field was 15 × 15 cm. The time was observed in which a definite dose was given on the surface and also in the depth. The surface and depth doses are then in an indirect proportion to the time consumed. The results were as follows:

POSITION OF IONIZATION CHAMBER	TIME CONSUMED IN WHICH THE ELECTROMETER DISCHARGED 5 UNITS
Surface	54.2 seconds
Depth of 10 cm.	122.0 "
Surface	52.8 "
Depth of 10 cm.	124.0 "
Surface	52.4 "
Depth of 10 cm.	125.0 "

The percentage between surface dose and depth dose is therefore 43.

The half absorption value layer is 3.7 cm. The distance of the focus from surface is 50 cm. from focus to depth 60 cm. The calculated dose at the depth of 10 cm. would be therefore only about ten per cent of the dose measured at the surface. This example shows the influence of the secondary radiation in the result of the measured dosis.

To be able to realize the magnitude of the error of a calculated dose, the decrease of the dosis was determined from centimeter to centimeter with the dosimeter and the results thus obtained compared with those calculated. The results are shown in Figs. 11 and 12.

The conclusions to be drawn are: A depth dose cannot be calculated from the half value layer and the law of radiation, but must be determined by exact measurements with the dosimeter either in the depth of the body or in the water phantom.

The dose measured in the water phantom, as we have seen, is composed of two factors, the primary radiations directly emanating from the tube and the secondary radiations derived from the surrounding region of the radiated water. The exact proportions of the two factors were determined using radiations filtered with 3 mm. Al., 10 mm. Al. and 1 mm. Cu. The focal distance was 50 cm., the size of the rectangular field 15×15 cm. The ionization chamber was placed in the center of the field on the surface and 8 cm. beneath the surface of the water. The time consumed to discharge 5 units of the scale was determined (1) with the secondary radiations excluded by using a field of only 1 sq. cm. and (2) with the primary radiations arrested by the interposition of a lead screen of 1 sq. cm. directly in the center of the field. See Fig. 13. The percentage of the primary radiation using 3 mm. Al. filter is 25, of the secondary 75; using 10 mm. Al. filter the primary is 28.5, the secondary 83, and using a 1 mm. Cu. filter the primary is 31.5, the secondary 82.5.

The next question to be answered was: Has the size of the field any influence on the time duration of the application of a dose? To answer this question the following sizes of diaphragms or fields were used: 4×4 cm., 6×6 cm., 8×8 cm., 10×10 cm., and 12×12 cm. The dosimeter chamber was placed on the surface of the water in the first series and in a depth of 8 cm. in the second series. The filters were 3 mm. Al. and 1 Cu.; the focal distance 30 cm. (See Fig. 14.) The results are shown in Fig. 15. *The result of these investigations is that the size of the field has a prominent influence on the time duration of the application of the dose.*

Another conclusion must be drawn from this last stated fact, namely, the ratio between depth and surface doses is dependable on the size of field. To prove this another series of experiments were carried out. The sizes of the fields were 5×5, 10×10, and 15×15; the focal distance 50 cm., the depth in which measurements were carried on 5 and 10 cm., the filters 3 mm. Al., 10 mm. Al. and 1 mm. Cu. The results are seen in Fig. 16.

A further increase in the size of the field is without any influence on the duration of time of application and on the quotient of surface and depth dose. The farther the source of the secondary radiation lies from the ionization chamber, the greater will be their dispersion in the region of the chamber. As a matter of fact, Friedrich could not detect any advantage in increasing the size of the fields above 15 sq. cm.

Secondary rays therefore must possess a distinctly limited space of action. Within a given radiation field the radiation rays are not equally intensive. The intensity is greatest in the center of the field and smallest at its periphery. The tissues surrounding the radiation fields, also, will receive a certain dose of rays, small perhaps, originating from the secondary radiations. These deductions also were subjected to a searching investigation. The phantom used is represented in Fig. 17. The ionization chamber K was introduced into the middle of one side. The surface of the water was 8 cm. above it. The anticathode R of the roentgen tube was placed in a lead-lined box within a focal distance of 50 cm. The box was held by a tube stand so that it could be moved exactly from centimeter to centimeter. The field was determined by the diaphragm B which was connected to the roentgen box with a connecting rod V. If the roentgen tube was moved, the diaphragm B also moved simultaneously. The measuring chamber K was immovable. The filter F consisted of 1 mm. Cu.

The results of the measurements are graphically shown in Figs. 18, 19, 20, while Fig. 21 represents the same experiment without the use of water. The limits of the intensity of the ray beam are very pronounced in Fig. 21. Within a distance of 2 cm. of the radiation field the dosis has sunk to an amount that could hardly be measured.

Conclusions:

1. Secondary radiation has an important influence on the distribution of the dose within and without the radiation field. 2. The dosis is most intense in the center of the field and gradually decreases towards its periphery. 3. The limits of the radiation field are not clearly defined but a gradual decrease of the dose occurs with an increase in distance from the border of the radiation field outwardly.

The possibility of exactly measuring the roentgen dose at any point within the area exposed to radiation enables us to select the quality of rays best suited for purposes of treatment. It also led to a revolution of roentgen ray therapy which has been very much simplified. The principle of the homogenous radiation fathered by Dessauer in 1912 has been accepted as correct. Until we, on this continent, are able to follow up the newer methods two changes must be worked out by the manufacturers, namely, a transformer must be built that will produce currents up to 220,000 volts and Coolidge tubes must be produced that will stand up under such loads.

Through the kindness of the Veifa Works and Prof. Dessauer I had an opportunity of minutely studying the newer roentgentherapy technique applied in cancer of the cervix. Four portals of entrance are chosen. The suprapubic and posterior fields are 20 sq. cm. and the two lateral fields are 4 to 6 sq. cm. Currents of 180 or 220 Kv. are used. The filters are 0.5 mm. zinc and 1 mm. copper respectively, plus 1 mm. of aluminum and a layer of heavy sole leather. The metal filters must be placed about half distance between focus and skin. The additional aluminum filter arrests the secondary radiation formed in the zinc or copper filters. 0.5 mm. zinc corresponds to 9 mm. aluminum and 1 mm. copper to 18 mm. aluminum. The load is 1.5 to 2 maṁp.

An exact outline of the transverse section of the pelvis just above the pubis and a median longitudinal section of the pelvis are made in life size on tracing linen. The extent and location of the diseased area are entered upon both sections. Carcinomata of the cervix and corpus of the uterus comprise well-defined growths of known size. The peripheral border is formed laterally by the true bony pelvis, superiorly by the pelvic brim and inferiorly by the bony pelvic outlet. The region of the cervix is situated almost exactly in the center, while the axis of the uterus lies in the axis of the true bony pelvis. The diseased area is measured by physical examination with the aid of a pelvimeter. The extent into the bladder and rectum, if present, is verified by cystoscopy and proctoscopy.

The antero-posterior diameter of the transverse section is about 20 cm. and the transverse diameter about 38 cm. The antero-posterior diameter of the true pelvis measures in the mean about 12 cm., the transverse diameter about 12 to 13 cm. Points 1, 2, 3, 4 and 5 seen in Fig. 22 are now exactly placed.

The rules to be observed in the application of the rays are: 1. Each radiation cone must entirely include the diseased area. 2. The points of intersection of the cones must cross beneath the skin surface and at such a depth that the summation of intensities at these points does not exceed the maximal lethal skin dose. This is given by Dessauer and Seitz and Wintz as 100, by Kroenig and Friedrich as 170 e. Burns or serious injuries to healthy tissues and organs might otherwise occur. 3. The summation of the roentgen energy of the four beams applied must attain the cancer dose at all points of the diseased area. The cancer dose has been placed at 90 per cent of the inflammation skin dose by Kroenig and Friedrich, *i. e.,* 150 e., while Seitz and Wintz fixed it at 110, if the skin dose is 100.

Dessauer has elaborated a system of radiation cones of different angles, in which the intensity curves of like doses are indicated from centimeter to centimeter. Fig. 23 shows such a cone for an angle of 36 degrees and a field of 20 sq. cm. for a current of 170 Kv. and 0.5 mm. zinc plus 1 mm. aluminum filters. These cones are placed underneath the transverse sections and the intensities at points 1, 2, 3, 4 and 5 are read off. The problem and the solution are shown in Fig. 22. It is also evident that the radiation intensity is almost a homogeneous one.

We have attempted to work out a technique in our laboratory based on the work of Friedrich and Dessauer. We proceed as follows: The focal distance is 30 cm., the filter 10 mm. aluminum, plus one layer of heavy sole leather, the field has the size of a diameter of 25 cm., the voltage is 95,000, the milliamperage 4 to 5. It takes three hours to obtain an erythema skin dose, while with currents of 170

Kv. and 1.5 to 2 mamp. 80 minutes are consumed. Our erythema skin dose is characterized by an immediate but transitory edema, an erythema of the skin with desquamation and epilation appearing 10 to 14 days later and intense deep brown discoloration after about six weeks.

We have so far been unable to obtain an iontometer. We are constructing an ionization chamber according to Friedrich's design, which will be attached to an electroscope provided with a scale on which each division represents an electrostatic unit, *i. e.*, charged to a potential of 300 volts. We hoped to be able to show the instrument at this meeting, but it is not yet finished. Should the apparatus give reliable measurements we then can proceed to determine the half value layer and the roentgen dose obtained with our apparatus.

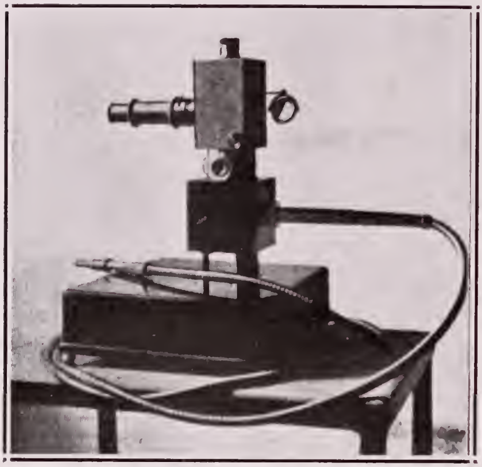
In conclusion we may summarize:

1. Kroenig and Friedrich's investigations have given roentgentherapy an exact and scientific foundation. Empiricism must be forever discarded.

2. The evolution of the hot cathode, gasless roentgen tube by Coolidge has given us unlimited output of roentgen ray energy which made the rapid progress of therapy possible.

3. The principle of the homogeneous radiation evolved by Dessauer and made possible by the development of transformers giving currents up to 220 Kv. has furnished the missing link in the triad of our armamentarium, namely, dosimeter, roentgen tube, and transformer.

25 E. Washington St.



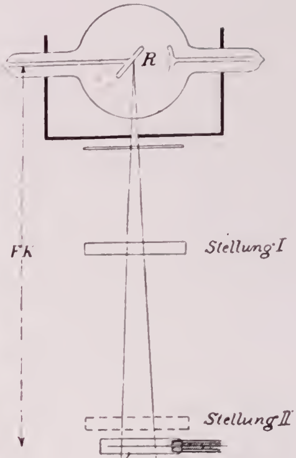


Fig 2

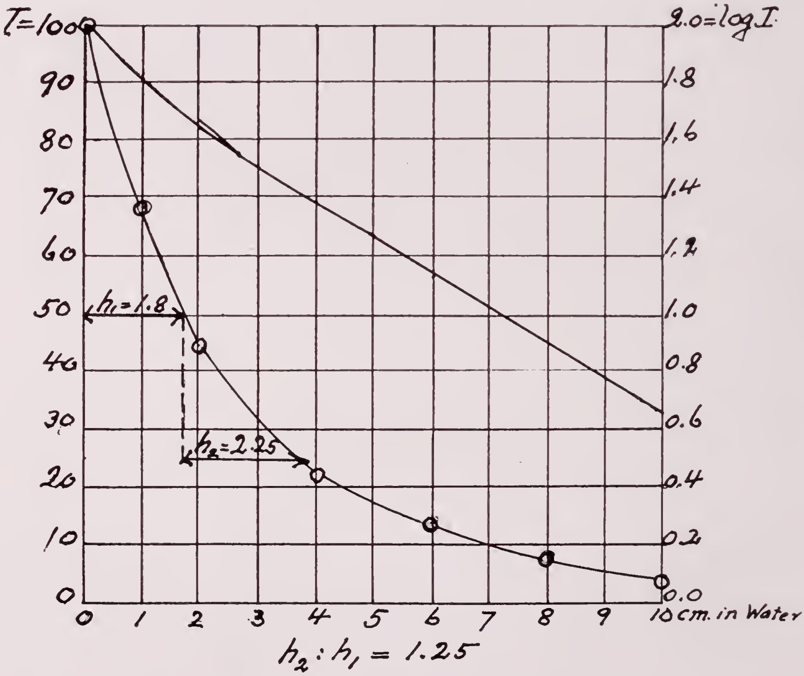


Fig. 3. Absorption Curve of unfiltered Roentgen Rays in Water.

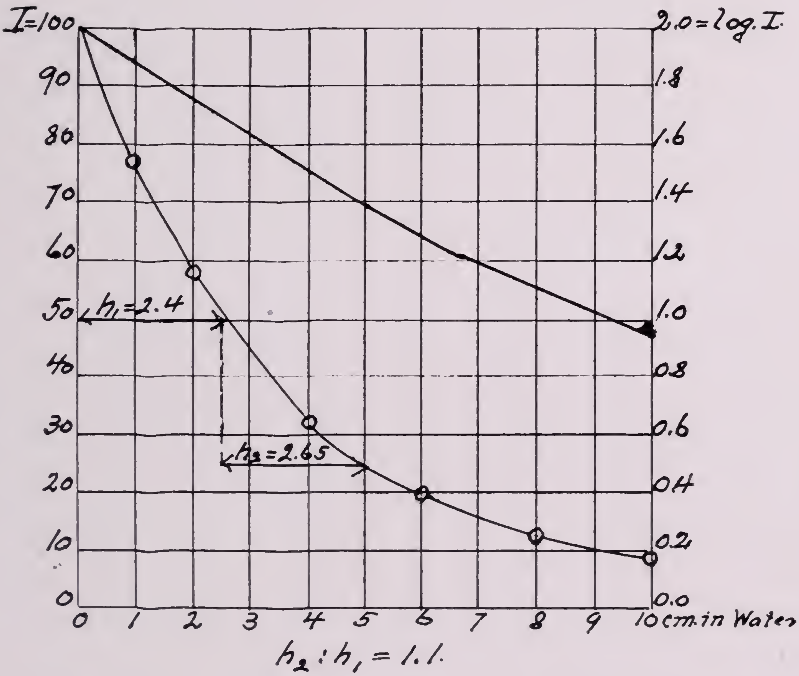
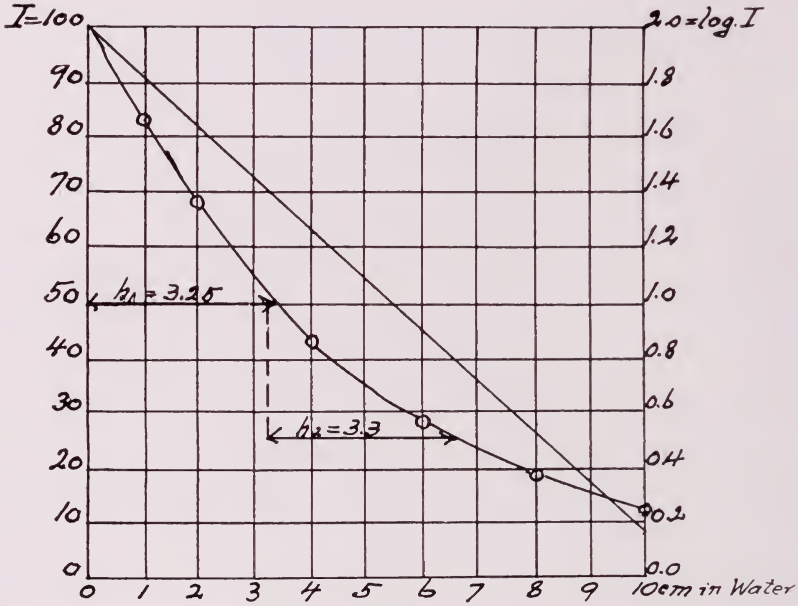
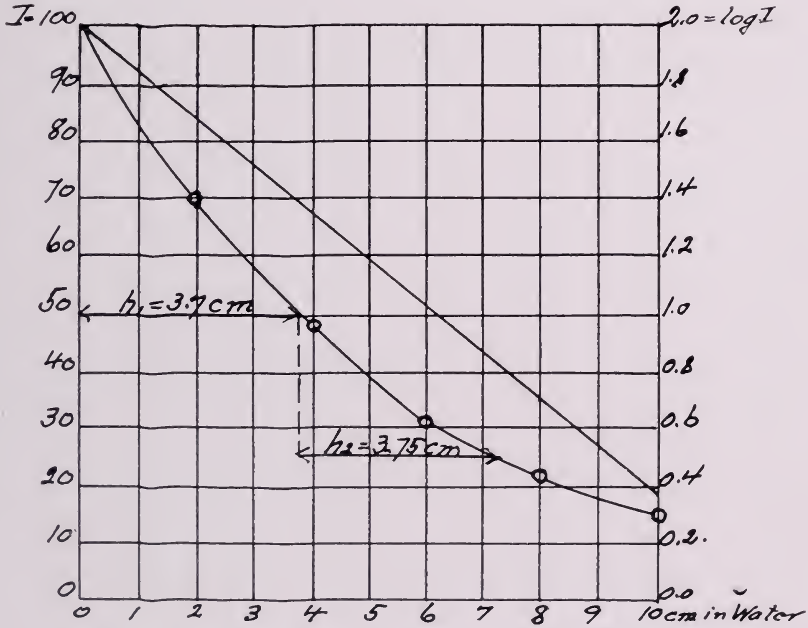


Fig. 4. Absorption Curve of Roentgen Rays filtered through 3 mm. Al. in Water.



$h_2 : h_1 = 1.02$

Fig. 5. Absorption Curve of Roentgen Rays filtered through 10mm. Al. in Water.



$h_2 : h_1 = 1.01.$

Fig. 6. Absorption Curve of Roentgen Rays filtered through 1 mm Cu in Water.

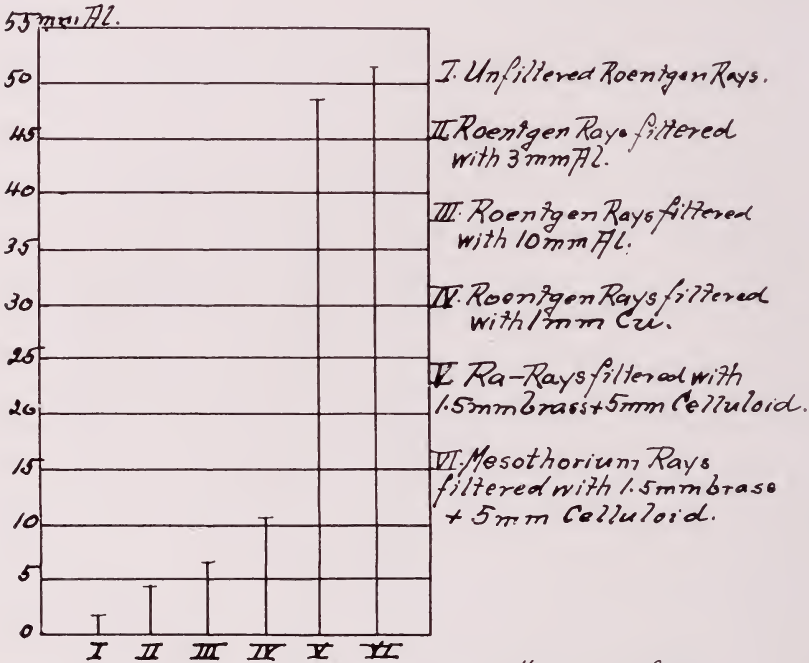


Fig. 7. The „First Half Value Layers" in mm of Al.

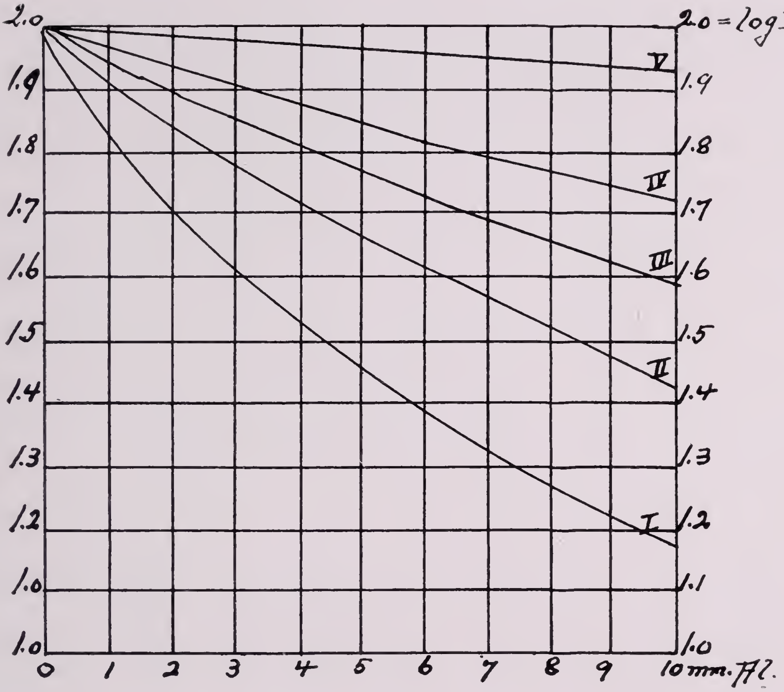


Fig. 8. Logarithmic Absorption Curves to show Deflection from the Straight.

I. Unfiltered Roentgen Rays.

II. Roentgen Rays filtered through 3 mm Al.

III. " " " " 10 mm Al.

IV. " " " " 1 mm Cu

V. Gamma Rays.

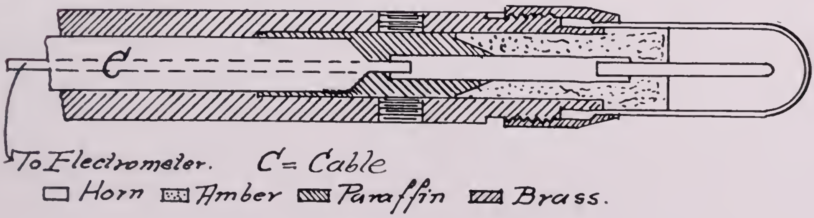
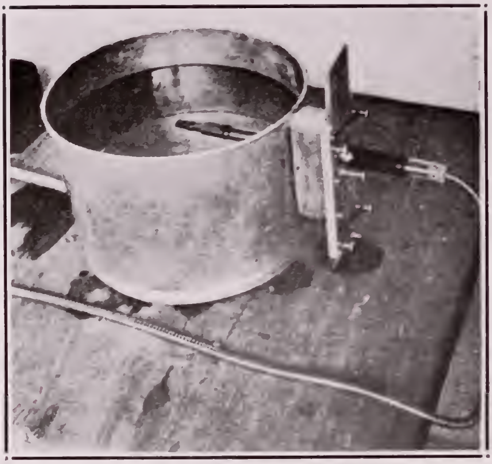


Fig. 9. Construction of Ionisation Chamber.



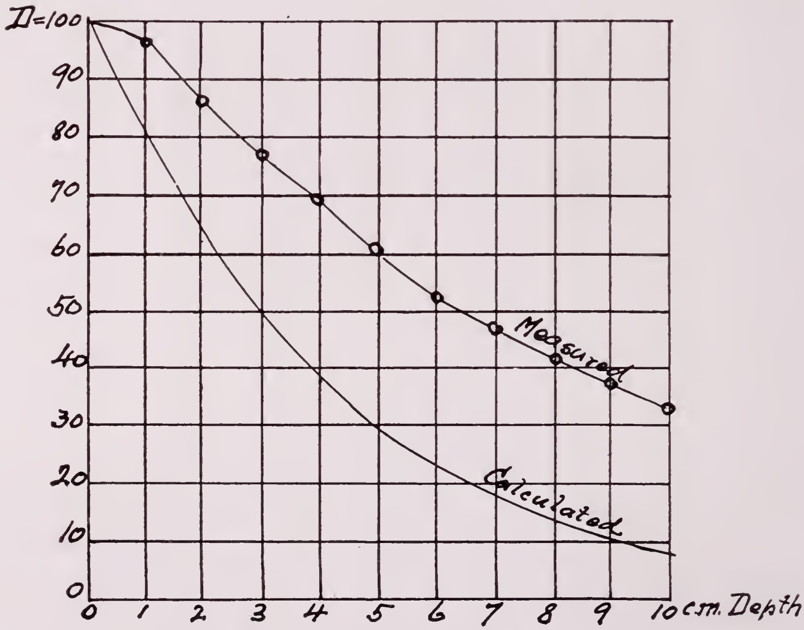


Fig. 11. Calculated and Measured Depth Dose of Roentgen Rays filtered with 10 mm Al. and size of Field of 15 × 15 cm.

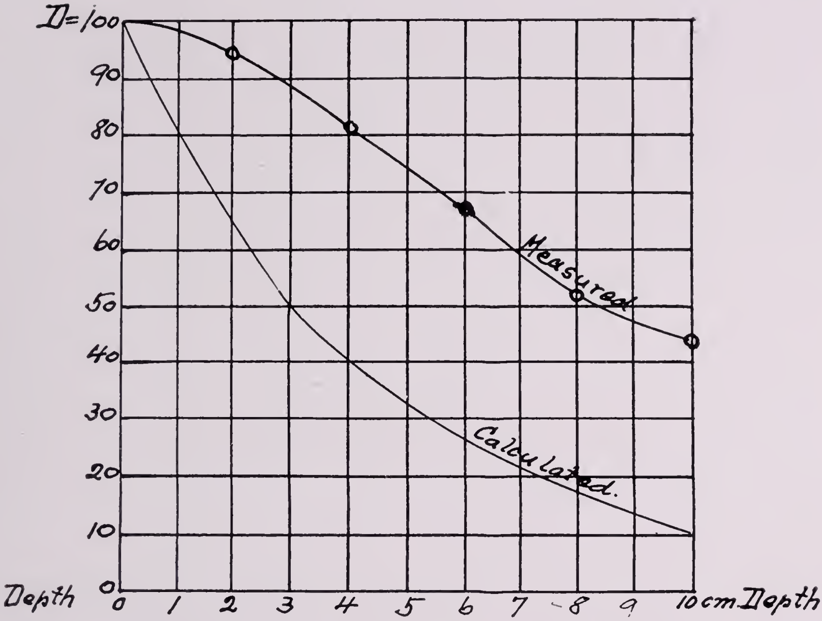


Fig 12. Calculated and Measured Depth Dose of Roentgen Rays filtered with 1 mm. Cu. and Size of Field 15 X 15 cm.

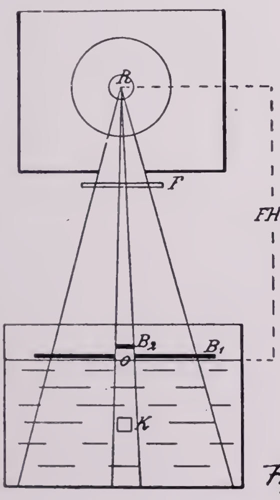


Fig. 13.

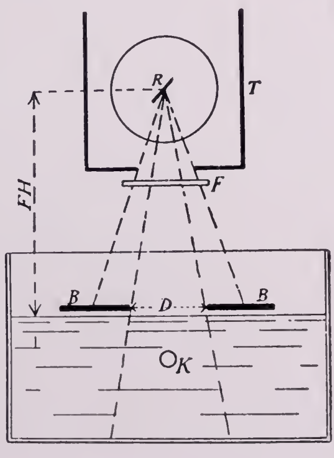


Fig. 14

Fig. 15. Influence of Size of Field on the Time of Application of Dose.

Quality of Roentgen Ray	Size of Field	5 units of Scale of Electrometer in Seconds.	Quotient of Time of Application
	A. Surface Measurements.		
Filter of 3 mm Al.	4x4 6x6	16.1 15.0	16.1 : 15.0 = 1.07
	4x4 8x8	16.0 14.1	1.14
	4x4 10x10	15.7 13.7	1.15
	4x4 12x12	15.5 13.1	1.18
Filter of 1 mm Cu.	4x4 6x6	39.3 35.6	1.10
	4x4 8x8	38.7 33.2	1.17
	4x4 10x10	41.0 32.7	1.25
	4x4 12x12	39.9 29.0	1.35
	B. Measurements in Depth of 8 cm.		
Filter of 3 mm Al	4x4 6x6	33.0 24.6	1.34
	4x4 8x8	32.1 21.0	1.53
	4x4 10x10	32.3 18.2	1.78
	4x4 12x12	32.1 16.4	1.96
Filter of 1 mm Cu	4x4 6x6	113 87	1.30
	4x4 8x8	116 73	1.50
	4x4 10x10	116 65	1.78
	4x4 12x12.	110 57	1.93.

Conclusion: The Size of the Field has a pronounced Influence on the Time Duration of the Application of Dose.

Fig. 16. The Ratio between Depth- and Surface Doses depends on Size of Field.

Filter	Size of Field	Position of Chamber	Seconds consumed to discharge Five Units of Scale	Quotient of Dose.
	5×5	Surface 5cm Depth	25.8 65.7	0.39
	10×10	Surface 5cm. Depth	21.9 49.3	0.44
	15×15	Surface 5cm. Depth.	19.8 40.7	0.48.
	5×5	Surface 10cm. Depth	27.1 194.0	0.14
	10×10	Surface 10 cm. Depth.	21.9 111.9	0.20
	15×15	Surface 10cm. Depth.	19.8 90.1	0.22
10mm. Al.	5×5	Surface 5cm. Depth	38.1 80.0	0.48
	10×10	Surface 5cm. Depth.	32.6 59.3	0.55
	15×15	Surface 5cm. Depth	29.5 50.1	0.59
	5×5	Surface 10cm. Depth	40.9 189.3	0.22
	10×10	Surface 10cm. Depth.	32.5 120.0	0.27
	15×15	Surface 10 cm. Depth.	29.6 95.0	0.31.
1 mm Cu.	5×5	Surface 5cm. Depth	62.5 111.3	0.56
	10×10	Surface 5cm. Depth	51.4 79.7	0.64
	15×15	Surface 5cm. Depth	48.0 66.0	0.73
	5×5	Surface 10cm. Depth	65.3 208.3	0.31
	10×10	Surface 10cm. Depth	57.6 151.0	0.38
	15×15	Surface 10cm. Depth.	53.1 123.7	0.43.

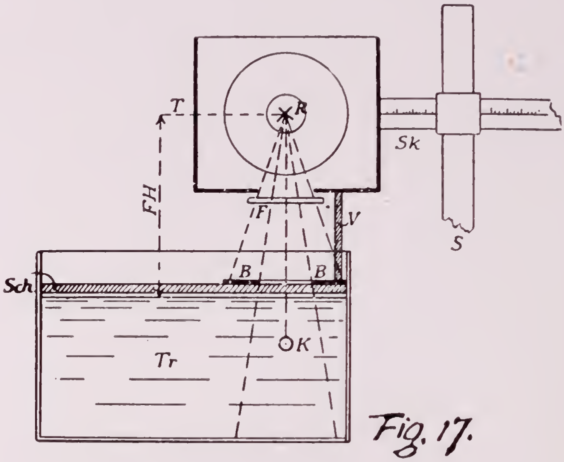


Fig. 17.

Fig 18. Influence of Secondary Radiation on the Distribution of the Dose within and without the Radiation Field, Measured in Water. Size of Field 4 x 4 cm. Roentgen Rays filtered through 1 mm. Cu.

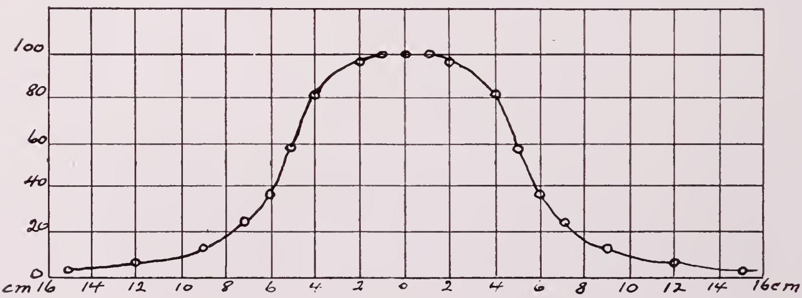


Fig. 19. Same as Fig. 18 but Size of Field 8 x 8 cm.

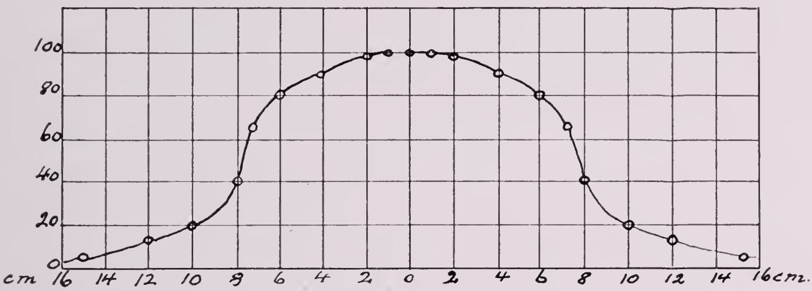


Fig 20 Same as Fig. 18, but Size of Field 12 X 12 cm.

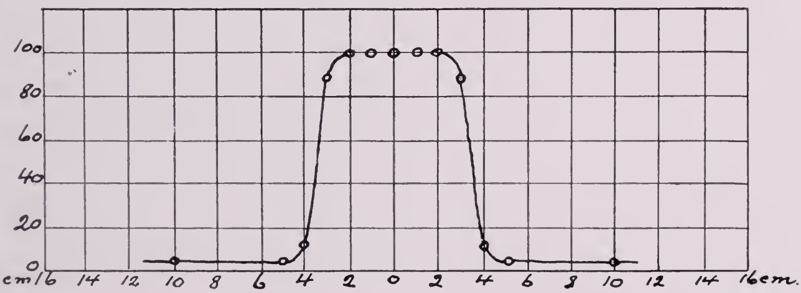
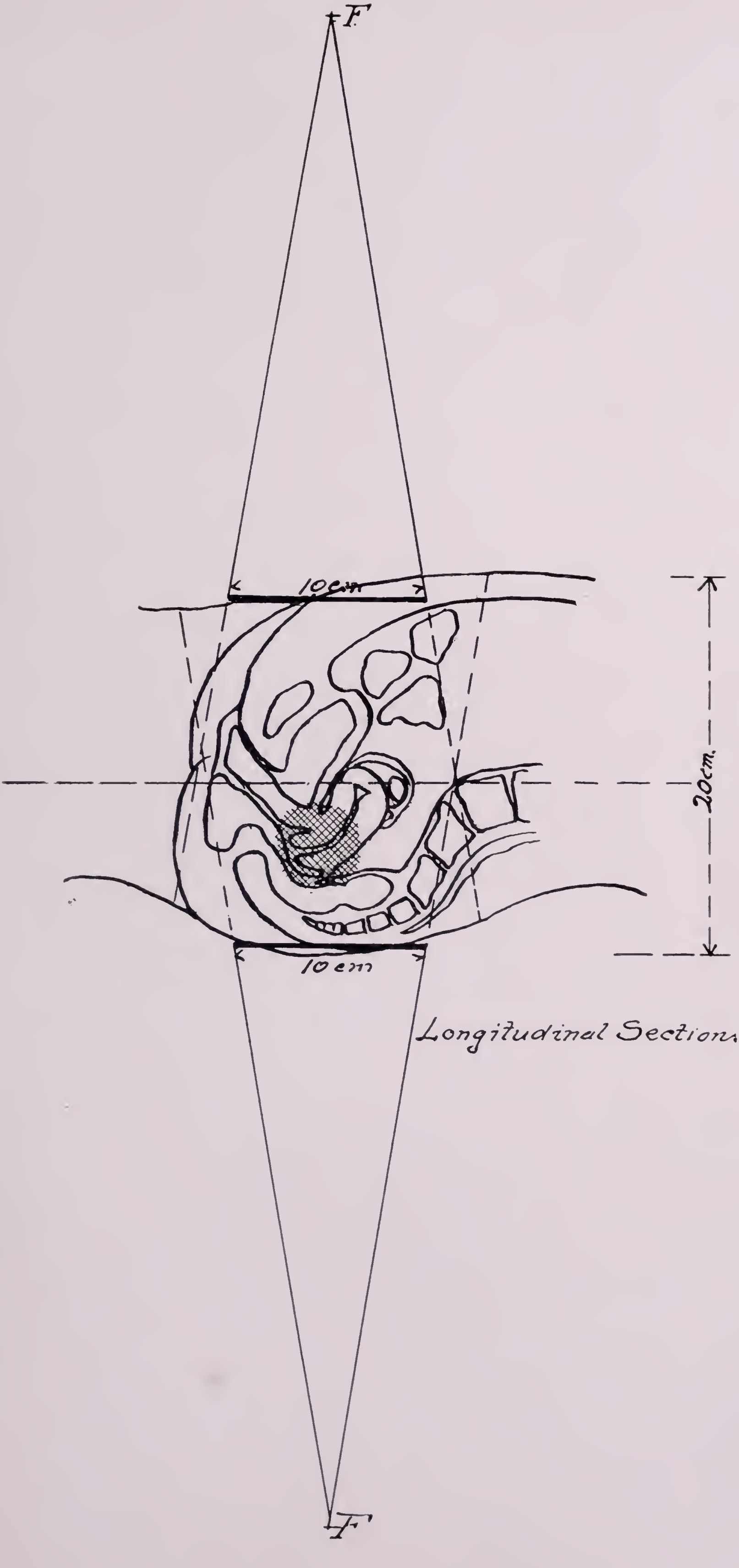


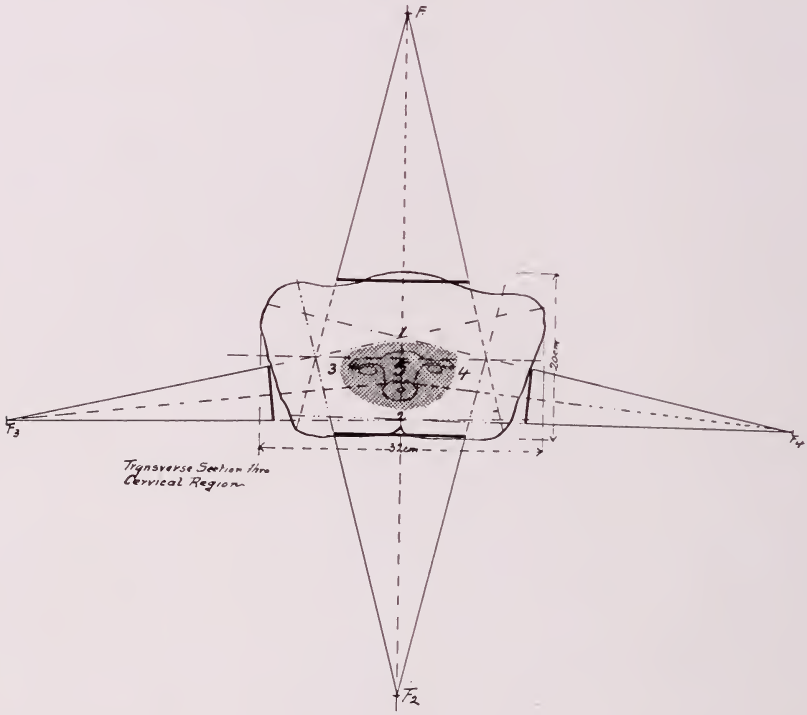
Fig 21. Same as Fig. 18, but Radiation measured in Air. Size of Field 5 X 5 cm.

Fig. 22. Solution of Problem offered by these two Sections showing Extend of Area involved and Direction of Radiation Beams

Points	1	2	3	4	5
Ant. Beam F_1.	41 / 33	29 / 21	31 / 26	31 / 26	36 / 28
Post Beam F_2.	33 / 26	44 / 37	33 / 27	33 / 27	39 / 30
Right Beam F_3.	15 / 11	15 / 6	4 / 1	33 / 21	15 / 9
Left Beam F_4.	15 / 11	15 / 6	33 / 21	4 / 1	15 / 9
Total Units Without Secondary Radiation	81	70	75	75	76
Total Units With Secondary Radiation	104	103	101	101	105



Longitudinal Section.


F
1
3
4
2
20cm
32cm
F3
F4
F2
Transverse Section thro
Cervical Region

TREATMENT OF MALIGNANT GROWTHS OF THE MOUTH AND THROAT BY RADIUM SUPPLEMENTED BY OTHER METHODS*

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As a routine procedure radium holds the first place in the treatment of malignant growths of the mouth and throat, but the treatment requires both clinical and technical judgment. Successful treatment demands specialized study and requires more skill and judgment than in almost any other part of the body, because often the disease progresses rapidly and the lymphatic glands are so early invaded.

There is a marked difference in results if all the cancer tissue in mouth or throat is given a lethal dose of radium instead of only a partial dose as is given by many. From the beginning, I realized that the erythema dose would not destroy anything except the small basal-cell epithelioma and certain types of sarcoma, and that it was necessary to give a lethal or cancer-destroying dose, which is considerably more than the erythema reaction. For this reason, after the treatment of the first few cases, heavy doses were given and at the end of from two to four weeks the white or necrotic tissue, which formed, was either removed by electric coagulation or by operation.

Since we have been burying radium needles the cancer tissue often receives a lethal dose without producing a reaction beyond that which will disappear promptly, and in many of these cases it has not been necessary to remove tissues which have been radiated as it was when intensive surface applications of radium were employed. However,

*Read before the Radiological Society, New Orleans, May, 1920.

it may be better to apply radium on the surface and to the adjacent lymphatic glands before burying the radium needles. This lessens the danger of metastases when the radium needles are inserted. Burying radium needles or giving a lethal radinm surface dosage, followed by removal later of the local tissues together with efficient radiation of the lymphatics in the neck, has changed the end results in the treatment of malignancy of the mouth and throat.

The gravity of innocent lesions must not be overlooked. It must be remembered that persistent lesions of the mouth and throat are nearly always malignant. In all examinations all pre-cancerous areas should be looked for and treated promptly. Superficial cautery seldom ever does anything except hasten the process and render the patient incurable. So many, not realizing the extreme malignancy of these lesions, often employ superficial cautery or prescribe inert mouth washes until the disease is far advanced. There is no place where it is more important to eradicate the disease without loss of tissue. Anyone treating these malignant growths should know what has been accomplished by radium, roentgen rays, electric-coagulation, and surgery as well as the amount of harm than can be done by useless cauterization.

Malignant growths may be divided into epithelioma of the lower lip, tongue, buccal mucous membranes, and carcinoma and sarcoma of the naso-pharynx. While the same general principles will apply to each, there are certain technical as well as clinical differences. The mucous membrane of the mouth and throat is more sensitive to radiation than almost any other mucous membrane and the malignant tissue here is equally or more malignant. This is frequently complicated by the disease starting in a very unhealthy mouth where normal tissue is of low vitality. This probably explains why cautery makes a small inert lesion take on such an active process which is soon beyond a curative stage. This is frequently seen when a very small lesion of the buccal mucous membrane is cauterized or even following the excision of a small epithelioma of the tongue.

It is true that cancer is a disease of old age and, in examining the mouth, it will be noticed that the tissues are often considerably older than the rest of the body. When the teeth and mucous membrane are unhealthy, it is not only more difficult to eradicate the disease but recurrence is more likely.

The treatment consists of the local treatment by radium, both by surface applications and by burying radium needles, and radiation of the adjacent lymphatic glands by radium and the roentgen rays. Without burying radium a lethal dose in the mouth cannot be given, except in very small and superficial lesions, without producing superficial necrosis of the surrounding healthy tissue. In most instances, it is perfectly safe to give a lethal dose of radium by surface applications without much filtration and distance; then the necrosis is superficial and can readily be removed by electric-coagulation. This is a method I have been using before I started to bury radium and in many instances the results are equal to inserting radium in the malignant tissue. By inserting radium into the diseased tissue, the radiation is better distributed and there is not the loss by absorption and by divergence. More important than this is the fact that the subcutaneous tissue will stand so much more radiation without injury than the mucous membrane. Even when radium has been buried, electro-coagulation is a valuable adjunct and is recommended in all cases where the reaction is slow in disappearing. By burying radium needles and using electric-coagulation, together with proper radiation of the adjacent lymphatics of both sides of the neck, more cancer tissue can be eradicated with less loss of tissue than by any other method.

Epithelioma or cancer of the mouth and throat shows itself by its progressive extension of the primary growth, and there is almost always an early invasion of the lymphatics of the neck, while, rarely, secondary deposits of distant organs or tissue occur. Formerly, it was said that there was a collar around the neck through which cancer cells rarely penetrated. This is not true, because by the older methods of treatment, death occurred from the local or regional disease before there was sufficient time for secondary deposits to become active. A review of any recent system of surgery shows that even most of the early cancerous lesions of the mouth and throat are regional as well as local when first seen. It has been said that the tongue exhibits only the visible part of the disease and there is usually a cancerous dissemination in the lymphatic spaces, and the glands are invaded at a considerable distance from the primary focus, even at an early stage of the disease. It is true that the cancer-growing edge, although unappreciated by ordinary methods of examination, is just as definite as the visible edge of ringworm, and that when more than one lymphatic chain in the neck has been found to contain cancer cells, microscopically, and that when the deep cervicals are involved, the cases are not cured surgically.

It is important for the radiologist to know what glands drain each area of the mouth and throat as well as the anastomosis of the lymphatic system. The lymphatic chains in the neck are closely connected, and those of one side of the neck anastomose with the other. It would be well for everyone to make a chart of the glands of the neck, showing the distribution of the important glandular centres and study this chart until each could be visualized or until each gland could be speared and insert radium without palpation. The lymphatics draining the lip are the submental group, which receive the vessels from the central portion of the lower lip, chin and floor of the mouth. The submaxillary, consisting of five or six glands, drain the lateral half of the lips, the cheek, part of the tongue and the lower portion of the nose. There is an anastomosis between the submaxillary glands of each side and the submental, and when one group is invaded, it is only a short time until metastases spread to the next chain. There are from twenty to thirty important cervical glands extending from the mastoid process to the junction of the subclavian and jugular veins, which should be memorized and visualized. This is an important group because when these can be palpated the disease is far advanced regardless of the size of primary lesion or of the submental or submaxillary groups. The cervical glands act as a fortress to the chains above, and their removal surgically is seldom, if ever, useful.

In radiotherapy of the tongue the course of the lymphatic vessels, influencing as it does the spread of malignant cells, is of utmost importance. There are two main chains; *viz*, submucous, and the intra-muscular. The lymphatics from the tip of the tongue pass to the submental and the inferior cervical; those from the lateral border terminate in the submaxillary salivary glands and some pass directly into the deep cervical, while most of those in the posterior part of the tongue enter a group of glands lying between the large vessels and the parotid glands, and another group of vessels pass into the submaxillary. The vessels passing from the tongue are closely connected with glands of both sides of the neck.

The chain of lymphatics most closely connected with the primary lesion whether palpable or not should always receive a lethal dose of either radium or *x*-ray, even if this amount produces a marked reaction. A burn, while it should be avoided if possible, is not to be feared as much as leaving cancer cells in the first lymphatic chains. Burying radium in these areas is preferable. It is important to remember that unless all the cancer tissue is removed, it will eventually kill the patient. Then we are justified in giving a lethal dose whenever an attempt is made to cure the patient, although an undesirable skin reaction occurs, but this is not justifiable if treatment is given for palliation only.

Epithelioma of the lower lip is the most accessible of the mouth lesions and, if treatment is given in the early stage before destruction of tissue has occurred and before the lymph nodes are invaded, radium is uniformly successful. More cases can be cured by radiation without loss of tissue or deformity than by excision, although it must be remembered even in the early stage that glandular metastases may have occurred, and the glands most closely connected with the part of the lip involved should receive radiation as well as a zone of apparently healthy tissue around the primary lesion. If the epithelioma is situated on the outer half of the lip, the submental, submaxillary glands, and also a gland situated at the inner angle of the mouth should receive intensive radiation. If the lesion is situated near the central portion of the lip, the submental, submaxillary glands at both sides of the neck, and the skin from the lip to the chin, must be thoroughly radiated in both early and advanced stages. It is safer in all stages of the disease to ray a wider area of lymphatics than seems necessary, instead of waiting until distant metastases have occurred.

In the advanced cases, more can be accomplished by radiation than by any other single method of treatment alone, but it is often advisable, after raying, to have a modified operation performed. In carcinoma of the lip, sufficient number of tubes should be employed to cover the entire lesion as well as a zone of healthy tissue and in advanced cases to spear the glandular junction most closely connected with the lip and to insert radium after cell proliferation has been checked by surface applications. Broder, at the Mayo Clinic, in speaking of epithelioma of the lip, states that "No patient with the cervical nodes or more than one group of any lymph nodes involved has been reported living." This is worthy of consideration because if cases have not been cured by surgery, where more than one chain of lymphatics are involved, a clinical cure by radiation has been obtained. Then the question arises in these clinically cured cases, Should a block dissection be performed five or six weeks afterwards to be followed by further radiation?

Carcinoma of the tongue is one of the most difficult of the mouth lesions to treat and the most difficult to obtain complete retrogression, particularly if the growth is situated on the posterior part of the tongue, because even in the early cases minute processes often have invaded muscle substance for a considerable depth and because of an early invasion of the tissue towards the tonsil. Therefore, the groove between the tongue and tonsil should always receive radiation. In fact, a lethal dose to the lesion and to a large surrounding zone of healthy tissue should always be given, including an area in front of the tonsil to be followed in many instances by electric-coagulation. The method that should give the best results is extensive surface application, together with intensive radiation of the lymphatics, burying radium needles, two weeks later, in the posterior half of the tongue and in the tissue in front of the tonsil on the affected side. This should be followed in many cases by electric-coagulation.

In the treatment of the lymphatics, radiation should be as thorough as possible, and then, like a thorough dissection, it often is not radical enough. If operation is performed it should be preceded by radiation, because this should dispose of the small deposits in the glands which are not palpable or at least damage the proliferating cancer cells. By waiting five or six weeks after raying the primary growth the cancer cells are far on toward retrogression. Then there is not the same danger of spreading fresh cancer cells into an area where there are no lymph nodes ready to encapsulate them. Lately, it is claimed that the lymph nodes do for a time choke cancer cells. While radium has many shortcomings in cancer of the tongue, it is a step in advance, and with improved technic more should be accomplished in the future.

Epithelioma of buccal mucous membrane does not invade the glandular system as early as cancer of the tongue and lip, but if the disease has invaded the submucous tissue it is very resistant to treatment. When it is superficial it may be favorably influenced by one surface application of radium, but when it has invaded muscle tissne, the best results are obtained by burying radium needles or by surface application giving sufficient dosage to kill the cancer cells. Then the necrotic tissue which will always be produced by such intensive radiation should be removed by electric-coagulation. The radium reaction which is marked in these cases is painful, but after electric-coagulation, this is entirely relieved and the base heals up promptly without discomfort to the patient, providing all the cancerous tissue has been destroyed, although the lymphatic glands are not so early invaded, the glands of the neck should have the same radiation as has been described.

Cancer of the antrum and alveolar process has been made to retrogress completely under radium and, like the cheek, does not invade the lymphatic glands of the neck until the disease is well advanced. It has been stated that the disease most frequently starts in the alveolar process, often at the root of a tooth and early invades the antrum. For this reason, it is advisable if the cancer starts in the alveolar process to open the antrum through the floor of the mouth, preferably by cautery, and insert radium.

Cancer of the floor of the mouth and inferior maxilla, in both early and advanced cases, should be treated internally and externally, including the submental and submaxillary glands by surface application to check cell proliferation. This to be followed by inserting radium into the floor of the mouth and in some instances into submaxillary glands through the floor of the mouth. The best results I have obtained in the floor of the mouth have been when radiation was applied and part of tissue removed later by electric-coagulation. By this method one very advanced case, with palpable submental and submaxillary glands, has been cured for over two years.

Sarcoma of the tonsil is one of the most amenable lesions in the throat to treat by radium. A large mass filling the throat, which is hopeless surgically, will melt away without leaving any visible trace of the disease by one treatment, but these patients usually die of deep chest metastases within a few years. This shows the necessity of not only treating the neck, whether the glands are palpable or not, but also raying the chest.

It seems that many think it is only necessary to remove the visible part of the disease of the mouth and throat as in the treatment of superficial epitheliomata of the face. Naturally, these radiologists are disappointed. Radium is an alternative on basal-cell epitheliomata and some sarcomas and will cause the tumor to shrink and disappear without much, if any, inflammation, while in other forms of malignant tissue, such as squamous cell carcinoma, it acts a destructive agent. This is very important in treating carcinoma of the mouth and throat where it is nearly always of the squamous type.

In summarizing, then, let me say more difficulties in technic are encountered in treating malignancy of the mouth and throat than in almost any other part of the body. Burying radium needles and electric-coagulation has changed the end results. Many are not giving sufficient treatment to the adjacent lymphatics. An anatomical study of the lymphatics of the neck should be made in which each lesion of the mouth and throat metastasizes should be known. Many are wrongly satisfied with the removal of the visible part of the disease. When more than one chain of lymphatics are involved at the time of operation, the patients are not cured surgically but many cases are clinically cured by radiotherapy.

EMPIRE BLDG.

THE PRESENT STATUS OF RADIUM THERAPY IN THE FEMALE PELVIS

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In the section of Gynecology, Surgery, and Obstetrics at the last American Medical Association meeting, a few papers dealing with the use of radium in pelvic conditions were presented. As the men in this section were practically all surgeons, the discussions following the papers naturally leaned toward the surgical treatment of these cases.

The radium adherents, despite the fact that they were in the minority, were holding their ground fairly well until one surgeon, in the course of his discussion, made the statement that, although he had an open mind and was quite far-visioned, he had never seen a single case of primary cancer of the cervix cured by radium. This remark caused such a prolonged and enthusiastic outbreak of applause that the writer, in his little corner of the room, sat stunned by the demonstration. The only interpretation he could place upon this extraordinary occurrence, was that the four hundred or more of America's representative surgeons present not only approved of the speaker's words, but were apparently genuinely glad that they could believe with him, that nothing had as yet been produced to supplant surgery in the treatment of malignancy of the uterus.

Upon sober second thought, the writer realized that he had been unduly hasty in arriving at an immature conclusion of this sort, although he still felt that the apparent injustice to his own group of radium workers was uncalled for. Of course, not even the most ardent radium enthusiast will claim that his method acts in any other way than a supplemental one to surgery, but to make the arbitrary statement that no case of cervical cancer had ever been cured by radium, is, in the face of present day accomplishments, highly erroneous. The doctor quoted, who, in his own words, was "far visioned", must certainly have been looking the other way when the procession went by. In view of the light thrown by this incident on what is apparently a somewhat general feeling among surgeons that the use of radium in a case like that of the one cited is still to a degree experimental and consequently not to be encouraged, the writer has been moved to present for your consideration a few of the outstanding facts, as he sees them, in regard to the present status of radium therapy as applied to the female pelvis.

It is readily admitted that up to the present, surgery has done more than any other therapeutic agent in combatting pathological processes in general in the female pelvis, but the question of malignancy, as it affects this field, is of much greater moment. The problem whether a certain case is operable or not, can be solved only by the test of time. It is operable if the lesion is massed, localized or circumscribed. Then, of course, it is curable by means of a complete physical removal. Whether this be accomplished by the knife, cautery, chemicals, *x*-ray, or radium is immaterial. The thorough removal or destruction of the mass by any or all of these therapeutic means will result in a permanent cure.

Is surgery a cure for cancer? This question must all too often be answered in the negative, not so much by medical men, as by people at large. An affirmative answer is permissible only when the physical condition of the tumor assures a most complete removal of every individual microscopic cell associated with it. The appalling number of cases when such a procedure is a physical or mechanical impossibility, and their number is legion, demand a negative answer. In other words, they are inoperable within the meaning of the word cure. With these facts confronting us, are we not then justified in seeking help elsewhere for these poor mortals already doomed, and have we not in the roentgen ray and radium, in the light of recent developments, if not a cure, at least a positive degree of relief from some of the most distressing symptoms of these pitiable cases? Furthermore, has not radium, due to our present day knowledge of and experience with its application, frequently proved its worth as a possible cure for certain forms of uterine cancer? In the writer's opinion, decidedly yes. Then it must be accepted and placed alongside those therapeutic agents which we are so fond as to term specifics, until a possible rude awakening forces us to other conclusions.

The value of any given treatment does not lie necessarily in its ability to effect a striking cure in a rare or uncommon condition, but rather upon a constant curative action over a given number of well recognized, pathological conditions. Such an action can be accredited to radium in a majority of the conditions which affect the female pelvic organs. The more or less constant regularity with which such affections respond to intelligent applications of radium can only serve to impress those who have their attention drawn to this work in a most gratifying manner. Unlike surgery, the use of radium in any pelvic pathology presents no contra-indications. This is directly opposed to the oft repeated warning that radium must not be applied in females under or over certain age limits, in large pedunculated fibroids, or in malignancies. If anyone can offer a single reason based upon common sense or personal observation, why such allegations as to contra-indications are promulgated, the writer would be glad to hear them. Obviously most of the conditions just enumerated are bad surgical risks, if not entirely inoperable. But why refuse such patients the possible benefit from radium treatment? Though it is scarcely to be expected that many cures will follow, the treatment, at least, will do no harm, and what other treatment can be offered? The assumption that radium will sometimes convert a fibroid, or myoma, into cancer, is all surmise. There is, however, much evidence already accumulated that the opposite is true. A microscopic study of the cytology of tissue cells, stimulated to the limit of tolerance with radium, will demonstrate that no malignant degeneration occurs. With regard, then, to uterine malignancies, and until a better treatment develops, radium may be pushed to the limit of its usefulness, and even the most hopelessly advanced conditions will show some favorable response, if only a temporary one.

The foregoing assertions are not the ill-considered outburst of a radium crank, but are based upon a rather extensive personal experience with radioactive agents of many years' duration. This has been in conjunction with a number of eminent surgeons, whose friendship and hearty cooperation have made the work both pleasant and professionally profitable.

The purpose of this brief discussion is not to detract one iota from the brilliant achievements of surgery in the female pelvis, but to emphasize the thought that in the energy of radiation as exemplified in radium therapy, we have a potent factor which, in the analysis of present day accomplishments has done more to merit the confidence of the medical fraternity as a worthy ally of surgery than any other agent hitherto produced.

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THE RELATIONS BETWEEN THEORY AND PRACTICE IN X-RAY PHOTOGRAPHIC PHYSICS

Millard B. Hodgson
and
Frederick C. Martin

"Science" by definition is exact knowledge. This conception precludes the spontaneous creation of any distinct branch of science; for inherently any such branch is the result of evolution—hence at any stage the term can only presume to be a relative one.

Astronomy, mathematics, physics and chemistry all grew very slowly; held back in the early periods by the veil of superstition thrown around them. Gradually fact became predominant and decade by decade these rambling divisions of thought and endeavor grew into strong assemblies of facts through the efforts of a few fearless and broad-minded individuals.

Two primary reasons for the slow growth of any science are the lack of constructive effort and distortion of fact. The first cause is not nearly as pernicious in its action as the latter.

Distortion of fact may be consciously or unconsciously brought about. The research investigator, alas too often, is liable to believe his theories before they are proven and unconsciously throws aside conflicting evidence.

A theory is only useful as a working hypothesis—and should not be formulated quickly or clung to too tenaciously. It should be elastic—to permit of inclusion of those odd bits of data seemingly at variance with it. Only in this way will a complete law be evolved by any investigation—and science thus increase in scope. Dushman recently stated the point most lucidly when he said, "The trouble with most investigators is that they regard their theories as a creed".

Unfortunately, certain phases of roentgenology were for a long time held back in development through the lack of exact physical research along those lines closely connected with so-called practical results. Meanwhile, a number of suppositions had sprung up—many at variance with one another because they were based on inconclusive evidence.

The application of the physics of the x-ray tube had many diverse and often ludicrous aspects;—the various phases of the photographic problems involved and the nature of the rays themselves were little understood as late as 1910. Primarily this was due to the rather individual nature of the science. Of late years, however, through the work of such men as the Braggs, Coolidge, Shearer, Kaye and others, combined with the coöperative spirit of roentgenologists, much has been accomplished—so that today from the standpoint of apparatus and ease of operation, little seems lacking.

It was for the purpose of studying these essential facts, connected with the photographic phases of roentgenology, which had important bearing on correct diagnosis, that research was begun in our Research Laboratory in 1913. The photographic world at that time, it must be confessed, knew little of the requirements of a photographic plate for roentgenology. Once these were broadly understood, rapid progress was made toward evolving plates peculiarly sensitive to x-rays by a number of manufacturers.

Exact measurements of the reaction of a photographic plate to the stimulus of light or any other sort of energy are exceedingly difficult to make, owing to the many factors entering into the making of a negative.

Exposure and development are so linked together in effect that it is an exceedingly difficult process to investigate quantitatively and state results numerically. A great deal of progress, however, has been made in the direction of solving photographic problems and bringing this field of research into the realm of exact science.

Hurter and Driffield,[1] as early as 1890, deduced the funda-

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[1] Hurter & Driffield, *Journal Society of Chemical Industry*, May, 1890.

mentals of plate sensitometry which are responsible for the bulk of this progress. They demonstrated and proved the existence of certain definite relations between exposure and development, in addition to evolving a fundamental method of graphically showing photographic reactions.

Sheppard and Mees[2] re-investigated the entire field of precise sensitometry and devised standard methods for the application of Hurter and Driffield's theories, which are the basis of present day sensitometry. Mees,[3] in 1910, first suggested the adaptation of this system to *x*-ray investigation.

Tugman,[4] in 1914, further attempted to adapt this system to *x*-ray investigation. His conclusions, however, were hampered by the lack of precise methods of obtaining *x*-ray exposures of constant quality at that time (1912–1913).

This work was continued by Hodgson,[5] who showed several typical curves of *x*-ray plates made under precise conditions of exposure and development. Since this initial investigation, an attempt has been made, and is being continued, to link these results with those of practical radiography and to demonstrate the exact effect on photographic quality of such factors as varying exposure technique, scattered radiation (diaphragming), screen technique, etc.[6]

In order to make clear the terms employed in scientific photographic research, the writer thought it would be of interest to graphically portray some of the parallel factors of precise sensitometry and practical radiography.

The first factor considered, and one of prime importance, is that of contrast. The sensitometric method of demonstrating this is shown in Figure 1, which shows a series of typical "H & D" curves to *x*-rays.

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[2] "Investigations into the Theory of the Photographic Process," by S. E. Sheppard and C. E. K. Mees.

[3] *Journal of the Roentgen Society,* July, 1910.

[4] Tugman, *Journal of the Roentgen Society,* October, 1915.

[5] Hodgson, *American Journal of Roentgenology,* December, 1917.

[6] Hodgson, *American Journal of Roentgenology.* December, 1918.

Each curve is obtained by plotting the optical densities of a series of developed silver deposits against the logarithm of the exposures which produced them. This optical density is proportional to the mass of developed or reduced silver. By means of the special sensitometer[7] devised for this work it is possible to govern the recording of data to within an error of from 3 to 5%.

The curves shown in Figure 1 are of sensitometric plates developed for varying times. It will be seen that the average slope of the curve increases with developing time. In fact, it presents an increase in contrast.

Contrast is that quality of a plate which differentiates differences in exposure as differences in density. It will be noted that in the curve for ½ minute development, a great difference of exposure is required to show a unit difference in density. Taking this same density exposure unit and applying it to the curve of eight minutes, we see an increase of six units in density difference, or the second negative may be said to have greater contrast. This point is illustrated in the radiographs of the rabbit shown in Figure II. The contrast secured by short development is so slight as to render differentiation in detail practically impossible. As development becomes normal the contrast is increased but reaches a certain maximum—depending on the plate—beyond which there is no gain by increasing the time of development. This is due to the fact that prolonged development causes the reduction of silver grains even though they are unexposed.

Thus is this seemingly intangible quality of contrast expressed mathematically and studied as a mathematical function of exposure—for it need merely be stated as the slope of the curve. This at any point may be expressed as the tangent to the curve at this point.

Simultaneously, the effects of varying exposures may be studied. In Figure III is shown a series of curves depicting normal development of negatives given varying expo-

[7] Hodgson, *American Journal of Roentgenology*, December, 1917, p. 613.

sures. It will be seen that as exposure is increased beyond normal (normal being when a complete range from zero to maximum density is obtained) the density values are such that they will transmit very little light although the contrast is not appreciably different. This point is illustrated by the radiographic negatives in Figure IV.

In Figures V and VI, the effect of varying the spark gap is shown;—first in mathematical form, second by a series of actual radiographs. It will be noted that the contrast increases with increasing x-ray wave length (which increases as the spark gap or voltage decreases). This is due to the combined effects of relative penetration of the subject at various voltages and the selective reaction of the photographic plate to the varying wave lengths of rays.

There is undoubtedly considerable drawback to using the longer wave lengths in practical roentgenology, due to the great increase of exposure necessary. Approximately exposure changes inversely as the square of the voltage. Not only this factor of exposure increase, but the additional factor of care necessary in computing the change, must be taken into account in deciding on the value of an exposure technique involving using a short spark gap.

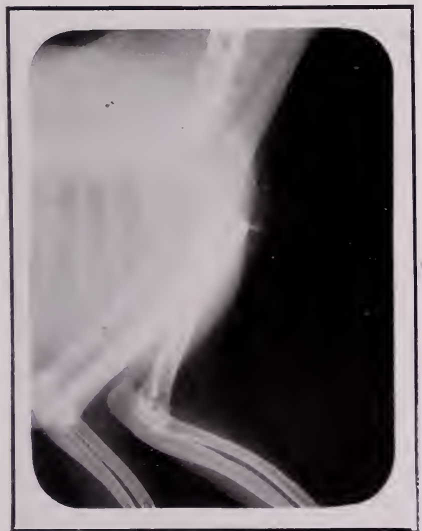
In conclusion, we might point out that investigation is now under way to study quantitatively the effect of scattered radiation, for, as we all know, this is of considerable importance.

We hope to present some of the results of certain investigations at some later time.

It is to be regretted that it is impossible to render in the half-tone illustrations the total scales of densities in the original negatives.

1 Minute

2 Minutes



5 Minutes

20 Minutes

DEVELOPMENT

FIG. 2

1 Second

2 Seconds

4 Seconds

8 Seconds

EXPOSURE

Fig. 4

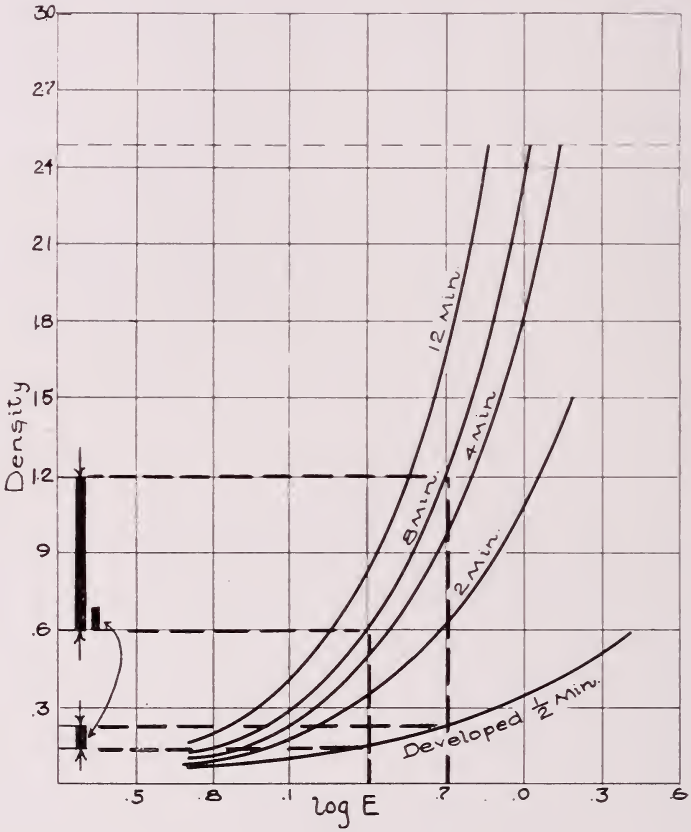
2 Inch

4 Inch

6 Inch

SPARK LENGTH

FIG. 6



Density
30
27
24
21
18
15
1.2
9
.6
.3
.5
.8
.1
.7
.0
.3
.6
log E
12 Min.
8 Min.
4 Min.
2 Min.
Developed ½ Min.

FIG. I

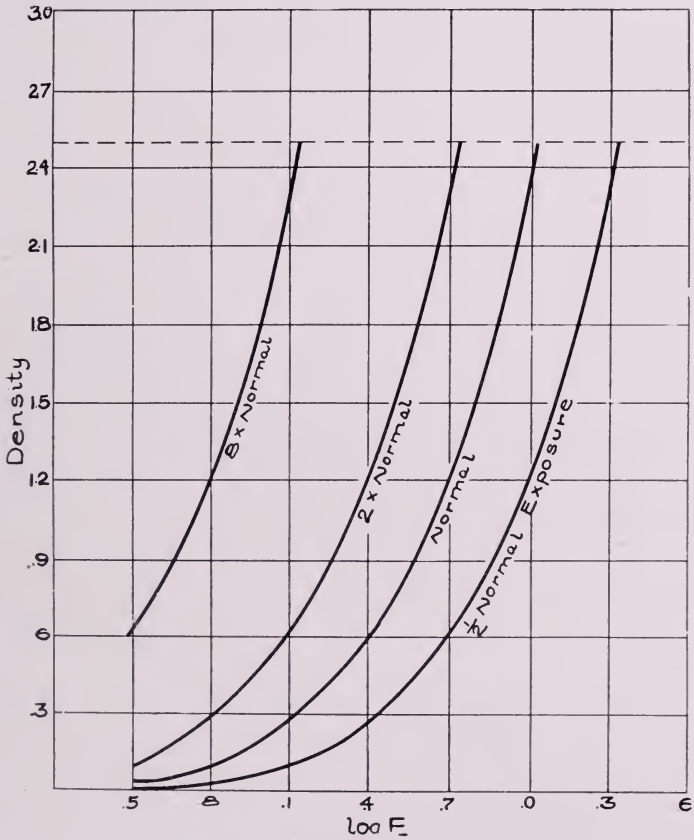

3.0
2.7
2.4
2.1
1.8
1.5
1.2
.9
.6
.3
Density
8 x Normal
2 x Normal
Normal
½ Normal Exposure
.5
.8
.1
.4
.7
.0
.3
.6
log E

FIG. II

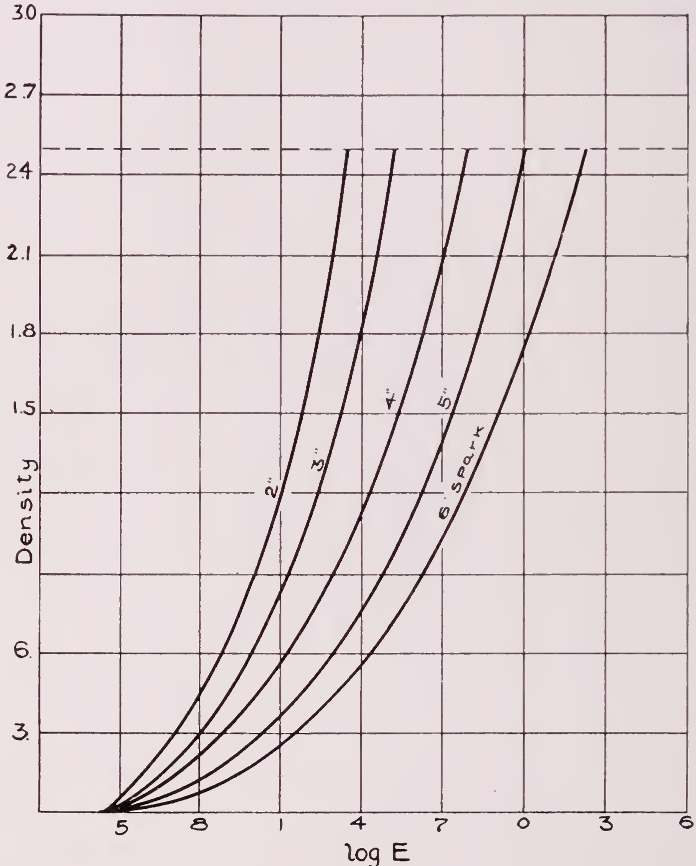


FIG. III

THE RADIOGRAPHIC DIFFERENTIATION OF URETERAL OBSTRUCTION FROM CERTAIN INTRAABDOMINAL LESIONS

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Denver

I became interested twelve years ago in the subject of intermittent hydronephrosis, this being described as a kidney that had become a large hydronephrotic sac, which would fill and empty at irregular intervals, if associated with temperature and perhaps chills it was then called a pyo-hydro-nephrosis; its etiology was usually obscure; however, about this time attention was called to certain aberrant blood vessels to lower pole of kidney that usually crossed the ureteral pelvic juncture and by its pressure upon the ureter would produce retention of the urine in the kidney and the back pressure from this retention and from the secretion of the oncoming watery urine would produce a dilation of the kidney pelvis and perhaps of the kidney itself with finally destruction of the parenchyma of the gland, which always necessitated a nephrectomy. It was my hope that a method might be found to diagnose this very serious condition before sufficient damage were done that would require its removal or even before its function had been seriously impaired.

There was also another class of cases that called my attention as being possibly in the same category which were a considerable number of individuals who had had the appendix out in an acute abdominal attack or whose appendix was called chronic and removed without relief of recurring attacks of their old pain; these were then usually diagnosed as abdominal adhesions and often successive operations were done in the abdomen without beneficial results. A few of these cases were recognized while yet in the hos-

*Read before the Radiological Society, New Orleans, May 25, 1920.

pital as the kidney being the true cause and a nephrectomy or other operation done usually with relief.

I talked this whole subject over with Dr. Geo. Stover, an honored member of your society and one of the real pioneers in roentgenology in the United States. I wish now to again acknowledge my indebtedness to him for his very great help and enthusiasm in the development of this method of diagnostic procedure which has proved to be so accurate and beneficial.

Upon questioning these patients I found that they gave quite a definite and typical history; the more prominent symptoms were: first, that their attacks had recurred many times, to me this pointed away from the appendix for when the appendix has an actual inflammation it almost surely goes to abscess formation unless removed; second, these pains usually came on when the patient was upon the feet doing some of the heavier household duties, such as washing at the tub, sweeping, scrubbing, ironing, reaching up to hang a picture or clean a ceiling, sewing at a sewing machine, horseback riding or getting a jolt in an automobile are very common; with men, in addition to some of the above, heavy lifting as in removing a wagon bed or putting on a hayrack or shovelling would bring the attacks, in fact any muscular effort that would tend to force the kidneys downward.

The character of the pain is very distinctive, yet it is such that it may reasonably be mistaken for an acute appendix, but if the kidney is thought of and examined externally the diagnosis of appendicitis will rarely be made in this condition. The pain, subjectively, upon the right side is usually in the high appendix region running into the right loin or extending clear through this portion, usually runs downward along the course of the ureter into the bladder or external genital region and often down the inside of the leg to the knee, accompanying this there is usually disturbance of the stomach and they usually vomit or feel nauseated, this is due to two causes, first because this patient is usually so toxic from continued under-elimination of waste products, very often they can take almost no food; secondly from direct reflexes that cause vomiting in all abdominal disturbances. The pain comes on suddenly usually as a sharp cutting pain but may come on as a dull, a gradually increasing aching pain in the kidney region. I believe almost every patient I have ever seen has found out for himself that relief may be had by lying down and putting on a hot water bag or hot stupes, by this the pain is usually relieved in a few hours to a day or two with a soreness remaining for a few days. This alone in history should eliminate the appendix from further consideration. Sometimes a patient will assume the knee chest position, or will raise the foot of the bed; I am told by Dr. E. I. Saltsbury that in the tropical hospitals it is not an unusual sight in the wards to see a half dozen infants in the knee chest position or even standing upon their feet with the head bent clear over the bed; it was recognized that these little sufferers were all afflicted with a pyelitis but it had not been suggested as to why they had learned to assume this position. The history of attacks of pain may go back to early childhood and it is not unusual to have a case who has undergone numerous operations in the abdomen; a year ago I saw a woman who in sixteen years had had eight abdominal operations and still had her original pain for which I was called; it is needless to add that she refused further surgery.

If the pain is in a similar position upon the left side it is usually regarded as due to some supposed pelvic lesion even though definite lesions here cannot be demonstrated; it is often called a pleurisy, especially if there is soreness or tenderness under the twelfth rib; it is extremely unfortunate that there is a pretty firmly fixed belief in the profession that almost any abdominal pain may be accounted for by some slight misplacement of the uterus or even a normal anteflexion may be blamed as making pressure upon the bladder; it is so often accepted by the patient as explaining all her ills. It is my observation that there is much reason for a better understanding in the profession in regard to the pathology of the female pelvic organs.

There is another very constant symptom and that is the expression of the patient's face, it is a pinched expression of chronic suffering and it always leaves the face within a few days after relief of the trouble and is a sure evidence of a correct diagnosis and a successful operation. There is also another observation that I have made many times, in fact it is almost constant in women patients, and that is that this pain is always worse at menstrual periods. I know of no explanation for it unless it is that all discomforts are probably worse during the nervous upset of menstruation; it undoubtedly has led to an incorrect diagnosis in many instances, thinking it had to do with the pelvic organs. These patients are nearly always markedly constipated, and the filled colon pulls the kidney down with it; they are always better after they take a cathartic.

I wish to emphasize a statement that I have made many times and that is that most kidney difficulties are really not kidney troubles at all but are simply the effects upon the kidney of ureteral difficulties, that is some form of ureteral obstruction primarily or secondarily producing various kidney lesions. This obstruction is produced by mobility of the kidney, the mobility may not be more than its normal excursion, and my explanation is that it is due to the production of an angulation or kink of the ureter somewhere within the radius of the excursion of the kidney, in other words some kidneys are extremely mobile and may drop as much as four or more inches and yet that kidney not give any marked difficulty, provided the ureter has no fixed point within this radius and thus is allowed to take up the slack ahead of the prolapsed kidney which it will do even as much as three or four inches; it does this by the contraction of its longitudinal muscle fibers, therefore ptosis itself is of secondary importance. The obstruction is always within, at most, four inches of the kidney pelvis and usually within two inches. I think the old idea of traction upon the renal vessels is of little importance. This fixed point is produced by an attachment of the ureter to the surrounding tissues or to a vessel or nerve crossing it.

In abdominal diagnosis this condition of ureteral obstruction is more often mistaken for appendicitis if upon the right side and if on the left is more often mistaken for ovarian or tubal trouble; the tube and ovary are next in frequency upon the right side, next in frequency of error are the following, adhesions, especially frequent if patient has been operated before, peptic ulcer often on account of the stomach symptoms from autointoxication and from reflexes; gall bladder is quite common, intestinal obstruction and intestinal stasis are occasionally diagnosed. Stone in the kidney or ureter is a very common error in ureteral obstruction, in fact ureteral obstruction gives an exact picture of kidney stone with the exception of the actual scratching of the stone and accompanied with blood cells; Mr. Lange makes the statement that 85% of the cases brought to him suffering with stone symptoms do not show stone shadows. They, undoubtedly, are within the scope of my findings. Too many *x*-ray men and general surgeons regard the kidney as being eliminated when a negative picture is takën of the kidney and ureter; it has been my experience that only fifty per cent of actual kidney stones are shown radiographically unless they are intensified by collargol absorption.

Inasmuch as this ureteral obstruction does not give trouble when the patient is lying down, it is quite evident therefore that the upright position is the one to be used in endeavoring to demonstrate this lesion; it is for this reason that I regard pictures of the kidney and ureter with the patient lying down as being without value except to show very gross lesions and then they do not show where the obstruction is, or what has produced the trouble, therefore all patients must be standing upright and the pictures taken after jolting upon the heels or after hard coughing to dislocate the kidney downward; external palpation should be also made in the upright position after jolting upon the heels.

The details of the procedure are as follows: first the patient is relieved of all street wear and a divided pajama suit is put on with only the stockings on the feet; he is now measured for height before the upright stereoscopic table; this table is left in place while the patient is being catheterized upon an ordinary examining table, the urine from one or both kidneys is collected and the cystoscope is withdrawn and the catheters left in the ureters up about the middle or slightly above and the patient then stood up before the stereoscopic table; the tube has also been adjusted and regulated in the meantime, a Luer syringe for each kidney has been filled with 8 cc. of 25% Col.; when the radiologist is ready 4 cc. are injected into upper ureter, and the kidney pelvis; now the patient is told to jolt himself upon the heels quickly and forcibly, and the catheters are withdrawn about three inches and the balance of the fluid is injected gradually, not too slowly or it might run back around the catheter, and not too rapidly or it might produce damage to the kidney, and when there remains about one ccm. the first picture is taken; the remaining collargol is being injected before the second picture is taken; the patient is then laid down upon his back upon the first table and the catheters are plugged and left in position for about five minutes, this permits absorption into the stone if one should be present; they are then withdrawn and we then wait twenty minutes and then take a series of 8 and 10 plates of the kidney, the middle ureter, and the pelvic portions of the ureter, these latter plates check up for stone shadows, also for retention of the collargol in the kidney pelvis and ureter. I must emphasize my feeling that the kidney pelvis should not be distended unduly in any manner of injecting the collargol, for kidneys have been damaged and patients have died from this misconception; let me repeat that the important thing is the ureter and not the extent of damage to the kidney itself, this if desired should be learned at a subsequent examination; the normal capacity of the kidney pelvis and ureter is under 10 ccms. Dr. Geo. Stover and I worked out years ago that the normal kidney and ureter would empty in less time than we could then change plated plates, about twenty or twenty-five seconds, and a retention at the end of 25 minutes sufficient to show the outlines of the kidney pelvis is a very gross lesion; this happens quite often. I had one destroyed kidney that retained collargol 42 days without any collargol having shown in the urine during this time. It is also important to watch each urination after injection to see when the urine is clear; if there is no marked retention it will be clear upon the second urination, showing after 12 hours or more is very definite of damaging retention. This procedure for a diagnosis is of course a considerable amount of work for the surgeon and some discomfort for the patient, both of which are really not to be considered when the patient's welfare is at stake and the possibility of an incorrect diagnosis and an unnecessary and perhaps damaging operation may be done without it. I do not recall having a patient regret it as they appreciate all that is done for their safety. Now after a diagnosis, what then? Are you going to tell the patient he or she must go on and suffer, as many of our doctors do? If you limit your operations to those in common use this is not bad advice, for none of them offer better than 50% to 60% of chances to be cured or even benefited; the Edebohls is the most general one. This fixes the kidney too tightly with sutures through the very fragile true capsule and coughing or vomiting in coming out of the anaesthetic usually tears out those sutures. Other operations, such as making a sling with gauze strips and the passing of a suture through the kidney parenchyma and the wiping of the kidney with carbolic acid, can only be mentioned to protest against them. Statistics have been compiled that show that failures to either benefit or cure by these operations run from 37% to 45%, and we must admit that this is a very high percentage of failures for any operation. Appreciating this situation in reference to nephropexy I developed ten years ago an operation which I hoped would be efficient. I have now used it or modifications of it in over two hundred and fifty operations and have more than 96% of complete cures and with no known complete failures. The important points in my operation are: first, the freeing of the ureter in its upper five to seven inches—this relieves all fixed points in the ureter, permitting the slack to be taken up; second, the use of fascia lata or of fascia taken from the back by extending the incision upwards along the spine; third, the diagnosis is made altogether before operation and the kidney is not stripped of its fatty-fibrous capsule nor is it even delivered, in other words an operative diagnosis of kidney is very unsatisfactory and to be used only in cases where it is impossible to get into the ureter with a catheter, these form a very small percentage of cases; fourth, upon exposing the kidney the ureter is first cleared of all adhesions or attachments to any surrounding structure, as far down as one can reach with the finger; fifth, the fatty fibrous structure which surrounds the kidney and extends downward and attaches to the posterior wall of the colon is now separated from the posterior wall of the colon at a level of the lower pole of the kidney, a hemostat is now passed through this from the anterior dissection and thrust through close to the ureter, leaving the ureter to the inside and a piece of fascia a half inch wide and four inches long and caught in the hemostat and carried through this opening in the so-called nephrocolic ligament; a hemostat is now plunged through the tissues just above the twelfth rib and the two ends of the fascia are caught and brought through this opening and sewed with chromic catgut to the fascia overlying the intercostal muscles, wound then closed with temporary drainage and patient kept in bed for two weeks; is allowed to turn from side to side but not sit up or be raised up.

It is my opinion that the radiologist is in a position very often to recognize these kidney patients in cases that have been sent to them for an intestinal examination and may often with open minded general surgeons suggest that the urinary tract be investigated, I think; however this will not always be met with favor but it will gradually gain recognizance regardless of any or all opposition.

It is extremely unfortunate that the operation of nephropexy has gradually fallen into more or less disrepute and it is even more unfortunate that many of our profession have obtained the idea that to tell a patient that he or she has a loose kidney is to make a neurotic out of them, so also would any other lesion if we could offer them no relief or discourage them in making an effort to obtain relief, for example, we do not hesitate to tell a patient they have syphilis or gonorrhea, yet many neurotics are made by this statement which is too often based upon a very cursory examination; it is therefore my hope to be instrumental in restoring the operation of nephropexy to its proper place in modern surgery and also to reduce the diagnosis of chronic appendicitis to its proper proportions which is probably about one-tenth to one-fifth of its present occurrence.

THE ETIOLOGY OF CARDIO-SPASM

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In studying this condition let us first review the normal anatomy of the esophagus. You will remember this organ as a musculo-membranous tube, which lies in the midline of the thorax, and courses behind the heart until it reaches the diaphragm, at which point it makes an abrupt curve to the left and enters the cardiac portion of the stomach. The lumen of the organ at this curve is normally only 12–13 mm. in diameter, this being by far the smallest portion in its course. The musculature is much like that of the intestine, being composed of a longitudinal and a circular layer. Very singularly these circular bands are transverse at the upper and lower portions of the organ and they have an oblique arrangement immediately. You will note then that stimulation of the entire circular muscular coat would cause a constriction of the lower as well as the upper end with little change in the intermediary portion. The constriction of the upper portion is not so complete for the reason that the lumen at this point is quite large. The nerve supply to this organ is derived for the most part from the vagi, but receives some fibers from the sympathetic system. These form a plexus on the anterior cardiac portion which sends fibers to both coats of the musculature and mucous membrane.

Cardio-spasm in its true sense is a partial or complete, non-malignant constriction of the esophagus seen in the lower curve of the organ just a few centimeters from its orifice into the stomach. The condition is due to a hyper-irritation of the muscular bands. This irritation is not lo cal but, due to the peculiar arrangement of the circular muscle, we find the constriction most marked at the cardiac orifice with some narrowing of the lumen in the upper portion and dilation in the intermediary area. This dilation is due to the internal pressure of the ingested food, the oblique circular fibers not being able to retain the contour. In this condition, in cases of long standing we find the intermediary portion of the esophagus has lost its tone, and the dilation is very marked.

The study of the musculature of the esophagus during cardio-spasm is most interesting. We have all studied the condition in front of the fluoroscope, but Kelly gives some most unique findings in studying a case of cardio-spasm with the esophageoscope. He states:

"In the examination of the esophagus with the tube, I found that the size of the lumen was constantly changing on inspiration and expiration. These appearances and movements were observed with the end of the tube some three cm. above the hiatal level and are given as normal. But as soon as the tube was introduced so that it came into contact with the parts around the hiatus, the lumen was at once closed and remained closed until the tube was withdrawn a few cms. when the opening and closing began again."

He concludes that there is an area of hyperasthesia in the gullet, and it is to this that the cardio-spasm is due. He states further that the etiology of the hyperasthesia is unknown.

Cardio-spasm has been a subject of roentgen study for the past twenty years and yet its definite etiology seems to be still in dispute. Pyoloro-spasm, a condition very closely allied with cardio-spasm, has been very thoroughly studied and at this time is one of our most helpful diagnostic signs in lesions of the stomach, duodenum, and gall-bladder.

I have been fortunate in having a small series of cases in which this condition might be studied from a clinical as well as a roentgenological standpoint. I have selected three of these case histories which are typical and illustrate the few conclusions I wish to draw.

CASE NO. 1. Mrs. W. Age 62. Chief complaint: Immediate regurgitation of ingested food and loss of weight.

Present Illness: Patient has had indigestion for some five years, however not severe. No definite pain at any time. For the past six months patient seems to regurgitate her food about as fast as ingested. This has been growing worse until at the present time she feels that little food reaches the stomach.

Physical Examination: Patient slightly emaciated but not particularly weak. No other noteworthy findings.

Roentgen Examination: Patient was placed in front of the fluoroscope and the barium meal given. As the mixture passed through the esophagus the outline was clear and no irregularities and no spasm were noted. The first portion of the meal dropped into the stomach and passed out into the small gut through a gaping pyloric sphincter. At this time, however, the esophagus clamped down into a typical cardio-spasm and it was almost impossible to force by gravity more of the meal into the stomach. Attention was then turned to the stomach which was seen to have a gaping pylorus allowing almost one-half of the ingested contents to pass into the small intestine, but at this time the pylorus also went into a spasm and it was impossible by palpation to force more of the meal out of the stomach. With even this small amount of barium in the organ it was possible to make out a filling defect involving the fundal and cardiac portions of the stomach. At the patient's request an exploratory operation was performed and a carcinoma of the greater curvature and cardiac portion was found with no metastasis in the esophagus.

CASE NO. 2. Mrs. S. Age 42. Chief complaint; inability to swallow food, loss of weight.

Present History: Patient has been troubled with indigestion for 10 to 12 years. For the past 18 months she has had some epigastric pain and has been unable to swallow her food.

Physical Examination: Practically negative.

Roentgen Examination: On fluoroscopic examination a considerable portion of the meal was ingested before the esophagus went into spasm, then the following picture was seen. A filling defect involved the entire length of the greater curvature and the pylorus of the stomach, causing a patent pyloric sphincter. A stricture of the esophagus was noted at the cardiac bend which was not complete but allowed only a small amount of food to reach the stomach. In this case a carcinoma of the stomach was demonstrated by an exploratory operation.

Case No. 3. Mr. M. Age 27. Patient gave a history of inability to swallow his food. Some nausea and vomiting. This had lasted over a period of 8 to 10 months. On physical examination the patient had some tenderness over McBurney's Point with few other findings of note.

The roentgenological examination of the esophagus revealed an intermittent cardio-spasm. The stomach was negative as was also the duodenum and small intestine. From clinical and roentgen data a diagnosis of chronic appendix with a reflex cardio-spasm was made. The appendix was removed a few days later and this patient has been free from any symptoms of cardio-spasm since the day of operation three years ago.

You will note in the above records, as is also true of the other cases of this series, that inability to swallow food and regurgitation of same was the chief complaint and it was for the relief of this symptom that these patients sought medical aid.

The etiology of every case of cardio-spasm should be carefully worked out before any treatment is instituted. Dilation by instrumentation will give temporary relief and is often advisable if the patient is weak and emaciated from lack of ingested food. Atropine in these cases gives very little relief.

From this study, one's conclusions are: That cardio-spasm is a spastic condition of the lower end of the esophagus due to a hyperstimulation of the circular muscle bands of this organ, this irritation being a signal or warning of some lesion in the gastro-intestinal tract. That cardio-spasm is not a primary lesion but a secondary condition to some pathological condition further along in the tract, and is the result of nature's effort to exclude the irritating food from the diseased part. That in every case of this series we have been able to demonstrate a definite organic lesion which was causing the cardio-spasm and when this lesion was removed the symptoms of the condition were completely relieved and roentgen examination of the esophagus was negative.

405 Waldheim Bldg.

Case 1

Case 2

Case 3

A CASE OF OSTEO-SARCOMA OF THE TIBIA WITH EXTENSIVE METASTASES REPORT OF TREATMENT

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The case under consideration is that of a girl thirteen years of age who in August, 1917, suffered an injury to her left tibia by a fall in which she struck her leg against a stone.

The wound is reported to have promptly healed over, leaving a scar and a soreness in the bone felt for a number of weeks. While at play with companions near Christmas, 1917, she received a kick over the same area of the injured tibia after which the bone continued painful and began to enlarge. May 4, 1918, a radiograph (Fig. 1) was made which in some features suggested an infected osteo-myelitis, but the proliferation of new bone in a view made with rays perpendicular to the line of the shaft pointed to osteo-sarcoma. Nevertheless an incision of the tumor with the expectation of evacuating pus was made, but only a "bloody spongy discharge" was reported. The limb grew rapidly worse and crutches were resorted to as the girl could no longer support her weight on the affected side, and the tumor was very tender. July 14, 1918, she returned to the hospital for further study and relief if possible. Radiograms made on that date (Fig. 2) show the destruction of bone much more extended and at the same time a rapid widening of the zone of osseous proliferation. The characteristic sun-ray shafts of bony deposit are quite marked, and the diagnosis of osteo-sarcoma is unqualifiedly given.

Amputation was advised by the consultation of physicians and surgeons, but a suggestion, that the *x*-ray be first given a trial, was favored. Accordingly a series of daily exposures was given from July 16 to the 24th, over all areas about the leg from knee to ankle.

The patient was then allowed to return to her home for three weeks. On her return August 17, she was without her crutches and greatly improved. The leg was again rayed on four consecutive days over as many aspects about the tumified portion. On September 6th the patient again returned and the exposures were repeated. She no longer limped, and the tumor was much diminished and entirely without pain.

About eight weeks thereafter, October 22, patient returned with a lump on her left lower jaw at the angle, and a history of having just suffered a siege of severe toothache. To relieve this a dentist had extracted the second lower left molar, the suspected cause of her toothache. She reported the pulling of the tooth was attended by a severe hemorrhage which continued for a day or two, and was difficult to control.

A radiograph of the jaw (Fig. 4) showed an area of bone absorption under the third unerupted molar, the probable cause of the trouble, and not the second molar as had been supposed. Evidently here was a metastasis into the jaw from the malignancy primary in the tibia. Three sessions of treatments as in the case of the tibia resulted in prompt subsidence of the tumor and complete disappearance of pain. A plate (Fig. 5) made three months later, January 21, 1919, showed normal bone beginning to fill the field of erosions in the jaw.

Up to this time the patient was steadily increasing in weight, and she continued well after the tumor in the tibia had responded to the ray. But on January 23, 1919, she complained of feeling ill and showed a degree or two of temperature above normal. The influenza was prevalent at that time, and to check a possible infection of the lungs a plate was made. Distributed at wide but relatively regular intervals throughout the chest, and in the body of the lungs were a number of bright shot-like spots, small lime-infiltrated nodes. Our suspicions were that these were new centers of metastases from the tumors of tibia and jaw. Three weeks later, February 14, a second plate of lungs was made (Fig. 6) and the limy nodules were found to be much more numerous, but none larger than of the first plate, and were about four to six millimeters in diameter. Forty milliampere minutes each day for three days were administered to cover the whole chest.

About six weeks later, April 1, patient returned. Plates showed the lungs now shot full of the calcareous nodules, all about the size of ordinary shot, and still in no way clustered, but distributed at regular intervals. Patient was feeling bad and refused further treatment at that time.

She returned on May 15, 1919. Since her last visit she had suffered a severe attack of mumps which left a conspicuous hard tumor mass at the site of the previously affected jaw. A radiograph showed the bone again rapidly disintegrating and proliferating externally, causing the conspicuous hard tumor. A series of three exposures of 50 milliampere minutes, through 3 millimeters of aluminum, distance 9 inches, spark gap 8 inches were given over that side of the face. The affected tibia was likewise treated as it showed evidence again of bony disintegration and proliferation. A small pulsating tumor simulating an aneurism appeared over the center of the tumefaction under the skin. This was easily compressible and was bandaged. Patient returned a week later, May 22, 1919, with the tumor of the jaw markedly reduced, permitting greatly improved function of the jaws. A plate of the chest at that date showed some of the calcified shot-like deposits in the lungs increased in size and taking angular shapes, but there was no increase in numbers. Patient was given a series of exposures over affected tibia, jaw, and spine.

About two and one-half months later, August 13, patient returned, complaining of pain in the right hip. A plate showed involvement of the right sacrum, ilium, great trochanter, and upper portion of the femur. Also a hard tumefaction of the skull had appeared and a plate showed the characteristic ray-like bone proliferation with scattered areas of absorption and rarifaction (Fig. 7).

So here were two new areas of involvement added to our troubles. A vigorous course of exposures was administered to all these parts as well as to the previously affected areas. The tumor of the skull subsided promptly and the pains disappeared from the hips but the function of the lower limbs was not much improved, and patient limped badly.

About October 15, patient fell in stepping down a low step at her home and fractured the right femur through the neck. The plate shows the upper portion of the femur involved by neoplasm. She returned to the hospital for observation and treatment the following month, with a partial paralysis of the right leg. A plate of the spine, made November 20, showed the dorsal portion from the 9th to the 11th vertebra rarefied and involved by neoplasm. A series of exposures of the spine improved the functioning of the leg movements but the patient was confined to the wheeled chair and bed from the time of the hip fracture.

December 13th, the right ankle became swollen and painful. The condition improved on exposure to the ray, the swelling disappearing almost entirely within two weeks.

Patient continued to improve slowly until January of the present year when she began to complain of severe headaches. The ray gave her relief from these after a single deep therapy exposure, but they recurred in intervals of about two weeks, when exposure again would give prompt relief.

Also about the first of January a swelling appeared over the right forehead. This subsided after two exposures to the ray.

In February patient began to fail rather rapidly and became bedfast. On February 27 she suffered a spontaneous fracture of the left femur at the lower third. Plates (Fig. 8) showed a marked degree of involvement by neoplasm at the site of fracture. An attempt at coaptation of fragments was made and two exposures of the ray given. Further plates (Figs. 9 and 10) made eighteen days after the break show a remarkable deposit of calous bone tissue about the fracture. After this fracture patient began to fail rapidly, at times lapsing into coma from which she would rally for a few days, indicating a brain involvement. She died in coma on March 25, 1920, two and one-half years after the first injury to the tibia, or two and one-fourth years after the second bruise to the same part, which may have been the inducing trauma to light up the neoplasm.

Summary

From the time of beginning of treatment to the close, the patient received at various portals of entry a total of 150 exposures, of an average dosage each of 35 milliampere minutes or a total of 5250 milliampere minutes, with a spark gap of 6 to 9 inches, and 4 to 5 milliamperes of current, and a target-to-skin distance of 10 inches.

The ray usually filtered through five sheets of aluminum of one millimeter thickness each, the filters being reduced to three millimeters only on a few initial occasions. At no time was any lead protection employed. Notwithstanding this extensive dosage never did an erythema develop over an area, and there was but slight falling of hair from the scalp subsequent to the exposures for the head tumors and the brain symptoms of headaches and sleeplessness.

Patient was of decided blond type.

All parts of the body were eventually rayed.

Patient complained a good deal of the ozone of the treatment room, protesting that it "sickened" her. This was relieved as much as possible by good ventilation by aid of electric fans and open doors.

A remarkable response to the ray was the prompt disappearance of pain on its application. Especially noticeable was the relief of the headaches and sleeplessness in the later months of the patient's life.

Possibly an extensive raying of the whole body at the start would have blocked the metastases, rather a severe procedure. Possibly a prompt amputation of the leg followed by extensive raying would have saved this life, but operative statistics in osteo-sarcoma are far from encouraging. The coma and brain symptoms at the close mark the usual course of brain involvement as the final stage of metastatic osteo-sarcoma.

Fig. 1

Note the ray-like deposit of bone in lines perpendicular to the shaft at the site of tumor. May 4, 1918.

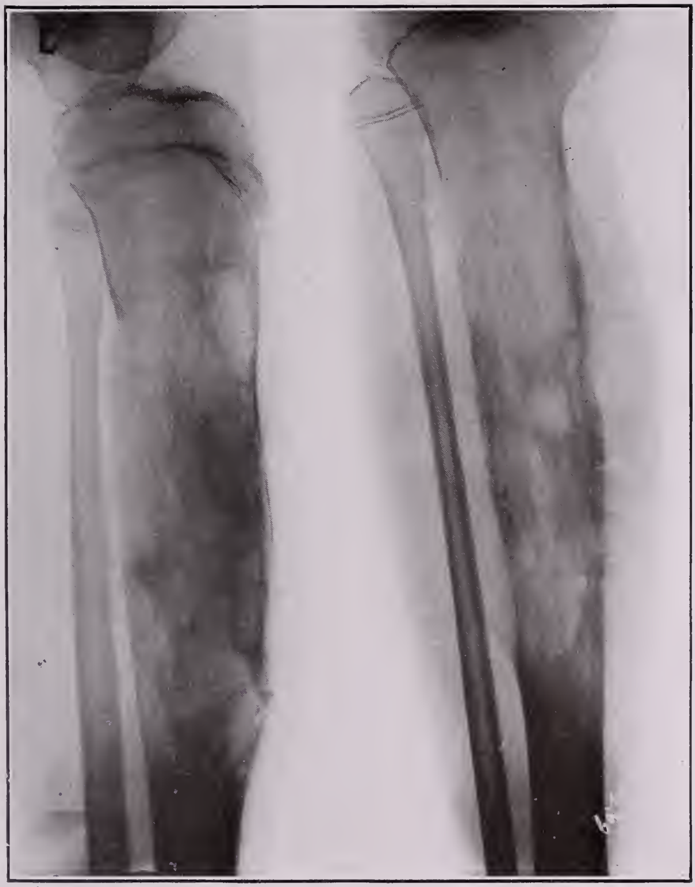

FIG. 2

Lateral and anterior views of diseased tibia. Note the rapid destruction of bone and at the same time the extensive infiltration of bony deposit about the tumor. July 14, 1918

FIG. 3

Lateral and anterior view of diseased tibia. Note the marked improvement of bone structure and organization of new cortex following x-ray treatment. January 21, 1919.

Fig. 4

Metastasis in the jaw. Note the disappearance of bone tissue and capsule under the third unerupted molar. October 23, 1918

Fig. 5

Note the return of bony structures about the third unerupted molar, under treatment. January 21, 1919.

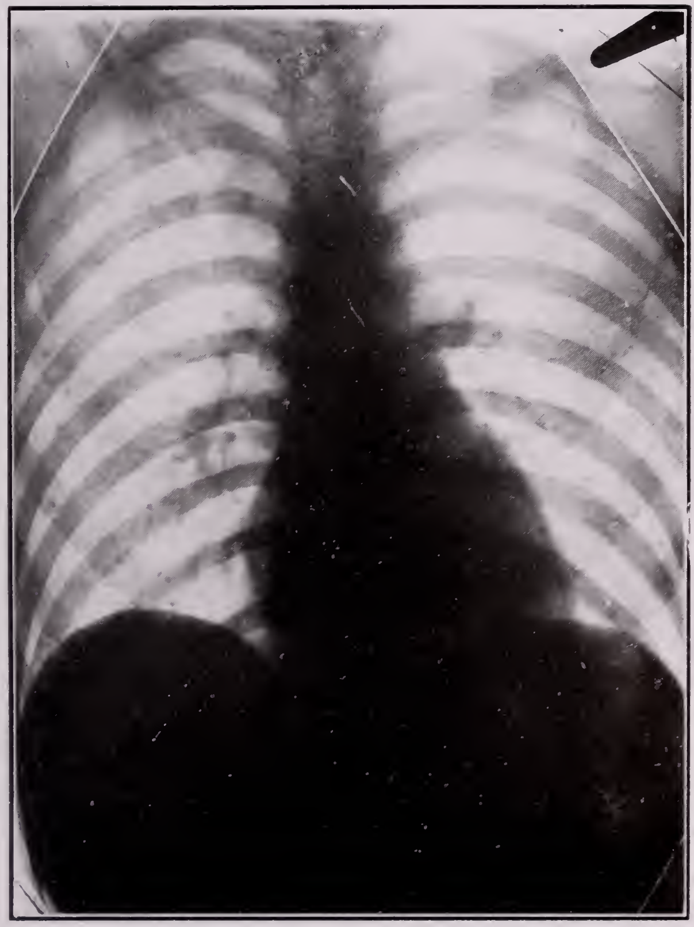

Fig. 6

Metastasis to the lymph nodes of the lungs. Note the many minute shot-like bodies scattered throughout the lung tissues.

Fig. 7

August 23, 1919. Metastasis to the skull. Note the new bone deposit in rays perpendicular to the skull surface, characteristic of osteo-sarcoma. Also note the areas of bone rarefaction in other parts of the skull.

FIG. 8

February 27, 1920. Spontaneous pathological fracture of femur at site of a new area of involvement. Compare Fig. 9 for rapid calous formation under treatment.

Fig. 9

March 16, 1920. Eighteen days after fracture. Note rapid bone repair about the fracture. Compare Fig. 8.

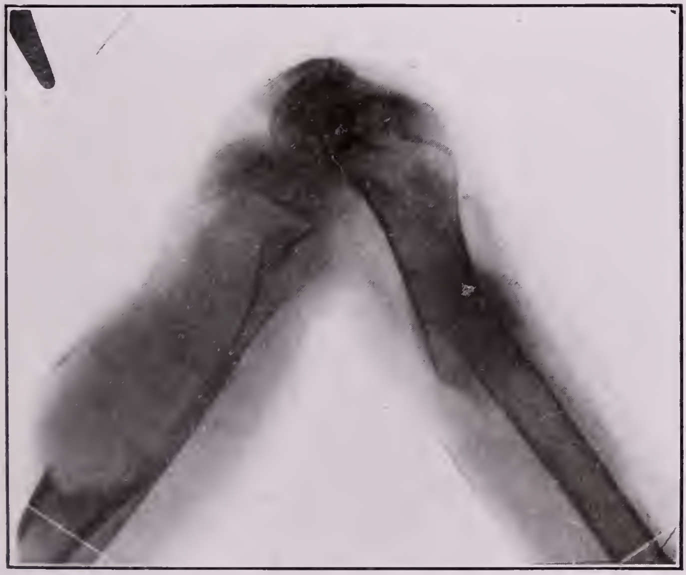

Fig. 10

March 16, 1920. Lateral view of the tibia and femur affected with recurrent osteo sarcoma

X-RAY FROM A SURGICAL ASPECT

H. A. Everett, M. D.
Lincoln, Neb.

Practically every paper read before our medical societies or presented in the literature on roentgenology has to do with the use of the *x*-ray as a diagnostic rather than a therapeutic aid.

To one who has watched the development of this particular branch of medical science, the evolution from a mere plaything in the hands of the medical diletantte and the eccentric medical enthusiast, to a sound and firm position among other diagnostic measures has been most interesting.

As has been hinted in the preceding paragraph those who first seized on the roentgen ray were men of small calibre and little judgment who adopted it because of its mystery and its fascination for the ignorant layman.

Succeeding years, however, found its use in the hands of the student and in the hands of those who felt and saw its possibilities.

Today we have equipment and method fairly well standardized and for the most part in use by men as skilled and as broad in their reasoning as in any other department of medicine.

The only thing at all disconcerting is the tendency to supplant the older methods of exact clinical investigation with a more or less mechanical application of the *x*-ray.

No matter how great the value of the roentgen findings, it can never supplant the type and form of clinical examination begun by Skoda and carried out to its full fruition under Neusser in the Vienna school.

No method of laboratory or mechanical diagnosis can ever hope to supplant brains and brains alone. One must not only educate the roentgenologist in accurate clinical observation but also educate the clinician as to the value of the x-ray results.

Only when this is done will we be able to get the fullest good from roentgenology.

The internist as always was the first to see the value of this new mechanical aid, which is not surprising, for the average surgeon travels along a rather narrow groove and is not as keen to use his modicum of gray matter as is his fellow—the internist.

It is only of recent years that the surgeon has been much better than the dentist. He has relied too much on his mechanical skill and not enough on his diagnostic ability.

Those of us who are lame in this latter characteristic should call in the aid of the roentgen expert and the careful internist. Just as soon as this is done the day of the medical juggler and of the cults will be a thing of the past.

It has been my pleasure to grow up with one of our skilled roentgenologists—for we began when the x-ray was practically in its infancy—have followed many blind trails, but by keeping up with the betterments in apparatus and in method—with the added knowledge gained by bitter experience and with the knowledge gained by others in the same field have arrived at what we think is a fair conception of its possibilities and its limitations.

It is not my purpose to dwell upon the use of the x-ray in a diagnosis but rather to see how far we can go with it as surgical procedure.

Only because of the tremendous improvement in apparatus that we can apply the roentgen ray surgically.

It is with deep regret that I recall my earlier experiences with the static machine and the smaller coils.

Here we had inadequate dosage—no knowledge of proper screening or protection of our patient—and the end result was disastrous. We stimulated active neoplasmic growth and rendered the last days of our patients almost unbearable from our x-ray burns and necrosis.

On account of the number of papers to be read today and because many or most of them have to do with the technique of the roentgen ray—I shall avoid this phase of the subject and will be as brief as possible in the exposition of my position in regard to surgical *x*-ray.

With this in mind I have purposely omitted wearisome case histories and will only state that I can fully substantiate my conclusions with the fullest of clinical evidence.

Before going into the treatment of conditions which formerly were considered wholly surgical I wish to mention a recent advance in *x*-ray diagnosis, namely, the injection of oxygen into the free peritoneal cavity.

Not only from the standpoint of diseases of the upper abdomen do we gain valuable information otherwise unavailable but also in the pelvis do we find a clearer, easier picture to read; kidneys, gall bladder, spleen, the subphrenic region, adhesions, the tubes, ovaries, uterus, the retroperitoneal region all stand out with startling fineness both under the fluoroscope and on the plate.

Certainly this method must be commended very highly to the careful investigator. No one who has not seen its demonstration can conceive its possibilities.

Another diagnostic aid neglected by the surgeon, in particular, is the raying of the chest in all cases of cancer. One should always ray in carcinoma of the breast, and in sarcoma, no matter where situated.

Many a patient apparently fully operable has been subjected to a useless operation because a picture was not made of the chest.

Too often the plate shows a snow-ball lung where the most careful examination of the history and of the patient affords nothing abnormal.

Three recent cases, one of a periosteal sarcoma of the lower end of the femur, one an endothelioma of the pelvis of the kidney, the other a cancer of the breast, all apparently early and operable with no evidence of any systemic invasion or deterioration; all three showed extensive lung involvement and so were allowed to finish out their span of life without surgical insult.

This dictum, ray all your chests in cancer of whatever type or form, should be absolute not only with the x-ray expert but also with his colleagues, the internist and the surgeon.

The two earliest applications of the surgical x-ray coming to my notice and tentatively adopted by me was the use of radiation in epitheliomas and cancer of the breast. At first radiation was confined to recurrences and in the vast majority of instances produced the sought for local result. In spite of this a startling number of individuals died from metastasis at some distant point. Here I do not feel it was the fault of the surgeon or the roentgenologist but because the case came late to both.

Thanks to Dr. Bloodgood and his intensive propaganda patients come to us with earlier diagnosis and are more favorable risks from every standpoint.

I am not prepared to go as far in the application of radiation as the x-ray enthusiast and prefer to remove the original focus of cancer invasion together with its drainage areas in the most thorough manner and then submit my patient to a painstaking course of intelligent radiation.

Certain of our cases have refused removal of the involved regional glands in carcinoma of the breast and face.

It must be confessed that even in these cases irradiation has apparently prevented recurrence and these patients are living and well today.

In contrast to these, those who had a radical operation. thorough and painstaking, with removal of drainage areas and who refused subsequent x-ray show a greater percentage of recurrences and an earlier mortality. This is true not only in my own personal work but also in the cases who have come to me from the various large clinics elsewhere in the country and whose course to a fatal termination I have been privileged and pleased to observe.

Given the choice, a radical procedure without subsequent irradiation or the removal of only the original cancer focus with irradiation, certainly I should choose the latter alternative for myself. No doubt this sounds like surgical heresy but I have the facts to support it.

A possible explanation for this contention lies in the fact that the original invading focus of cancer grew but slowly and in the face of all the inherent power of resistance the organism afforded while the invaded glands are of a younger generation and have not the difficulties to contend with that the parent focus had. Any roentgenologist will tell you that a metastasis will melt under treatment where the primary cancer is invulnerable.

The proper ground to take today is thorough operation with thorough irradiation. It is even to be anticipated that with improvement of technique the removal of the primary focus with subsequent irradiation would become the accepted therapy.

Beck of Chicago with his radical operation, with no attempt to cover denuded areas with skin followed by intensive radiation, seems to have given us a forward impetus in the treatment of late cancer of the breast.

There is but little to offer in the treatment by x-ray of cancer within the body. Here the condition is at present wholly surgical, if anything. Some experimental work has been done with radium especially in cancer of the hollow viscera and the prostate, perhaps radium will afford some result; it is useless to expect anything of irradiation otherwise.

This hope is probably futile for I have yet to see radium accomplish anything that the x-ray will not do better.

Observation of the end results in a large series of operations for sarcoma of the glands of the neck; this includes, of course, peritheliomas and endotheliomas; has led me to believe that here surgery has no place.

It did not matter who the operator was—how painstaking, careful, or skillful—a prompt recurrence and a fatal termination was the thing to be expected.

I have yet to see an actual sarcoma of the neck successfully removed; when the patient lives I doubt the diagnosis.

For many years because of these unfavorable results I have not operated on what clinically appeared to be sarcoma of the neck. These cases come to me in considerable number each year and in every instance they are told that they have a better chance without operation. Some have gone elsewhere for operation and are dead from recurrence; while those that chose the *x*-ray and who were not frankly too late for any procedure whatsoever, are living and well today.

It is admitted that the element of error in diagnosis must be taken into consideration, and I can say only that clinically all of these numerous cases were from every standpoint—sarcoma.

For many years the operation for tuberculous glands of the neck seemed to me to be unnecessarily mutilating and at times unsatisfactory in its end result. Certain patients refusing surgery, radiation was advised and applied with the result that no case of tuberculous glands of the neck is at present operated on in our practice. With this exception, when the mass is so large that toxic absorption is to be feared, or where the gland is so broken down that drainage must be done. Under these circumstances only the removal of the largest mass is done or a local abscess is drained. The case is then turned over to the *x*-ray man and an invariable favorable result is obtained.

Surely no surgeon is justified in doing useless surgery when a cure can be performed in an easier and safer way.

We have extended the use of the ray to those glands subacute, inflammatory, in nature; following acute throats in children, and where the gland has not broken down but persists over a considerable period of time and where the child looks pale and sick and carries some little temperature. One or two irradiations will stop the process, and cause the absorption of the mass without breaking down on abscess formation.

The use of the cross fire irradiation in selected fibroids, or in the myopathic uterus at the menopause, need not be dwelt upon for its value is only too well known. Here a word of caution is necessary; for the x-ray enthusiast seems to think that all such cases belong to his department. Much harm has been and will be done if your material is not studied carefully and as carefully selected.

One of the most troublesome conditions coming to the general practitioner and later to the surgeon are those unfortunate neuropaths who are entirely prostrated at the time of their monthly period and who are almost completely incapacitated between times.

Examination shows nothing organically wrong. All sorts of procedures are carried out in hope of relief but with no result. Surgeons are as helpless as are the internists.

Cross fire their pelvis as for fibroid until menstruation ceases, send the girl away for a few weeks and you are certain to be surprised at the rosy, blooming, happy creature who comes in to report her condition to you.

The success achieved in the treatment of tuberculous glands and with the subacute adenopathies together with the known ability of the x-ray to relieve pain led us to try radiation in carbuncle.

The results startled us and modified our surgical procedures.

For years in the greater number of cases, we, as routine, removed the entire necrotic or necrosing area; our present practice is to make a cruciform incision for drainage and for relief of tension and then submit our patient to two or three radiations.

From the time of the first irradiation there is relief from pain; a decided lessening of the existent inflammatory infiltration, a rapidly progressing demarcation of the necrosed area.

The temperature and other evidences of toxicity disappear rapidly and the patient goes on to an uninterrupted recovery without much surgery and with a minimum loss of time.

When I hear of or see some unfortunate extremely toxic pop-eyed patient going back to one or another of our famous surgical clinics for a second or third operation for the relief of their alarming and distressing condition, or when I find waiting in my reception room one of my former patients from whom I have carefully removed the greater portion of the thyroid, when I again examine this patient and admit to myself that the condition has been but little, if any, bettered, I am forced to conclude that surgery in toxic thyroids does not afford the solution of the thyroid problem.

There are but few conditions in surgery which give such wretched and unsatisfactory results; I have never examined an operated toxic thyroid whether from my own practice or from other clinics and found them free from toxic manifestations.

Naturally the question arises if medicine and surgery afford so little, what can be done?

We are in a position today to answer, much; and again we call upon the roentgenologist for aid.

Careful, cautious irradiation combined with as careful management by the internist will obtain results entirely satisfactory to the patient and such results as can be reached in no other way.

It is seldom, from my experience, that surgery need be resorted to.

So firmly convinced am I of this that no patient is operated on without a thorough trial of irradiation and medicine.

I have also called in my old operated thyroids for further observation and treatment, have had determined the type and form of intoxication.

The results of a combination of the x-ray and properly directed medication have closely approached the ideal.

It is to be hoped that in this paper some of the limitations and the possibilities of roentgen therapy have been made plain. No attempt has been made to go into detail for that would confuse the issue if attempted in the time allotted.

The surgical x-ray has an extremely narrow field, due care and caution must be used in its application and even more caution and care must be used in attempts to extend its scope.

It must be remembered that in the x-rays we have a powerful weapon and capable of great harm. Harm not only in its use but its misuse.

Its administration must not be attempted by any but the most highly trained and skilled individual. A mere technician or one who possesses merely the necessary money to purchase the requisite outfit should never attempt roentgen therapy.

You must remember that it takes brains, training, and experience to reach the desired results.

Discussion

Dr. B. B. Davis, Omaha: I think we have all been very much pleased with this paper, which is very moderate and shows the writer has been exceedingly fair, not only with the roentgenologist, but also with the surgeon.

Now there are two phases of this question. One of them —the diagnostic element—he touched rather briefly upon; and the other is the therapeutic. From the diagnostic standpoint, I think all of us agree with the proposition that the x-ray is an exceedingly valuable aid in diagnosis. There has been more or less trouble and a tendency for some to get into lazy habits in diagnosis, and trust too much to the x-ray. I have tried to make out a working basis of my relationship to the x-ray in reference to diagnosis, and that is to take with extreme suspicion a showing in x-ray which is not supported by other diagnostic methods. I think it is our duty to use all the methods possible in arriving at a conclusion. Two or three times I confess I have been tripped up very badly by trusting too much to the x-ray, which has compelled me to make another classification of liars:

First, we have liars.

Second, we have d—— —d liars.

Third, x-rays that are not interpreted correctly are sometimes the cause of a bad falling down in diagnosis.

So although I use the x-ray right along in every case that seems at all obscure, and we get all the good we can out of it, it must conform somewhat to other diagnostic signs in order to be accepted.

I feel as though if the surgeons and x-ray men would get together a little better and do a little more teamwork—the surgeon going to the x-ray laboratory and studying the plates more; and on the other hand, if the x-ray man would reciprocate, and after he has been doing the x-ray work, would be present at the operation—I think it would help all along the line.

Passing to the therapeutic side, we surgeons are too much inclined to depend upon surgery to remove things, because we have been accustomed to do things in the past. Oftentimes we do surgical operations that might be better treated by the x-ray; and on the other hand, the x-ray man is treating cases that might better be handled surgically. So we must coöperate more than in the past.

I had the pleasure of seeing and studying a number of Beck's cases which he had photographed, showing the condition that existed before he began the irradiation by his method. It is startling the results he seems to have produced, extending over a long enough period to mean something. His argument is that the almost impermeability of the skin to x-rays shows definitely we must modify our methods where the trouble is beneath the skin.

Take a secondary carcinoma of the breast with a great amount of tissue involved. If we would remove the entire surface and let the x-ray come in contact with the tissues, I think it would accomplish a great deal.

It seems to me there are several problems here the x-ray men and surgeons must work out together.

I thank you. (Applause.)

Dr. E. H. Skinner, Kansas City, Mo.: I do not think I have ever listened to a paper by a surgeon which would please the heart of the x-ray man any more than this paper of Dr. Everett's. I do not think I ever heard a paper by a surgeon or roentgenologist which showed a more honest and earnest and conservative attitude to both. I think it is remarkable that you have in your community here a gentleman and a physician and surgeon who is able to sift out the true from the untrue. I think it is one of the most splendid papers which brings together a lot of facts which have been written on extensively by roentgenologists and by surgeons; and the Doctor has been able to pick out the wheat from the chaff.

There is one point I want to discuss in the method of radiation which has received an impetus through Dr. Beck. It is well for us to know certain factors in his method of treatment before we are able to judge. Dr. Beck and his roentgenologist have never worked with the Coolidge tube in deep roentgen therapy. That's a very significant thing to roentgenologists. It may mean nothing to the surgeons. The work Dr. Beck has done will have a subsequent report, which will probably change, or at least decrease, the hopefulness which I had myself at first when I read his article in the S. G. O. They use a water-cooled tube and a piece of paper for filtration. I saw Dr. Eisen in February, and he said they had one serious effect in radiating a breast in which all of the bony tissue of the ribs had disappeared in the radiated part. So they are bound to modify their method.

I think roentgenologists who have used a Coolidge tube over a period of years and are able to attack their recurrences with vigor and courage are able to show the same results that Dr. Beck shows with removal of the skin. So I do not think we ought to judge yet upon the advantages or disadvantages of Dr. Beck's work. It opens up a new field, and the discussions of this before the W. S. A. I think I find the appreciation of the roentgenologists for that presentation, because it gives us courage to go ahead. If we do get some reaction upon the skin, this method as presented by Dr. Beck gives us courage to go ahead and pursue it without fear and with great courage and much vigor. (Applause.)

Dr. W. L. Ross, Omaha: I want to congratulate the Society on the paper. Those of us who are pioneers in x-ray therapy surely feel a great deal of courage. I remember the time when I began treating carbuncles I did so with great fear and trembling. I had no literature and knew no one who was treating carbuncles. Now it is a comfort to have even a surgeon say that.

Wherever you have a local foci of infection, it is all right to treat it with the x-ray; but are you treating a primary or secondary infection when you treat your enlarged glands? The user of x-ray therapy does not shoot away with the Coolidge tube and think he is done. He must watch his results, and if he is not getting the proper results, he must think possibly he is treating a secondary infection instead of a primary.

Another thing I wish to thank the Doctor for is the fact that he acknowledges and encourages our treating acute forms of infection, not only in the treatment of the carbuncles of the neck.

But I want to emphasize early diagnosis is the thing sought for today, and we must use every known method, either laboratory or physical diagnosis or case histories, to arrive at an early diagnosis. The earlier the diagnosis, the quicker the results out of your x-ray and your surgery.

I was glad to hear him say x-ray is of value in deep seated pelvic organs. Acute infectious diseases are just as easily handled with our Coolidge tube and proper treatment as those superficially located in the neck.

Since Dr. Bloodgood taught us to distribute that wide knowledge among our patients that we should see a cancer early in order to be of great benefit to them, the patients are coming to us early with a little lump or any enlargement. If it is true that primarily a cancer is a local thing, then your chances for doing the patient good in x-ray treatment are just as advantageous as to the surgeon. Emphasize this fact: After a major operation of your cancer of the breast and a recurrence on any part of the scar tissue, they will invariably recommend the x-ray instead of a second operation. If x-ray will kill a cancer cell after operation, why aren't we justified in believing it will do the same thing before operation? (Applause.)

Dr. Everett: I want to emphasize the point too few surgeons use x-ray therapy, and I want to emphasize the point that too many x-ray men overdo the roentgen therapy. I do not believe, Dr. Ross, that any man is justified in treating a primary foci of malignancy, especially in the breast, by the use of the x-ray. I tried to make it clear that the primary foci arose under the greatest of difficulties, and hence had an extreme handicap to external influences; while the metastasis has much less resistance to external influences, and hence would yield to the x-ray.

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Case Reports

FRACTURE OF HUMERUS

W. Walter Wasson, M. D.
Denver, Colorado
By courtesy of O. M. Shere, M. D., Denver, Colorado.

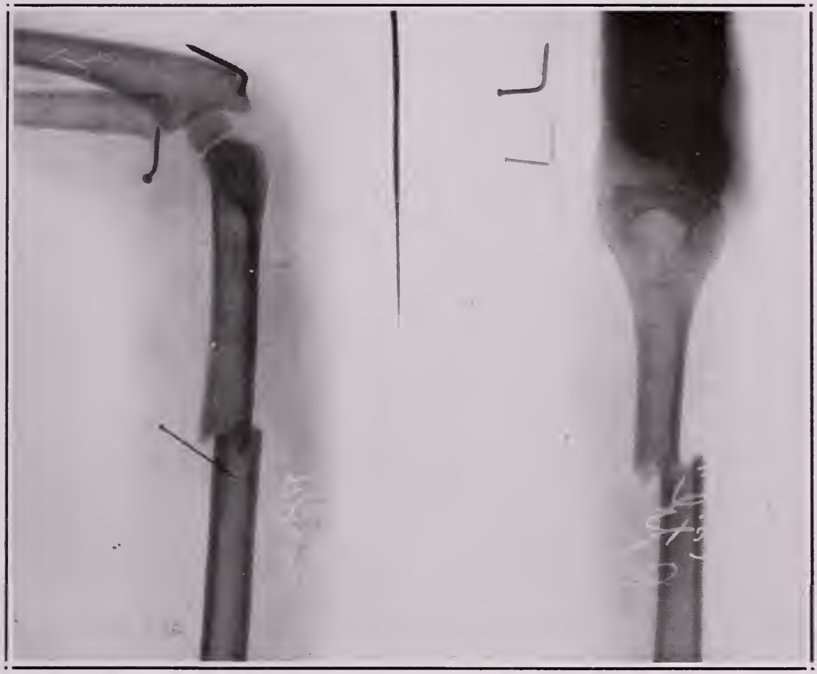
Master A. R. Sex: Male. Age: 10.

Present Condition: Had arm fractured one year ago in auto accident as shown in the accompanying *x*-ray made at the County Hospital, Denver, Colorado, and was so treated. Now has wrist drop and some atrophy of the muscles of forearm, especially those supplied by musculospiral nerve.

Roentgen Findings: Now shows an old fracture of humerus at junction of middle and lower third. No large callous. Slight thickening of bone. Thickening about nutrient foramen.

Operative Findings: Musculospinal nerve caught in the middle of callous, completely cutting nerve in two, and forming canal which was mistaken for nutrient foramen. Nerve attempting to regenerate. Unable to find the distal end.

Subsequent History: Wrist drop has not improved.



Posterior anterior and lateral view of arm showing fracture at time of injury.

Posterior anterior view of arm after union showing small amount of callus, and slight thickening around new canal for nerve.

Lateral view of same arm.

KNIFE BLADE IN BRAIN

W. Walter Wasson, M. D.
Denver, Colorado
By courtesy of A. J. Lof, M. D., Denver, Colorado.

Literature: Foreign bodies in the brain common but knife blades rare. *New Orleans Medical and Surgical Journal,* March, 1917, page 626. In the *Long Island Medical Journal,* 1916, a case was reported with knife blade broken flush with skull.

Mr. E. S. Sex: Male. Age: 56.

Family History: Negative.

Previous Illness: June 9, 1917. Drank steadily until six years ago. Typhoid fever twenty-nine years ago. Twenty-seven years ago hit or cut on head with revolver or knife, thinks it was knife. Was not unconscious, and given no medical attention. Scalp healed in two months with no other symptoms. Six years ago had attack with left side, became stiff and fell over unconscious for hour. Since has had pain in right side of head. Had four other attacks, lasting about fifteen minutes. Attacks began with sensation in left big toe, followed by paralyzed sensation of leg. Diagnosed epileptic by neurologist. Has been taking bromides.

Physical Examination: Negative.

Roentgen Findings: Metallic substance (knife blade), penetrating the brain, in posterior part of temporal bone, nearly in median line, and slightly on right side. Broken off flush with cranium.

Operative Findings: Found piece of knife blade in sheath of longitudinal sinus, with point in brain substance.

Subsequent History: December, 1920. General condition good. Pain in left leg continued for a time after operation and then gradually disappeared. Two years now since operation, and no return of epileptic symptoms.

Anterior posterior view of head showing piece of knife blade in cortex pointing toward right side.

Lateral view of head showing piece of knife blade in posterior part of skull.

FAULTY GROWTH OF RADIUS

W. Walter Wasson, M. D.
Denver, Colorado
By courtesy of C. B. Lyman, M. D., Denver, Colorado.

Miss M. W. Sex: Female. Age: 15.

Previous Illness: When nine years old sustained fracture of or near left wrist. Treated and union in usual time.

January 25, 1919

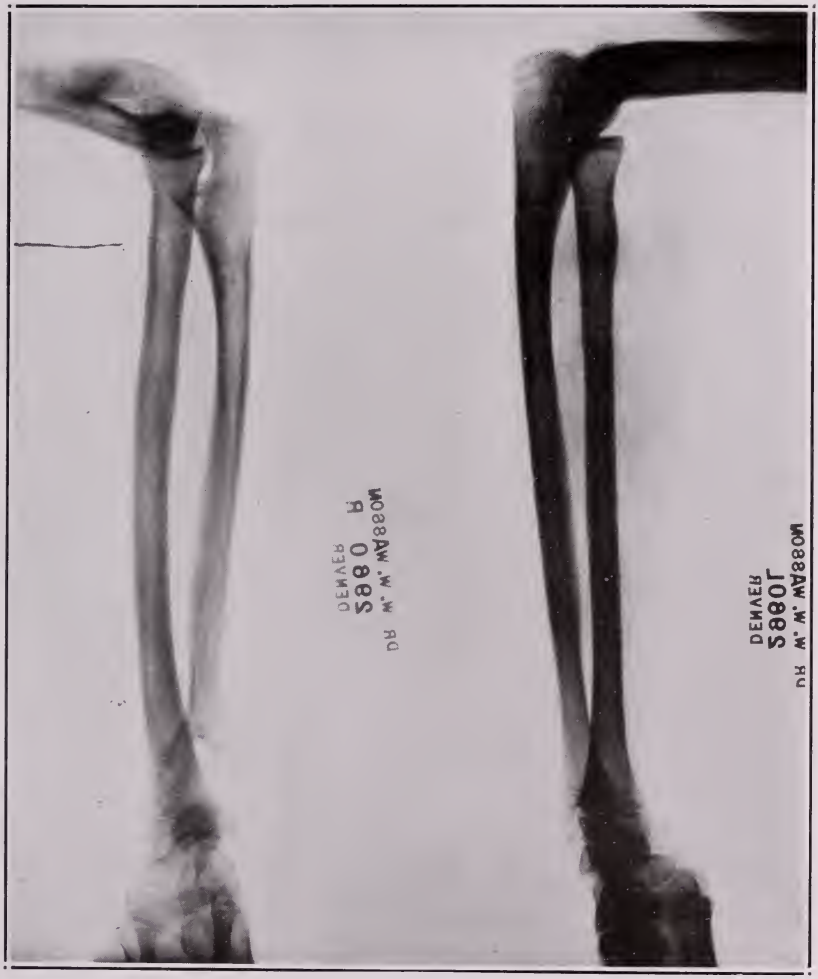
Present Condition: Three months ago noticed swelling on outer side of elbow accompanied by pain of moderate degree. The physical examination shows the head of radius displaced slightly upward toward humerus, and upon extension of joint it impinges against the humerus, causing some limitation of motion of elbow joint. Radius is curved outward in its lower third. The usual styloid prominence of ulna is not palpable. Lower end of ulna about one inch above wrist joint.

Roentgen Findings: Lack of development of ulna with union of lower epiphysis, probably as result of injury. Partial dislocation of elbow joint due to normal growth of radius resulting in curvature of radius, and projecting backward of head of radius.

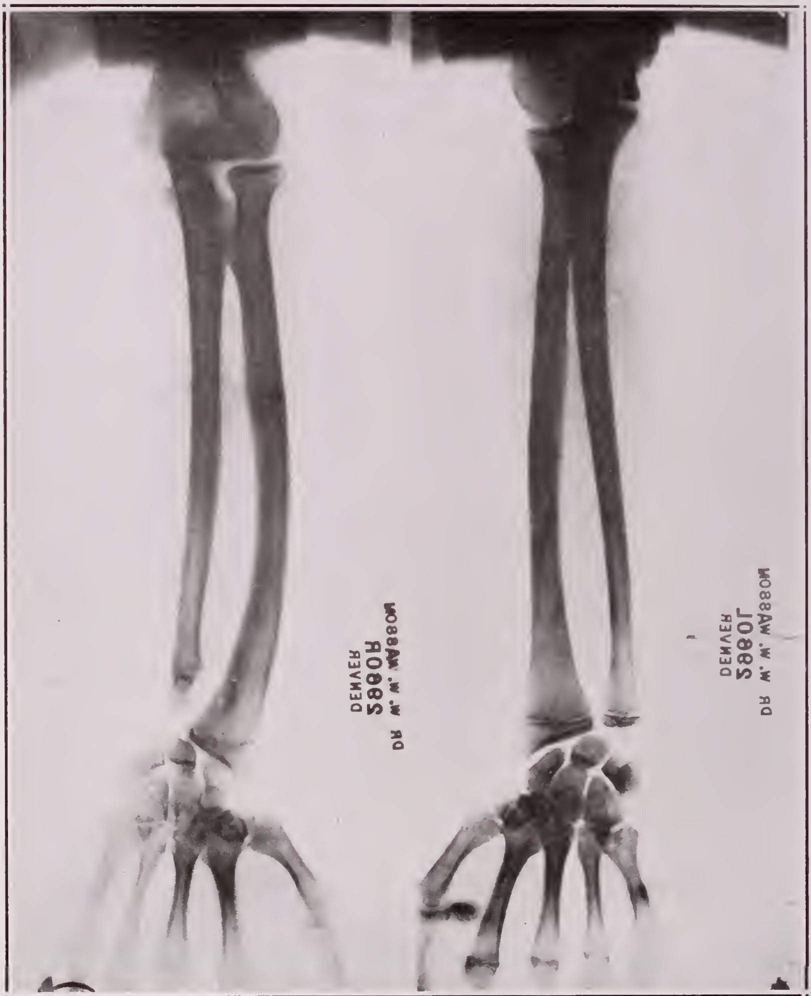
August 6, 1919

Operative Findings: Resection of an inch of radius in the lower third, with approximating the ends, and straightening radius. Replaced the head of radius and corrected partial dislocation of ulna.

Subsequent History: August, 1920, perfect use of elbow and no pain, slight amount of curvature of arm. Slight convexity on radial side.



This plate shows lateral view of each arm. The left normal. The right shows shortening of ulna, and partial dislocation of radius at elbow joint.



This plate shows anterior view of both. The right arm shows curvature of radius and shortening of ulna with union of lower epiphysis of ulna.

GASTRIC ULCER AND CANCER

Case of Each Reported

John W. Shuman, M. D., F. A. C. P.
Sioux City, Iowa

The two cases reported in this article clearly illustrate the diagnostic value of radiology. Both cases were operated upon and the operative findings substantiated the clinical diagnosis.

Case Number 1. Mr. P. H., age 70 years, of Alton, Iowa, was referred by Dr. W. G. Rowley, Sioux City, on September 27, 1919, complaining of "a burning sensation in the stomach". He gave the history of having had "an ulcer diagnosed and cured six years prior by a 'quack' M. D. in ten days' time".

Hunger-pain, food-ease, hyperacidity and hypersecretion were positive. Radiograms, of the stomach containing barium and buttermilk, at 30 minutes, 2½, 3½ and 4 hours in the prone position showed (see Fig. 1) a constant deformity of the lesser curvature, which was interpreted as a penetrating gastric ulcer. At 18½ hours the head of the meal was midway through the transverse colon and a "fleck" (crater of ulcer) in about the position of the lesser curvature of the stomach.

The conclusion was drawn that we were dealing with a penetrating ulcer of the lesser curvature of the stomach; but malignancy was considered on account of the age and appearance (mal-nutrition) of the patient and history of chronicity. Celiotomy was advised and performed October 22nd and "a perforating ulcer dime-size was found situated one-half distance between the pyloric and cardiac end of the stomach, on the lesser curvature of the stomach. The same was cauterized and excised and a posterior gastrostomy performed.'' January 15, 1920, this man had gained forty pounds and was feeling ''the best in years''.

Case Number 2. Mrs. M. E. G. of Lemon, S. D., very weak, age 72, was referred by Dr. W. G. Rowley, Sioux City, November 16, 1919, complaining of ''inability to keep food down'' and with the findings of ''a palpable freely movable mass in the upper abdomen. She had lost 35 pounds during the previous year.

Radiograms made immediately after the meal, at 30 minutes and at 3½ hours showed a marked ''filling defect'' in the pre-pyloric portion of the stomach (see Fig. 2). Celiotomy was advised and performed two days later and ''a turkey-egg sized mass, cauliflower in appearance, found inside of the stomach attached by a pedicle to the wall of the stomach on the lesser curvature''.

There were no peri-gastric adhesions or enlarged glands noted. The neoplasm was removed and a gastro-enterostomy made. This mass had evidently acted in a ball-valve like manner to occlude the pyloris. The patient died six days later.

The pathological diagnosis of the tumor by Dr. W. G. Rowley was adeno-carcinoma.

Frances Bldg.

FIGURE 1

FIGURE 2

Roentgenology of Tuberculous Enterocolitis. R. D. Carmen, M. D., Rochester. The Journal of the American Medical Association, May 15, 1920.

Although tuberculosis does not in every instance furnish evidence sufficiently definite to differentiate roentgenologically such conditions as caecal malignancy and other forms of ulceration, it does furnish definite, early pathology which can often be interpreted as probable tuberculosis, and this particularly in the presence of definite tuberculous lesions elsewhere in the body. As an intestinal lesion, tuberculosis is apt to be encountered as an ulcerative hyperthrophic or a nodular lesion, generally in the region of the caecum, the ascending colon, or the terminal portion of the ileum. Its pathology in this zone produces early lesions subject to successful radiographic investigation.

The roentgen findings are visualized as filling defects and irregularities or as the result of spasticity. The bowel may fill with constricted lumen or at times with definite gaps. Spasticity often manifests itself by the rapid disappearance of the barium shadow from the tuberculous area as soon as the flow of the enema is discontinued, even while the remainder of the colon remains filled. The usual barium meal by mouth may apparently jump the affected area, filling the bowel normally on either side but leaving the tuberculous zone without shadow. This phenomenon has been noted by other observers.

The technic of examination is based upon the usual routine barium meal by mouth or the barium enema. The author gives decided preference to the latter method.

Chas. G. Kerley, M. D. Roentgen-ray Demonstrations of Abnormalities of the Gastro-Intestinal Tract in Children. *American Journal of Diseases of Children*, 1920, Vol. 19, p. 227.

The study covers sixty-six cases, age three months to fifteen years.

1. The gastro-intestinal tract of the runabout child has

been given credit of being structurally normal and physicians have been content to examine stools, gastric contents, and urine. Roentgen ray studies show that recurrent periodic vomiting diagnosed as a manifestation of acidosis is due in many cases to a dilated ptosed stomach in which there is retention and residue long after the feeding period. These stomachs may never be empty.

2. Children who eat unwillingly may have a stomach of defective emptying capacity.

3. The stomach of a normal child empties in from four to five and one-half hours. A five-hour residue means slow emptying.

4. There is a relation between the emptying time of the stomach and intestinal stasis. Intestinal stasis retards the emptying of the stomach.

5. Children who were not ill have been studied to check these findings.

6. Ptsosed stomachs, ptsosed colons give symptoms.

7. Elongated sigmoids usually give no symptoms, but weak relaxed abdominal muscles and elongated sigmoids are strong predisposing factors.

8. Barium sulphate in fermented milk is used for colon injections. The opaque meal is Bismuth Subcarbonate in fermented milk. E. W. Rowe.

Dr. Edwin G. Davis, Omaha. Recurrent Calculi Associated with Calculus in Diverticulum and Controclure of Vesical Arifice. *Journal of Surgery, Gynecology and Obstetrics*, 1920, p. 503.

This article is a complete case report of a patient suffering from recurrent vesical calculi. The important and interesting points to the roentgenologist are connected with the value of the part played by the roentgen examination.

Roentgenograms of the bladder with and without sodium bromide used as an opaque media demonstrated the presence of a calculus in a diverticulum which was connected with the bladder. The calculus seen in the bladder by the cystoscope cast no shadow. E. W. Rowe.

A. S. Hyman. Radiography in Artificial Pneumo-peritoneum. *Medical Record,* 1918, Vol. XCVII, p. 100.

1. Oxygen used for the production of artificial peritoneum is often contaminated and to prevent this he advises the use of heat and petrolatum. He suggests a simple apparatus which can be improvised for filtering the oxygen through heated vaseline at 59° F. The temperature of the gas on introduction is 95–110° F. Low temperatures cause shock and collapse.

2. The normal abdominal pressure varies from 25 mm., minus, of water to 10 mm., plus, at end of inspiration. In the injection of gas he uses the pressure to determine the amount which is about 200 mm. of water. The amount of gas may vary from one liter to eight liters.

3. The indications for pneumo-peritoneum are: All obscure lesions involving the liver, spleen, kidneys, and uterus.

4. The opaque medium may be used but he has had no particular success with it and gas, in the peritoneum.

E. W. Rowe.

Wm. Pusey, M. D. Symposium on Carcinoma. Carcinoma from the Standpoint of the Dermatologist and *x*-Ray Treatment. *Intern Clinic,* 1920, Vol. IV, 28th Series, pp. 292–295.

Chronic irritation is the great cause of skin cancer. Exposure to the light and weather as people grow older seems to cause an increase in the frequency. Epithelioma is likely to develop on so-called pre-cancerous spots. Xeroderma pigmentosa is caused by light and may be produced by the roentgen ray.

Smoking and syphilis are not the greatest causes of skin cancer. Bad teeth and uncleanly mouth hygiene stand first. A review of his cases shows that they occur as frequently in non-smokers as in smokers. Irritation from syphilis, lupus, psoriasis and other chronic processes predispose.

Occurrence in moles is rare. The dark, blue black mole, situated down in the skin, is the dangerous one.

Carcinoma and sarcoma can be destroyed with the roentgen ray, the same as any other tissue. To destroy the carcinoma without injuring the patient is the problem. The normal tissue has a great resistance to the ray. Carcinoma tissue is less resistant than normal tissue. Any localized epithelioma on the skin can be destroyed, and the larger as well as the smaller can be better treated with the roentgen ray than any other method.

Carcinoma of the neck from lip or mouth has not been satisfactorily treated. Neither has it been satisfactorily treated by surgery. In carcinoma of the breast to prevent recurrence after removal he insists strongly on roentgen treatment. Cases are symptomatically cured and all are benefited.

Carcinoma of cavities of the body give him no hope from the roentgen ray. He believes no material good is done. Radium does good in cancer of the uterus. Carcinoma of the abdomen and lungs gives altogether no satisfaction.

E. W. Rowe.

R. D. Carman, M. D., Rochester. Roentgenology of Tuberculous Enter-Colitis. *Journal of the American Medical Association,* 1920, Vol. 74, No. 20.

Even when pulmonary tuberculosis is present the early clinical history is not sufficient for diagnosis. The roentgen ray furnishes the most satisfactory early evidence. The roentgen diagnosis is difficult. No pathognomonic signs are present. The ilio-caecal region is the portion of the bowel most often attacked. If pulmonary tuberculosis is present a lesion at this point is probably tuberculous. Necropsies show that seventy to ninety per cent of persons having advanced tuberculosis have tuberculosis of the intestines.

The pathology of tuberculosis of the intestines divides into three types: (1) Nodular, (2) ulcerative, and (3) fibrous. These types are self-explanatory but nodular tuberculosis of the intestines is not recognizable. The ulcerative type is evidenced by irregularity of bowel contour in the roentgenogram, in the terminal stage it produces obstructions. The fibrous type gives the same roentgen picture. It shows resistance on the part of the patient.

Usually the barium enema is given, occasionally the ingested meal, rarely the two combined. Roentgenoscopic and roentgenographic methods are used.

Roentgen signs of tuberculous colitis:

1. Filling defect.
2. Spastic phenomena.
3. Obstruction.

The caecum fills irregularly. The haustra are absent. The valve usually is incompetent. The invalve portion empties promptly all barium while the other may retain it. Spasticity rather than hypermotility is present and passes the barium along rapidly.

The filling defect is due to this spasticity. The filling defect and localized absence of barium shadow are not entirely due to tuberculous colitis. Carcinoma may occasionally produce the same symptoms. But if a definite tuberculous lesion can be definitely located in the lungs, the lesion in cecocolon is most likely tuberculous colitis.

The roentgen diagnosis of tuberculous enteritis is less certain than that of tuberculous enteritis due to difference in anatomical structure. Obstruction is not characteristic. Further study of the small bowel is necessary.

Summary

1. A lesion roentgenologically demonstrated in the iliocaecal coil with irregularity of bowel contour, and without the physiologic barium shadow in the cecocolon although it may represent any ulcerative process, is probably tuberculous if pulmonary tuberculosis is present.

2. The tuberculous lesion may be nodular, ulcerative or fibrous. They may be associated. The nodular is recognizable only if it encroaches on the lumen of the bowel, the ulcerative and fibrous types by irregularity of contour, and in the terminal stage of obstruction.

3. The presence of spasm is important and is diagnostic when the lesion is not demonstrable.

4. The opaque enema is preferable but the disease may be demonstrated by the enema. E. W. Rowe.

Announcement

THERE is a good deal of satisfaction for the officers of The Radiological Publishing Company as well as the editors of The Journal, in the fact that The Journal has been revived and will be issued regularly from now on.

The members of The Radiological Society entrusted us with a tremendous undertaking, when, at the annual meeting last December, they suggested the formation of a publishing company as a separate entity so that The Journal might be conducted on an absolute business basis.

Any one who has ever had any experience in publication work, readily appreciates the fact that to expect Dr. Allen to carry on the enormous responsibility of a publication of this kind single handed is beyond reason.

Realizing that The Journal had become a very vital thing to the members of the Society, it was the concensus of the meeting that as many as could subscribe financially to the publishing company do so in order to provide the necessary working capital to put The Journal over the hill.

It is no small task to establish a publication of this kind on a self-supporting basis, and, while the present organization has very great advantage in the work previously done, still there is very much left to be done. Those of the members who have not yet subscribed should do so at once in order that no shortage of funds may develop later that will act as an astringent on the proper and efficient administration of The Journal.

A word as to the publishing company: The Radiological Publishing Company is a Nebraska corporation. Its stock can only be purchased by members of the Society. The funds will be under the direct supervision and control of Dr. I. S. Trostler, of Chicago, treasurer, and Dr. A. F. Tyler, of Omaha, president. A Detailed monthly statement of business will be mailed to every stockholder at the close of each calendar month.

It is the desire of the Society that this publication succeed. Indeed, it is essential to the preservation of our individual and collective self-respect, purely aside from the professsional and intellectual benefits we shall all derive from a publication devoted to the scientific exposition of the functions and principles of Radiology, to see that The Journal merits the recognition it deserves as the official publication of the Society. That means every man must get behind The Journal financially, morally, physically and mentally. He must constitute himself an active agent for subscriptions and advertising.

A proposition of this magnitude and importance cannot be shifted to one or two men, however self-sacrificing they may be. This is *your* publication. The least you can do is to get behind The Journal and push

And the business end of The Journal is not all of the story. Copy must be prepared and forwarded in sufficient time to afford the editor an opportunity to plan each issue so as to give every reader the greatest possible benefit. Rome wasn't built in a day. Neither can The Journal be slapped together at the last minute by one man who finds himself confronted with the job of filling a lot of otherwise blank pages, and have it measure up to that high standard which The Radiological Society of North America has adopted and has a right to expect in keeping with its place in the professional cycle of humanitarian service. The columns are open to you. Indeed, they are yours to fill. Your membership signifies that you understand and appreciate your individual professional obligation. It becomes, then, strictly a personal question as to whether you will function and grow, or whether you will "let George do it" and drift into obsolescence.

The Journal will be published at Omaha All communications should be addressed to The Radiological Publishing Company at 511 City National Bank Building, Omaha.

A. F. TYLER,

President. The Radiological Publishing Co.

The Absorption of X-Rays by Various Media

F. K. Richtmyer, Ph. D.

Cornell University

FROM the standpoint of a clear understanding of the various phenomena connected with the x-ray region of the spectrum it is perhaps unfortunate that the application of x-rays in medicine and the laboratory study of x-rays had proceeded so far before we had knowledge of the real nature of an x-ray beam. Long before the work of Laue and Bragg, who showed that a beam of x-rays consists of a spectrum of various wave lengths in the same way that a beam of white light consists of a series of wave lengths extending from red to violet, you of the medical profession were applying x-rays in your everyday practice, and it was perfectly natural that both in the application of x-rays and in their laboratory study there should grow up a kind of "cut-and-try" terminology involving such terms as soft tubes, hard tubes, soft rays, hard rays, penetration, etc. However, in the light of more recent knowledge a careful laboratory study of x-rays reveals that practically every -ray phenomenon has its counterpart in a corresponding phenomenon in the visual region of a spectrum with which from every day observation we are fairly familiar. It is in part the purpose of this paper to emphasize the similarity of x-ray phenomenon and the optical phenomenon of the visual spectrum and yet to point out the differences. In short, I wish to emphasize the fact that whereas the laws of ordinary optical phenomena, such as light emission in characteristic spectra and absorption are so exceedingly complex, that we have been unable to formulate any general laws, the corresponding phenomena in x-rays are exceedingly simple.

If the light from an incandescent lamp be passed through a prism in conjunction with a suitable optical system there will, as you know, be thrown upon a screen a spectrum extending, so far as the eye is concerned, from the deep red through yellow, green and blue to the extreme violet. By means of a small apparatus called a diffraction grating we are able to ascertain that the wave length of the extreme red is of the order of .00007 cm; and of the extreme violet, .00004 cm. Such a spectrum we call a continuous spectrum. Its characteristics in the main do not depend upon the nature of the body which is emitting the light. A carbon filament at a given temperature will give very nearly the same *continuous* spectrum as a tungsten filament at the same temperature. Such spectra are in general characteristic of incandescent solids.

If, however, the light from, say, the Cooper-Hewitt mercury vapor lamp is passed through a similar optical system we shall see upon the screen not a continuous spectrum, but a line spectrum. There will be, for example, two yellow lines very close together, a very brilliant green line, a faint green line, a brilliant blue line, and two violet lines quite close together. Such a spectrum is characteristic of mercury.

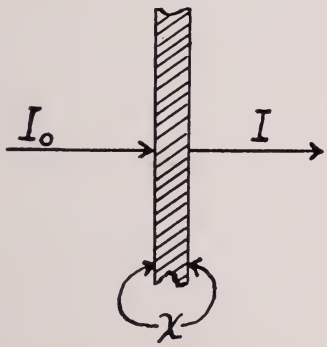
An entirely different spectrum, apparently showing no relation whatever to the mercury spectrum, would be obtained if light from a cadmium arc had been dispersed into a spectrum. In fact, each element has its own characteristic line spectrum, and in general there appears to be no known relation between the line spectrum of one substance and that of another. With these phenomena you are already familiar.

When we come to the x-ray region of the spectrum, the wave lengths of which are of the order of one ten-thousandth of the wave lengths of the visible region of the spectrum, we find these two kinds of spectrum. In short, a beam of x-ray from any target consists in general of a continuous spectrum not characteristic of the target at all, but depending only upon the voltage applied to the tube, upon which is superimposed a characteristic or line spectrum which does depend upon the nature of the target, i. e., the characteristic spectrum of a tungsten target differs from that of a molybdenum target.

But there is this difference between the x-ray characteristic spectrum and the characteristic spectrum of the elements in the visual region; whereas in the visual region there is perfect chaos when one considers the relation of the spectrum of one element to that of another there is perfect law and order in the x-ray region The characteristic x-ray spectra of the elements appear to differ from each other only as regards wave lengths. We recognize in the x-ray spectra of practically all the elements at least two series of lines known as the K series, which consists of four lines, and the L series, which consists of three groups of several lines each. The spectra of all elements appear to have the same number of lines. The only difference from one element to another being that the higher the atomic number of the element the shorter the wave length of its characteristic lines. So much for the similarities and yet the differences in the emission of x-rays and of ordinary light. When we come to consider the absorption of x-rays and of light we find a curiously similar parallelism.

In order to discuss intelligently this matter of absorption, either of x-rays or of light, it will be necessary to define the terms "absorption coefficient" and "mass absorption coefficient." Imagine a beam of light or of x-rays falling upon a layer of absorbing material the thickness of which is X.

FIG. 1.



Let Io represent the intensity of the incident energy and I the intensity of the emergent beam. (In the optical region of the spectrum we would measure these intensities by means of a photometer; in the x-ray region of the spectrum these intensities are correspondingly measured by what is known as an ionization chamber.) The coefficient of absorption, μ, can now be defined by the following equation.

$$\mu = \frac{\log_e \frac{Io}{I}}{X}$$

Or, put in words, the absorption coefficient may be defined as the logarithm to the natural base of the absorption ratio defined by the thickness. The *mass absorption coefficient,* which is frequently used in the discussion of x-ray absorption, is simply this coefficient μ divided by the density of the absorber usually expressed in gm./cc., i. e.

$$\text{mass absorption coefficient} = \frac{\mu}{\rho}$$

(For those who may wish a simpler, though much less usable, statement of the meaning of the term absorption coefficient the following may be given: Imagine that the layer of absorbing material is so thin that only a small fraction, say 1 or 2 per cent, of the incident energy is absorbed. Let this fraction be denoted by p. Then, so long as p is very small, say, .01 or .02 we may say approximately

$$\mu = \frac{p}{X}$$

It should be pointed out that this latter equation cannot be used for larger values of p than .01 or .02. But it will serve to give some information as to the thickness of a layer of material necessary to absorb, say, one per cent of the incident energy. Thus, the value of $\frac{\mu}{\rho}$ for aluminum at a wave length of .2Å, i. e., at a wave length of .000000002 cm., is approximately .25. Since P for aluminum is 2.65, the value of μ is about .66. A thickness of aluminum to absorb 1 per cent of x-ray energy of wave length .2Å can be found by this equation.

$$.66 = \frac{.01}{X}$$

from which $X = .015$ cm. i. e., at this particular wave length .015 cm. of aluminum will absorb one per cent. If, however, actual computations of the absorption are to be made for thicker layers of aluminum and of higher absorptions the log. formula above referred to must be used.)

If a solution of copper sulphate be held in front of an incandescent lamp it is well known that only the green and the blue in the spectrum of the incandescent lamp are transmitted, the yellow and red are absorbed. If, however, we hold in front of the incandescent lamp a solution of potassium bichloride the exact opposite is true, i. e., the blue and the green are absorbed, but the yellow and red are transmitted, and so far as we have been able to discover, there is no known relation between the absorption of potassium bichloride and of copper sulphate. Laws doubtless exist, but their complexity so far has defied discovery.

It is well known that carbon is a particularly opaque substance. Sulphur, likewise, is opaque, but if these two substances are combined in the atomic proportions of carbon disulphide a nearly colorless liquid results, transparent so far as visual observations go, to all wave lengths.

Fig. 2.

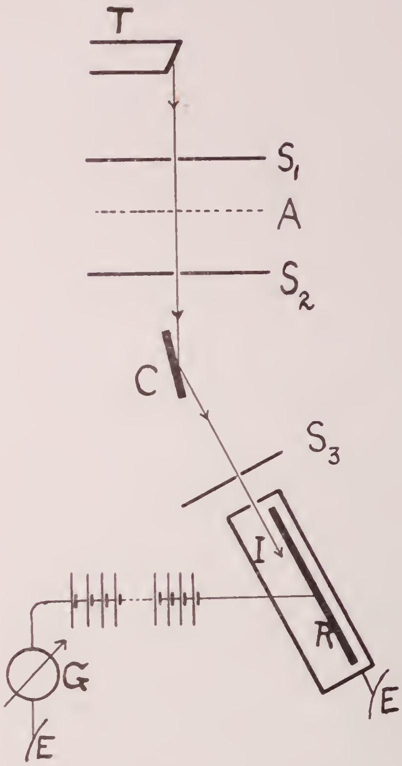
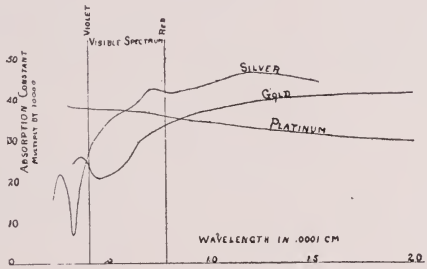


Fig. 2 will illustrate the complexity of the absorption laws in the visible region of the spectrum for the three elements, silver, gold and platinum. Although for ordinary purposes metals are considered opaque to ordinary light, yet by special means they can be prepared in films thin enough for absorption studies. The irregularity of the absorption of silver will be noted. It appears to be highly absorbent in the infra red region of the spectrum, its absorption decreases as one goes through the visible region from red to violet, which means that thin films of silver would be bluish, and in the ultra violet there is a very narrow region of high transparency. It would be extremely difficult, if not impossible, to attempt to express the absorption constant of silver as a function of wave length. The same thing is true of gold and of platinum. And a glance at the curves will show that there is no apparent relationship between the absorption of these three elements. It would be impossible, for example, from a knowledge of the absorption curve for gold to predict that of silver and of platinum.

The above examples illustrate the fact that absorption laws in the visible and near-visible regions of the spectrum are exceedingly complex. When, however, we come to the x-ray region of the spectrum, although the same logarithmic law of absorption holds, we find instead of the chaos characteristic of the visible region perfect law and order in regard to the absorption of any one substance at various x-ray wave lengths, in regard to the absorption of atomic combinations of two substances, and in regard to the relation of one substance to that of another.

It was the privilege of the writer to spend some months at the Research Laboratory of the General Electric Co. at Schenectady in making some careful measurements of the absorption coefficients in the x-ray region of the spectrum of a number of substances at various wave lengths. The apparatus used for this work is diagramatically illustrated in Figure 3.

Fig. 3.



T represents the target of the x-ray tube, S_1 and S_2 are narrow slits in lead screens placed in line with the target. C is a thin crystal of NaCl. S_3, a third slit placed immediately in front of an ionization chamber I. This consists of a hollow cylinder of brass covered with lead with an opening over which a thin sheet of mica was fastened by sealing wax, the whole chamber being filled with some highly absorbent vapor such as methly-bromide. An insulated metal rod R was raised to a potential of two or three hundred volts, the other end of the battery being connected through a sensitive current measuring device G (in this case a very sensitive gold leaf electroscope) to earth. The brass case of the ionization chamber is also connected to earth.

It is well known that if a beam of x-rays strikes a natural crystal such as NaCl at an angle θ a part

Fig. 4

of that beam of wave length λ, given by the following equation, will be reflected at the same angle θ.

$$N\lambda = 2d \sin \theta$$

In this equation d is what is known as the grating contents of the crystal. In the case of NaCl it is equal to the distance in cm between a Cl atom and its neighboring Na atoms. For NaCl this value of d is 2.814×10^{-8} cm. By turning the crystal C then at varying angles with respect to the incident beam it is possible to reflect into the ionization chamber any desired wave length. The crystal C and the ionization chamber I are mechanically connected in such a way that the chamber moves through twice the angle that the crystal does. The beam reflected from the crystal, therefore, always enters the chamber.

This beam of x-rays renders conducting the absorbing gas in the ionization chamber, the conducting power being greater the greater the intensity of the beam. It is obvious, then, that when the beam of x-rays is passing through the chamber the current measuring device G will register an electrical current. The magnitude of this current is taken as a measure of the magnitude of the x-ray beam.

This apparatus is patterned after the well known Bragg x-ray spectrometer. In order to measure absorption a layer of the material to be studied can be placed as shown by the dotted line A. Measurements of the current through the electroscope G are made respectively with and without the absorber in position A. This gives the quantities I and Io respectively referred to above. The thickness of the absorber is then measured and the coefficient of absorption determined from the logarithmic equation. This coefficient divided by the density of the substance gives the mass absorption coefficient which is plotted in all the curves hereafter referred to. It may be pointed out in passing that one of the serious difficulties encountered in this investigation was the accurate measurement of the thickness and density of the absorber. It was found, for example, extremely difficult to get homogeneous strips of such metals as molybdenum and silver thin enough for absorption work. The following curves will give quantitatively the absorption of several important substances in various regions of the spectrum and will also serve to illustrate the simplicity of x-ray absorption laws.

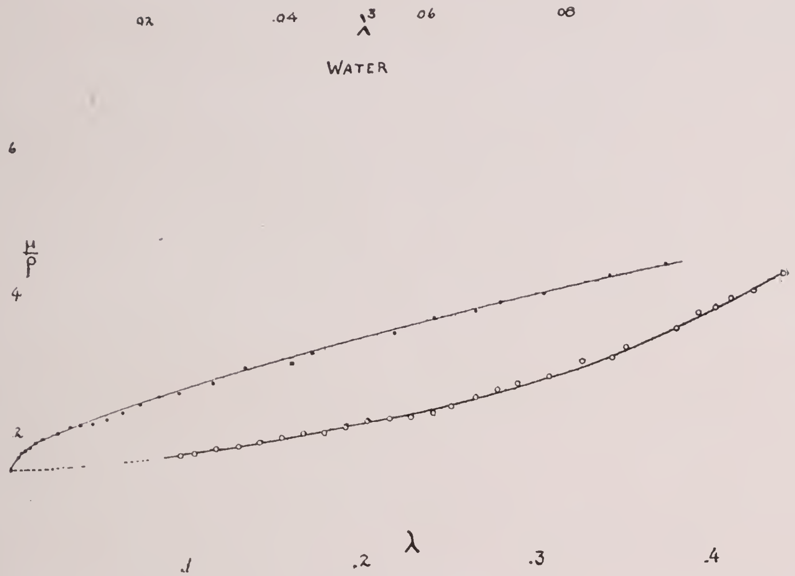


Fig. 5.

Fig. 5 (lower graph) shows the absorption curve for water from approximately .1Å to .45Å. In the first place it will be observed that this is a perfectly smooth curve, and if we were to follow it to still longer wave lengths it would follow the same regular curvature, the absorption getting greater and greater. It will also be observed that while there is some decrease in the absorption below .3Å this decrease is not much. It may be pointed out in passing in connection with the fact that there is comparatively little decrease in absorption below .2Å to .3Å there is little to be gained in the penetrating power of x-ray radiation by going to shorter wave lengths, i. e., to higher tube voltages or to lower equivalent spark gaps. A 10-inch spark gap, for example, filtered through several mm. of aluminum will give an equivalent radiation in the neighborhood of .2Å. Comparatively little in penetrating power would be gained by doubling the spark gap.

It may also be remarked in passing that whereas the value to which this absorption curve seems to approach as the wave length approaches zero is approximately $\frac{u}{\rho} = .16$, the value of $\frac{u}{\rho}$ for certain of the hard rays from radium C is .045. This means that the rays from radium C have a much higher penetrating power than any x-ray wave lengths that we have been able to produce. If we could follow this curve much lower than .1Å we might be able to observe the point at which it bends down to reach the absorption from these gamma waves from radium C the wave length of which is not definitely known, but is of the order of .001Å to .01Å. The last point on the curve, however, was obtained with the greatest difficulty at a voltage impressed on the tube of approximately 145 K. V. (peak value) and as will be observed, there is no apparent tendency for a downward bend in this curve toward the radium absorption value. To reach this latter value we should have to be able to apply several million volts to the tube, which is, of course, at present out of the question. It is to be doubted whether this value of $\frac{u}{\rho}$ for water would decrease materially in going down as far as .06Å, which would correspond to a voltage of something like 250-300 K. V.

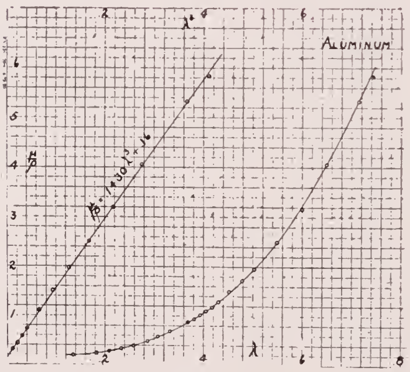


Fig. 6.

Fig 6 (lower curve) shows the absorption of aluminum up to .7Å. It will be noted first that this curve is smooth, of the same general shape as the absorption curve for water, but that the values of $\frac{u}{\rho}$ for corresponding wave lengths are larger for aluminum than for water. For example, at .4Å the value of $\frac{u}{\rho}$ for water is approximately .35, whereas the corresponding value for aluminum at .4Å is 1.05. The upper curve in Fig. 6 shows the result of plotting $\frac{u}{\rho}$ as a function of the cube of the wave length. The values of λ^3 are at the top of the figure. This graph is a straight line not going, however, quite through zero. We would express this fact by saying that "the mass absorption coefficient is a linear function of the cube of the wave length." The value of $\frac{u}{\rho}$ for aluminum at any wave length, at least up to approximately .8Å, can be found by substituting values of λ in the equation shown on this straight line graph, namely:

$$\frac{u}{\rho} = 14.30\,\lambda^3 + .16$$

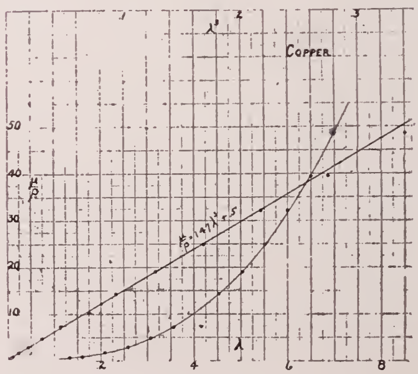


Fig. 7.

Fig. 7 shows the corresponding values of $\frac{u}{\rho}$ for copper. The ordinates scale it is to be noticed has been reduced very much in order to get the curve on the sheet. The value of the absorption coefficient .4Å is 10. It will be noticed that at least up to .7Å the curve between $\frac{u}{\rho}$ and λ^3 is nearly straight, and up to this wave length $\frac{u}{\rho}$ for copper can be computed approximately from the formula

$$\frac{u}{\rho} = 147\ \lambda^3 + .5$$

Copper, it will be remembered, has a much higher atomic weight than aluminum; or we may say, the atomic number of aluminum is 13 and that of copper is 29.

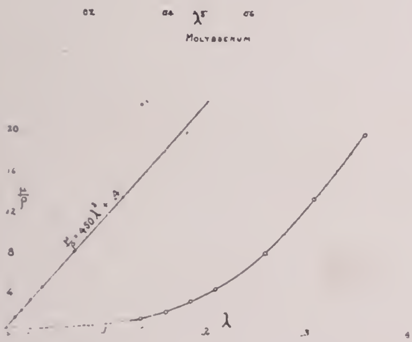


Fig 8.

Fig. 8 shows the absorption for molybdenum. Again it will be noted that the ordinates scale has been reduced and that the absorption of molybdenum is much greater than that of copper, although the two curves, the one where $\frac{u}{\rho}$ is plotted against wave length (lower curve) and the one where $\frac{u}{\rho}$ is plotted against λ^3 (upper curve), show the same characteristics as for copper. The value of $\frac{u}{\rho}$ for molybdenum at .4Å is not shown on this graph, but it is of the order of 35.0.

In order to show the absorption of molybdenum over a wider range of wave length Fig. 9 is shown.

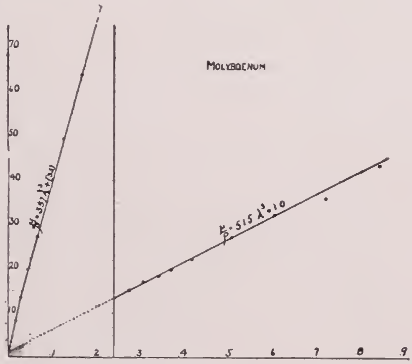


Fig. 9.

In this figure we have plotted the cube of the wave length against $\frac{u}{\rho}$. It will be remembered that as one passes along the wave length scale toward higher wave lengths the value of the absorption coefficient takes a sudden drop as one passes the region where the K series of lines begin. The vertical line shown on the λ^3 scale at about .24 represents the cube of the wave length of the shorter line in the K series of molybdenum. It is referred to in the literature as the *critical K absorption frequency*. On the short wave length side of this curve it will be noted that the same linear relation between $\frac{\mu}{\rho}$ and the cube of the wave length holds at least approximately (there is to be noted a bend in the curve at a value of $\frac{\mu}{\rho} = 13.5$). On the long wave length side of this critical absorption frequency we find that the values of $\frac{\mu}{\rho}$ are much less There has been a very sudden decrease in the absorption as one passes this critical limit. It is, however a matter of much theoretical interest to note that this graph for the longer wave lengths for which the equation

$$\frac{\mu}{\rho} = 51.5\ \lambda^3 + 1.0$$

has been determined when projected backward, cuts the axis of the absorption constant at apparently the same place as does the curve on the short wave length side.

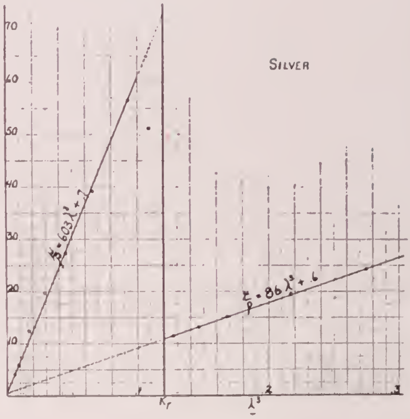


Fig. 10.

This critical absorption limit occurs at shorter and shorter wave lengths for substances of a higher atomic number. This is shown by comparing Fig. 9 with Fig. 10, for silver. It is to be observed that for silver the same phenomena occurs as for molybdenum The cube of the critical absorption frequency, however, for silver occurs at 122Å as against .24Å for molybdenum. The atomic number of silver is 47 and that of molybdenum 42.

Fig. 11 shows the absorption data for lead. The curve marked "Pb" (abscissa scale below) shows the coefficient of absorption of lead from about .160Å up to .6Å, and the straight line shows the values of $\frac{\mu}{\rho}$ plotted against the cube of the wave length (upper scale). Lead being a substance of very high atomic number, its characteristic K absorption occurs at .158. The values here shown, therefore, are entirely on the long wave length side of the characteristic absorption. Yet, as in the case of silver and of molybdenum, there is a linear relation between $\frac{\mu}{\rho}$ and λ^3 over at least a portion of this length. It may be noted in passing over this range up to the characteristic

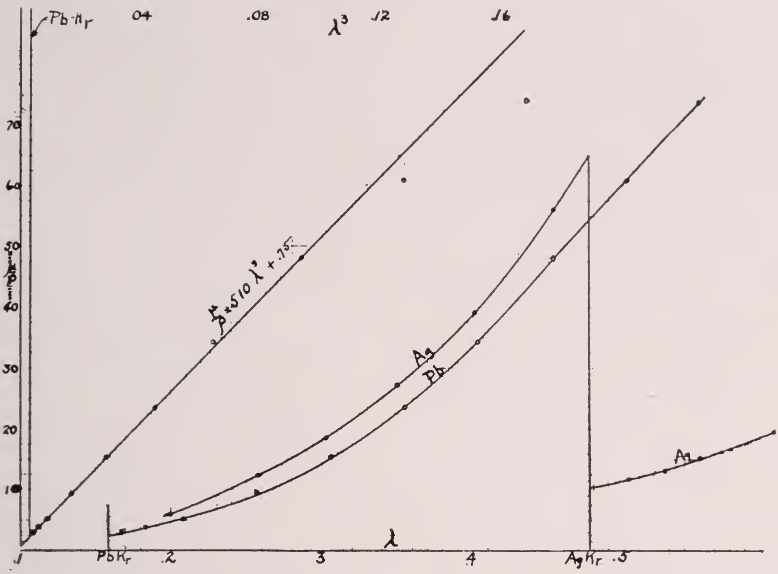


Fig. 11.

absorption of silver, which occurs at about .478, silver is a better absorber than lead. On reaching this latter wave length, however, as shown also in Fig. 10, the absorption of silver decreases very greatly, and beyond this point lead is the better absorber.

It is obvious, then, from an inspection of these curves that the absorption laws in the x-ray region of all the substances examined are very similar. And not only is this true, as, for any one substance, one states the absorption at various wave lengths, but it is also true as one goes from one substance to another. In referring, for example, to the linear relation between the absorption constant and the cube of the wave length the several equations have been written in the form

$$\frac{u}{\rho} = A\,\lambda^3 + B$$

The following table gives values of A for the several substances on the short wave length side of the K absorption limit.

Substance	Atomic Number	A
Al	13	14.45
Cu	29	147
Mo	42	450
Ag	47	603

If a curve be plotted between these values of A and the cube of the atomic number an approximately straight line results, showing that we can connect the absorption laws of any two substances by a single equation. In fact, we are now in a position to compute the mass absorption coefficients of all substances from Al to Ag, at least on the short wave length side of the K absorption limit from a single equation. This fact will serve to emphasize the simplicity of absorption laws in the x-ray region.

It is not the purpose of the presen writer to point out the application of these laws to the various phases of medical practice. It is, however, obvious that the question of absorption is one of fundamental importance in medical diagnosis and treatment. It is a fundamental proposition that it is only absorbed energy which can produce any physical effect, and unless the energy absorbed has a frequency which is reasonably close to some characteristic frequency in the substance under investigation the effect of absorbed energy will be approximately the same for any wave length. Body tissues are made up in general of elements of low atomic weight): carbon, oxygen and hydrogen, in various chemical combinations. The characteristic x-ray frequencies of these substances are at far longer wave lengths than are used in medical practice. The writer wishes to predict, therefore, that when a study is made of the physiological effect of x-rays on living tissue, as a function *of wave length,* it will be found that the specific effect of, say, .1Å will not differ materially if at all from the specific effect for .2Å. By specific effect is here meant for *the same actual energy absorption.* By knowing, therefore, the composition of body tissues and these absorption laws, it is possible at least to take one step in the computation of the amount of energy which will be absorbed by any tissue at any depth. It should be clearly pointed out, however, that this does not take account of the question of scattered radiation, a part of which is, of course, absorbed. Scattered radiation renders the problem somewhat more complex.

Much more data is needed on the phenomena of scattered radiation, perhaps upon the absorption of substances of lower atomic number, and certainly of the specific effect of various x-ray wave lengths on tissue. Where would photography be, for example, if nothing were known of the effect of different colors of the spectrum on the photographic plate? Data of this kind may be difficult to get, but once it is obtained it will clear up a great many difficulties in the same way that an accurate knowledge of the nature of x-rays has cleared up many puzzles in x-ray phenomena. At least in studies of this kind we need in all probability not worry about the chemical composition of the substances, for, unlike the case of absorption of energy in the visual part of the spectrum, chemical combination of an element does not change its ability to absorb x-rays. If we know the absorption of carbon and of sulphur separately we can compute with corresponding accuracy the absorption of CS_2.

It is to be hoped that in the future there will be a much closer collaboration between the physicist and the student of the application of x-rays to medical sciences than there has been in the past. The subject of x-rays from the physical side is probably too involved for the average medical investigator to completely master for efficient use in his research and it is certainly even more true that the reverse is the case with the physicist to attempt to master medical science. Further developments along this line must be by men representing each field, working in groups, each to supplement the other. It is the firm belief of the present writer that the large societies, such as the Radiological Society of North America, can do much to advance research along these lines.

Cornell University, December, '20

DISCUSSION

CHAIRMAN TYLER: We will now have this paper open for general discussion.

DOCTOR COOLIDGE: Mr. President, I should like to discuss the paper, but I would very much rather have Professor Richtmyer say a few words. It seems it might be helpful if he would put on the board just a rough outline sketch of the apparatus, so the men can see just how the points on these curves were obtained. It seems it might be helpful if he would illustrate so they would see the target of a tube and crystal, and how the rays come off, and how you pick up a particular wave length.

DOCTOR RICHTMYTR: I shall be glad to do so. Perhaps, in giving you a diagram of the apparatus, I might say just a word in regard to what is meant by the absorption constant.

Now, to those of you who remember your college algebra, shall I say, it is defined in this way. Suppose you have a slab of material through which a beam of x-rays or light or energy of any kind whatsoever is passing. The beam has a certain intensity before it strikes the slab of material, and it is reduced in intensity afterward.

We measure the intensity before it reaches the material and after it comes out, as shown in formula above.

DOCTOR COOLIDGE: I would like to call attention to one thing, how different that is from the sloppy method that has always been used, up to the time of Professor Richtmyer's work. Up to that time we had the x-ray tube up there, and we had the ionization chamber, and we had the different thicknesses of absorbers, but we had any mixture of x-rays, never twice alike.

It depended on a great many conditions, on the wave form of the circuit, and various other things, so that as people went ahead and measured the absorption coefficient of the rays up to this time, the thing had no meaning. It was useful for some purposes, but it had no clean-cut meaning.

You could not tell from your results what particular mixture of x-rays you had to give those results. You could fix up an infinite number of mixtures, all of which would give exactly the same result.

But now Professor Richtmyer, with these curves which he has shown us, has some clean-cut data on the transparency if you will, of different materials to x-rays of different kinds.

When I was in Germany recently, one of the German physicians, who was working in this field, was disappointed, indeed, to hear that Professor Richtmyer had done this work. The importance of it had been recognized there, but it had not been done. It is absolutely fundamental work. If we knew the wave form of the high tension current voltage that we are using on tubes, with the different types of apparatus, which are used, it would be possible, from Professor Richtmyer's data, to calculate everything there is in regard to absorption and scattering of radiations in the tissues of the body. There would be no need of further experimental work.

As a matter of fact, we lack sufficient data, at the minute, perhaps, on wave forms with the various machines you are using for that to be completely carried through, but you can make a great many useful applications of Professor Richtmyer's data today.

For example, if you admit certain things—I won't go into it too deeply, because I want to say a few words about it in my talk later—but if you admit certain things in connection with therapy, then you can say from Professor Richtmyer's data there is no use at all in trying to get rays more penetrating than to a certain point, because you can see from this data, that in the case of water, the tissue is going to be pretty nearly the same density. Of course, that the factor that causes the reduction in intensity of the x-ray beam as it penetrates the tissues is not absorption in the ordinary sense, but it is scattering, and his data shows you that scattering over a very wide range of penetrating powers of wave length is independent of the wave length. So after you get up to a certain penetrating power, there is no use at all in going further in that direction, so far as trying to increase, for example, in other language, trying to increase the ratio of depth dose to skin dose, because after you get to that point, the thing that causes the diminution of intensity is scattering, and you don't help that by going to more penetrating radiations.

I don't want to take too much time. I would much rather hear Professor Richtmyer.

MR. MORRISON: I have only just a question to ask. The absorption, you found, was proportional to the cube of the wave length. I did not get a chance to see that.

DOCTOR RICHTMYER: I shall not say "proportional to", but a "linear function of", which is a different thing.

Here is absorption, and here is wave length. If it is proportional to the cube of the wave length, it would start out at this point, which is not true. It starts out here.

MR. MORRISON: That is a constant?

DOCTOR RICHTMYER: The cube of the wave length multiplied by some constant, with this added, gives you the absorption.

CHAIRMAN TYLER: Is there any further discussion?

DOCTOR RICHTMYER: Thank you, Mr. Chairman. I might add just one more thing. Again, from a physical standpoint, it is only absorbed energy which can produce a physical or a physiological effect. You know that from your actual experience with the optical spectrum. If you put out two beakers in the sunshine, one clear water, and one with India ink, the one with India ink in the water will warm more rapidly, because it absorbs more rapidly.

So from this data we can get some notion of the amount of the absorbed energy, and it is only the absorbed part of the energy that can possibly produce a physical or a physiological or a chemical effect. (Applause)

Roentgenographic Diagnosis of a Three Months Pregnancy

F. H. Kuegle, M. D., Sioux City, Iowa.

THE clinical signs and symptoms of pregnancy are, as a rule, so clear cut that the obstetrician has no difficulty in establishing a diagnosis by the end of the third month of gestation. There is, however an occasional case in which the physical findings leave the examiner in considerable doubt so that no definite conclusion can be reached. This is particularly true in young and vigorous primiparae in whom there is no relaxation or softening of the generative organs and in whom vaginismus is excited by examination.

The writer was recently called upon to make an x-ray examination of such a case with a view of definitely reaching a diagnosis. This was done with considerable misgivings, since no report in the literature of a successful, roentgenographic diagnosis of a three-

months pregnancy could be recalled.

In this case, the history is so clear that there is little doubt that the pregnancy is under three months. This is borne out by the size and shape of the fetal shadow on the roentgenogram and by the fact that it lies low in the true pelvis. It is in the upright posture, measures $2\frac{3}{4}$ inches vertically and $1\frac{1}{2}$ inches transversely. The two femora are clearly shown, as are also the umbilical cord and the placental attachment.

The technic of the exposure was as follows. A duplitized film, double screen and 30 MA. radiator type, Coolidge tube were used. The tube was energized with 25 MA. current at a voltage of 42,000, which necessitated a relatively long exposure. By following this technic, the writer believes that there should be no difficulty in showing a three months' pregnancy in a high percentage of cases.

What Say?

A man by the name of Sprague wrote a beautiful story in a recent issue of the Saturday Evening Post in which he had a whole lot to say about the "stand-off system" in big business—from the angle of too many office boys and secretarial artists.

But he missed the big story—one that has all the merits of truth as well as the freedom of fiction. The fact is, business pretty generally has been on a "stand-off" basis for quite some time. And it seems yet to be a case of who can stand the other fellow off longer.

Any practicing physician or surgeon will testify to these facts.

The Importance of the Correlation by the Roentgenologist of the Clinical and Roentgen Ray Findings in Pathological Conditions.

Samuel B. Childs, m. d., Denver, Colo.

IT MAY seem superfluous to state that in a very large number of the cases referred to the roentgenologist, accurate and reliable information can be furnished from the x-ray evidence alone. This class of cases does not engage our attention in this paper. In the obscure or doubtful cases, however, the writer has found that the evidence obtained from the personal examination and the clinical history of the patient frequently adds materially to the ability of the roentgenologist to correctly interpret the x-ray findings.

It is taken for granted that all cases are referred to the roentgenologist solely for the benefit of the patient and for the greatest assistance that can be rendered in making an accurate diagnosis. On this hypothesis the title of this paper is based and any deductions from the paper apply especially to those roentgenologists who do not limit their x-ray diagnosis to some particular field.

Let us for a moment consider the status of the roentgenologist at the present time. Are there not some who attempt to make a diagnosis in all pathological conditions from the x-ray evidence alone? If their opinion is substantiated by conclusive proof their skill in interpretation is enviable, but the writer never expects to reach that degree of efficiency, for his observation is that the more closely the roentgenologist traces his findings to the operating table, the more he is convinced that several conditions can produce x-ray evidence so similar, that in one case, a certain disease is demonstrated, while in another, apparently the same x-ray condition is detected, but a different lesion is found to produce it. This applies not only to the diagnosis of certain pathological conditions in the softer structures of the body, but also in the denser, for some forms of bone disease are extremely difficult to differentiate from the x-ray evidence alone. If these observations are correct we need additional data not furnished by the x-ray to aid us in obtaining greater accuracy in diagnosis.

We are also aware that there is a comparatively small number of practitioners who presume to make their own deductions from the plates made by a roentgenologist not employed by them as an assistant. This admits of two inferences, either the roentgenologist is considered incapable of correctly interpreting the x-ray evidence or else the physician or surgeon by the aid of his knowledge of the clinical findings in the case feels more competent to make a correct diagnosis by correlating the combined evidence. In either case, the roentgenologist is at fault by his failure to qualify himself so that he can make a more accurate diagnosis in a given number of cases than any physician or surgeon who devotes only a comparatively small part of his time to the study of x-ray data. By his failure o qualify himself, the roentgenologist is considered a laboratory assistant.

Is it not true that some of us are subject to just criticism in many instances for attempting to read too much into our plates? Do we devote sufficient time and study to anatomy, clinical medicine and clinical surgery? Should not the experience we have acquired in these lines give us a more comprehensive view of the problem in obscure clinical pathology before we attempt their diagnosis by the x-ray alone? Do we realize the great responsibility assumed by the roentgenologist in diagnosis and do we thoroughly equip ourselves by adequate preparation to meet this responsibility? If so, then only can we expect to have the judgment necessary for correct interpretation, which will entitle us to be considered as diagnosticians or consultants and not laboratory assistants. In presenting a subject such as indicated by the title of this paper, the writer asks your indulgence for any personal allusions as it is believed that the citation of a few cases will illustrate the thoughts intended to be conveyed better than any other means.

Case I. A few years ago a patient was sent from an eastern city for tuberculosis of the lungs; this diagnosis was made following an x-ray examination of the chest. The case was referred to the writer and upon the chest plate, in the right lung just below the hilus in the line of the descending bronchus, was a dense circumscribed shadow not unlike that so frequently found in calcified tuberculous nodules in this area, except for its unusual shape. There were also changes in the base of this lung which simulated the appearance of tuberculosis. The patient's history disclosed the fact that a number of her teeth had been removed under a general anaesthetic some time prior to her being sent to Colorado, and that upon regaining consciousness there was a cough which had persisted and been her main symptom. No cough was present prior to the operation described. With this history the dense nodule was readily identified as a molar tooth and the changes noted at the base were considered secondary to the presence of the foreign body. The tooth was subsequently removed and the patient speedily regained her health. The error in the original diagnosis was evidently due to the failure to obtain the clinical history.

Case II. A man thirty years of age was referred from a distant town in Colorado. He brought a note from his physician, stating that carcinoma of the stomach was suspected. The patient presented a marked cachexia, experienced great difficulty in retaining any kind of food, had lost about thirty pounds in weight, and was easily exhausted. Our examination failed to disclose any organic disease of the gastro-intestinal tract and pernicious anemia was suspected by exclusion. It was suggested that the patient be referred to a laboratory man for a blood examination. This was consented to and the typical picture of the disease suspected was found. In this case, the diagnosis was made from the correlation of the clinical and laboratory evidence and the negative x-ray findings.

In the gastro-intestinal examinations of people past middle life, the writer has been impressed with the fact that various abdominal symptoms are alleged that simulate closely those present in an organic lesion of the viscera and yet not sufficient evidence is found at the x-ray examination to warrant the existence of those symptoms. There is evidently an organic basis for the symptoms as the situation always seems serious to the patient. We have also noted that the x-ray evidence disclosed either cardio vascular disease or else a high blood pressure record was found, generally with evidence of cardiac insufficiency. No attempt is made to give an accurate explanation of the abdominal symptoms in these cases, but a plausible one seems to be that certain pathological changes in the heart and aorta produce symptoms which are referred to the gastro-intestinal tract due to the fact that the nerve supply of of each is derived from the same trunk of the sympathetic system or possibly these symptoms are caused by an atheromatous condition of some of the arteries within the abdominal cavity.

Case III. A man of fifty-eight years of age was referred with a probable diagnosis of gastric ulcer. He had many of the typical symptoms of this disease, was extremely weak, prostrated and short of breath, but nothing from our examination was found to indicate disease of the stomach, or furnish evidence of any disease of the alimentary tract. The heart and aortic shadows showed evidence of cardio vascular changes, although the heart shadow was only moderately enlarged. From the correlation of the clinical symptoms, mainly shortness of breath and prostration, the x-ray evidence from the heart and aorta, an opinion was given the attending physician that the stomach symptoms were probably due to cardio vascular disease. At the time of our examination the apex of the heart was just outside the nipple line. Subsequently I was informed that in a few days the apex beat was still more to the left of the nipple and the area of heart dullness was considerably increased. In about two weeks this area had markedly increased and the patient died from cardiac dilatation.

A correlation of all the evidence at our disposal is considered particularly advisable in a case that has received an injury, while in the employ of a corporation or an individual, for the question of compensation for damages is always to be considered a possibility and fairness to both sides frequently demands that our opinion be based upon such correlation. The following case is a good example.

Case IV. A young man who had been in the employ of a railroad for a few days alleged that while engaged in construction work, he had slipped and fallen, doubling his left knee under him, and as a result, had sustained a disabling injury. When he was brought to the hospital two days after the injury, adhesive strips covered the greater part of the joint and over these was a bandage. After the dressings were removed some swelling was apparent about the joint but the general appearance of the knee did not indicate the probability that severe traumatism had produced the symptoms of pain, local tenderness and inability to use the joint of which the patient complained. The x-ray demonstrated that the patella was dislocated to the outer side of the external condyle, but the amount of distention of the joint generally found in a recent traumatic dislocation was not detected. By correlating all the evidence, despite the alleged symptoms, an opinion was given that although the patella was dislocated, it was believed that this dislocation was not caused by his injury. When the patient was informed that the disability in his knee was not due to his recent accident, he admitted that he had been able for quite a time, frequently, to displace this patella at will, and that he could also, occasionally, do the same with the patella in his other knee. Furthermore, he stated that he, with the aid of a young man about his own age, who had had some experience in the army in applying surgical dressings, had applied the adhesive strips and the bandage. He was discharged from the hospital and immediately returned to work.

In this connection it is well to call your attention to a condition which has often confronted all of us, namely, the examination of a laborer who has previously sustained an injury to the spine or some joint like the hip, in which are demonstrated bone changes, ordinarily considered typical of osteo-arthritis. Let me call to your notice the changes in the bony structure, particularly noticeable in certain parts of the body, due to pressure from occupation which are purely physiological or certain senile changes that take place in joints without actual disease in the joints as a starting point. This subject was comprehensively covered by Mr. W. Arbuthnot Lane in articles which were published in the Transactions of the Pathological Society of London in 1886, and in Guy's Hospital reports of the same year. Referring to the bone changes in patients under the above classes, Mr. Lane states "All these changes have been regarded as the products of the disease rheumatoid arthritis. I think I have brought sufficient evidence to show that they are the results of the transmission of pressure."

From the x-ray examination it is considered difficult, if not impossible, to differentiate these bone changes due to pressure from traumatic or pathological osteo-arthritis, so similar if not identical is the appearance. Hence in these conditions it is extremely important to obtain all the information possible about the presence of any bone changes in joints other than those in question, as well as the clinical history and previous occupation of the patient before we ascribe such changes to traumatism. The medico-legal question of the effect of traumatism upon these pressure changes above referred to is an entirely different matter.

The writer could cite cases not only in illustration of the type above referred to but also of many other conditions of the body, in which valuable assistance has been rendered in the interpretation of our findings by correlating other evidence, but time does not permit.

My conclusions are stated in two sentences:

Accuracy in the diagnosis of obscure pathological lesions demands the correlation of clinical and x-ray evidence.

The sooner the roentgenologist realizes this the sooner will he attain his proper standing as a consultant.

Speaking of Education

TALKING about headlocks, strangle holds and scissors—judging from newspaper accounts, the midwest farmer would like to know in what banks Lewis and Stecher got their training.

Watch "The Journal"—It Leads!

X-Ray Treatment of Leukaemia

G. E. Richards, M. D.

Associate in Radiology, University of Toronto.
Director of Department of Radiology, Toronto General Hospital.

THE chief object in view in bringing forward this subject at the present time is the conviction that roentgenologists generally do not take a strong enough position regarding the value of roentgen therapy in luekæmia, and secondly, because of the fact that one finds the profession at large either ignorant of, or at least not convinced of the fact that in roentgen-ray therapy and radium, we possess by far the most successful therapeutic procedure so far advanced for the treatment of this disease.

The general opinion seems to be that a diagnosis of leukæmia is tantamount to a death sentence within one or two years, and since nothing can be done, the patient is given a prescription containing arsenic, and advised to put his affairs rapidly in order.

While I am forced to admit that our best efforts have so far failed to alter the essentially fatal nature of the disease, and to agree that in consequence the treatment of such cases is depressing, yet there is the other side of the picture, namely, the fact that we can restore many of these people to a relatively normal state of health for long periods, and by careful management preserve for them a number of years of comparative comfort. These results we are all familiar with, but have we sufficiently emphasized to the profession just how far superior the results may be to other forms of treatment?

The treatment of the disease really resolves itself into a rather rigid management of the patient's life, and in our experience of twenty-two recent cases, several facts have so forcibly impressed themselves upon me that I thought it might be of value to bring them up for discussion.

In treating the group of cases here reported, we have made an effort to solve the problem of correct technique by reasoning from two of the commonly accepted theories as to the etiology of the disease.

It is admitted that until we have more definite information as to the cause or causes, much or all of our work must be empirical as in the past. But two fairly definite lines of thought present themselves as a present guide, and in my belief these involve entirely different conclusions, and modes of treatment. This is written also with an intimate knowledge of the excellent writings of Pancoast and others, and more in the hope of assisting in arriving at some recognized standard procedure than in the belief that anything very new or original is being added to the literature.

ETIOLOGY

(1) In the first case the disease has been compared to sarcoma, and thought to be essentially a malignant manifestation of the blood and blood-forming organs.

If we adopt this view our treatment must take the form of intensive irradiation using a high spark-gap, heavy filtrations, etc.

(2) The second view would regard the process as primarily and essentially a hyperplasia of the spleen and bone-marrow, not in itself malignant though productive of changes incompatible with life. The fact of the hyperplasia of course we know to be present in both instances, but its significance is considerably altered in the two theories.

We therefore, decided several years ago to try out the two theories, basing our technique upon these two conceptions, and although the series of cases is too small to justify a generalization, we have obtained so much better results from following the second line of reasoning, as to lead to the belief that it is more than coincidence.

We believe that we may logically draw an anology between our therapy in disease of the thyroid and the present case. In the thyroid our best results are obtained in the active hyperplasias with great toxicity. And here we select a ray, the purpose of which is to depress the activity of the cell, and inhibit cell division, and so cause a return to normal function. The analogy may be pursued in Hodgkin's disease, except that in the latter it seems probable that we are confronted with at least two distinct types of the disease, depending upon certain biologic differences in the lymphoid tissue, not as yet adequately described. Of these, one will respond to irradiation, and the other is almost entirely unaffected. This very observation, if it is an accurate one, leads too far for the purpose of the present paper, but may account for failures in certain forms of leukæmia associated with extensive involvement of lymphoid tissues generally.

The whole point in the argument is simply this: Our results would lead us to the conclusion that better results are to be obtained by a technique designed to depress the function of cells which are in a condition of hyperplasia than by one designed for the destruction of cells. The use of terrific irradiation with high spark-gap and heavy filtration will result in extreme fibrosis of the spleen, and other changes of a permanent and disadvantageous nature in the medulla of bones, and will not give as good ultimate results as a less severe procedure.

What then may be regarded as the procedure from which we may expect the maximum of results in the average case?

After very careful study of all the available literature upon the subject, and in view of our own experience, we have adopted the following as a routine, which is modified slightly to suit individual cases, but which is adhered to fairly closely nevertheless.

The irradiation is commenced upon the spleen using areas four inches square, and limiting the treatment to one area each day.

This serves a double purpose—

(1) It almost entirely eliminates the danger of nausea and depression due to the treatment, and,

(2) It brings the patient gradually under the influence of the ray and the altered conditions resulting therefrom.

The treatments are continued over the splenic area daily until sufficient have been given to entirely cover it according to the usual method of deep therapy The long bones are then exposed in rotation, still adhering to one area of the same size each day.

The other factors we believe to be of great importance. The spark-gap is six inches or possibly seven inches,—never more. Filtration is 2 mm. of aluminum, and through this we deliver 25 milliampere minutes at 10 inches distance.

The result is that the patient receives such an exposure each day for about two weeks, and receives a constant effect, both local and constitutional during the whole of that time.

A blood count is made at the end of two weeks from the date of the last treatment, and upon that basis the necessity of further treatment is determined. If the count has been considerably reduced, but is not normal, the same series is repeated in exactly the same order. And this is continued until the white count reaches ten or twelve thousand, when all treatment is discontinued for the time. Blood counts are continued every two weeks until the count begins to rise, and the entire series is then again repeated, even though the elevation in the count had been slight. In the average case, which is not extreme or far advanced, three such series have been sufficient to stabilize the blood picture at a point which could be said to be normal for leukæmia.

As soon as the blood appears to be stationary, the interval between blood counts may be increased to one month, but *these should be insisted upon at monthly intervals during the remainder of that patient's life.*

This is one of the two outstanding lessons which have been impressed by the present series of cases. Of nine cases treated by the above routine, six are still alive after three years, and of these four have practically normal blood pictures, and the spleen is not palpable in any of them. The three who died all departed from the routine in some particular. In one of these the patient's husband had influenza, during which she nursed him for two months, and then took an additional month's holiday. At the end of that time her blood count was up, myelocytes which had been absent had reappeared, and the spleen was again enlarged, extending down about two inches below the costal margin.

Another patient whose blood seemed stationary, went away for the summer, and remained three months. When he returned the spleen had again enlarged, and the count was up with very active cell changes.

The second point I emphasize, naturally follows the first. If the spleen has been enlarged, and has receded behind the costal margin so as to be nonpalpable, and is then allowed to enlarge, the chance of it again responding to radiation is very slight. In one or two cases I have seen it do so, but in the majority it becomes hard, fibosed, refuses to respond to further treatment, and this may be accepted as a condition which is certainly hopeless. It is, therefore, our duty to so carefully guard our patient that the spleen once having disappeared shall remain there. And this is only done by frequent blood examinations. By doing so I am convinced we can prolong the lives of our patients much longer than has been possible in the past or is possible at present by any other method of treatment.

Similar results are no doubt obtainable by radium, but it is easier to make the application over the larger area by means of x-rays. In addition to this, the majority of the cases one sees treated by radium have palpable spleens, which are already fibrous and hard. This I believe may be prevented by less intensive x-ray dosage, and its prevention is a very great consideration.

As to the use of arsenical preparations, we have thought there was a better response in those cases in whom arsenic was present in the blood at the time the treatment was being given, and have continued it accordingly. Benzol has not been used in any of the present series of cases.

Injection of the Sphenoid Sinuses With a Suspension of Barium Sulphate

MAXIMILIAN J. HUBENY, M. D., CHICAGO, ILL.

THE roentgen method of examination has been utilized to a very extensive degree in several important fields such as urology, gastro-enterology, and pulmonary diagnosis, by ingestion or injection of opaque substances. Necessarily the anatomical or pathological conditions make such a procedure possible.

Figures I. to X., inclusive, represent different views of same patient, in which a unilateral injection was made.

Fig. I.—Case No. 19388—Lateral radiogram before injection.

Fig. II.—Lateral radiogram after injection.

Through the kind co-operation of Dr. John A. Cavanaugh, the examination of the sphenoid sinuses was undertaken for the purpose of showing their size, shape and position, also if possible to

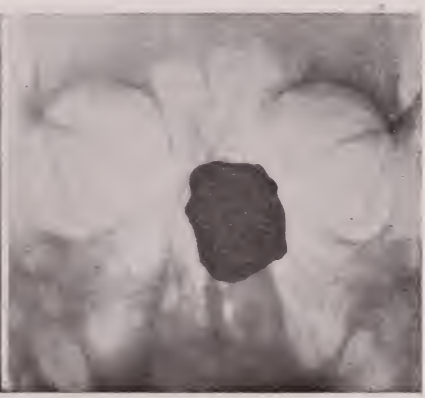


Fig. III.—Case No. 19388—Posterio-anterior radiogram before injection.

Fig. IV.—Postero-anterior radiogram after injection.

note the proximity of adjoining structures and determine the cause of neighborhood symptoms.

The sphenoid sinuses occupy the body of the sphenoid bone, being situated directly behind the ethmoid capsule at the posterior and superior portion of the nasal cavities. In the fully developed stage the sphenoid sinus represents a cavity which may be regular, irregular, large or small, depending upon the amount of re-absorption of spongy bone which has occurred. The sinuses are separated from one another by a septum, which, like that of the frontal sinuses, may be considered as a continuation of the nasal septum. Along the anterior attachment

Fig. V.—Case No. 19388—Right oblique position before injection.

Fig. VI.—Right oblique position after injection.

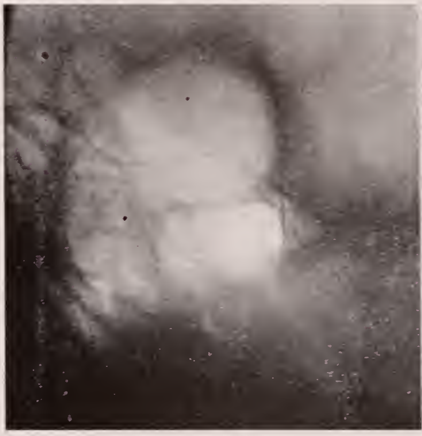


Fig. VII.—Case No. 19388—Left oblique position before injection.

Fig. VIII.—Left oblique position after injection.

this septum is usually in the median line, but as it extends backward, it frequently deviates to one side, thus making one side larger than its fellow. Complete absence of this partition, throwing both sinuses into one large cavity with a single ostium, has also been observed.

(1) deviations of an inter-sinus septum, (2) over-reabsorption, causing unnatural enlargement of the cavity and prolongations, (3) over-extension of the posterior ethmoidal cells.

Under deviations of the septum we have inequalities in the size and shape of the two sinuses. This

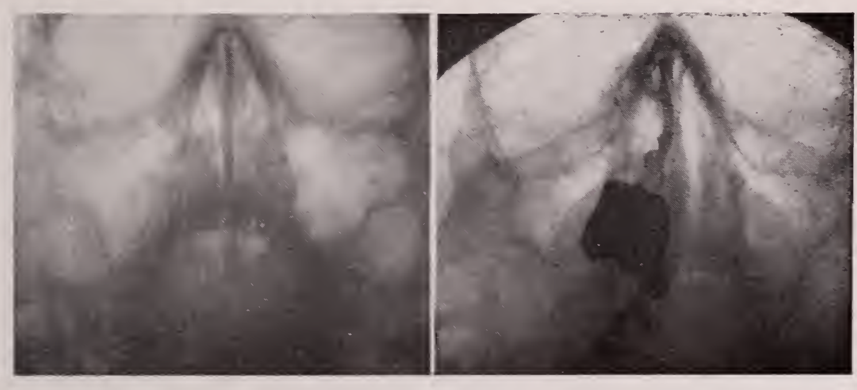


Fig. IX.—Case No. 19388—Water's position before injection.

Fig. X.—Water's position after injection.

The ostium of the sinus is situated in the nasal portion of the wall, usually in the upper third and seldom below the median line. Whether it lies close to the nasal septum appears to depend largely upon the depth of the spheno-ethmoidal recess, as the deeper the recess the further away from the median line it seems to find its location. The position of the ostium in relation to the sinus floor is similar to that found with the maxillary, namely, in a very unfavorable position for drainage.

There are many peculiar cell formations and anomalies exhibited by the development of the sphenoid. These may be due to

may be slight and confined to the posterior portion or be so great as to practically throw both sinuses into one large cavity, with a small cell representing the other sinus, in the anterior portion. Ordinarily the curvature is in the antero-posterior direction, but it sometimes also takes on a lateral deviation, thus placing one sinus in relation to the sella turcica, both the cavernous sinuses and both the optic nerves. Incomplete septa are frequently formed on the posterior sinus wall. These sometimes are so large as to lead one to think of a triple sinus.

Over-reabsorption often causes the sinus to be prolonged in various directions (a) into the lesser wings and clinoid processes, (b) into the antero-inferior angle; (c) into the pterygoid processes.

When re-absorption extends into the lesser wings and clinoid processes, the sinus encroaches upon the optic nerve, often to such an extent that the nerve comes to lie almost within the sinus cavity The importance of this anatomical configuration cannot be over estimated, especially in connection with ophthalmic complications resulting from infection of the sinus mucosa.

When the sinus extends into the antero-inferior angle, the maxillary sinus is in direct relation with the sphenoid, only a thin partition of bone separating the two cavities.

This formation is rare, but when present is particularly favorable for operation on the sphenoid via the maxillary sinus route.

Re-absorption into the pterygoid processes causes circumscribed depression to be formed in the floor of the sinus, thereby favoring stagnation and poor lavage in case of suppuration.

Fig. XI.—Case No. 19401—Postero-anterior radiogram with left sphenoid injected.

Over-extension of the posterior ethmoidal cell. Occasionally the sphenoid sinus is poorly developed; a posterior ethmoidal cell pushing it downward and backward and occupying the place where the sphenoid is normally situated, thereby forming a spheno-ethmoidal cell. Under these circumstances the posterior ethmoid cell is then in relation to the optic chiasm and pituitary body. Not infrequently this cell is in relation to the splenoid sinus of the opposite side, and if diseased, it could easily communicate the infection to this cavity.

Fig. XII.—Case No. 19401—Left oblique position after injection of left sphenoid.

From the above, it will readily be appreciated that the sphenoidal sinuses are difficult to portray with a fair degree of certainty, even though a comprehensive x-ray study is made. It is not intimated that the following should be used as a routine diagnostic measure, but in cases where the symptoms are obscure, or treatment unresponsive or if the sinus is suspected of being in close relationship to the surrounding structure.

Not enough cases have been examined in this manner to draw comprehensive conclusions, but it is hoped that the feasability, ease of application and apparent harmlessness will stimulate others to apply this method of examination in selected instances.

Technique: The opaque medium (barium sulphate suspended in a solution of malted milk) is injected into the ostium, after the latter has been dilated and anesthetized, until over-flow exists. Then mop away any solution outside of the cavity and introduce cotton to prevent the liquid from flowing out, after which the necessary plates are taken. The following positions were usually employed:

(a) Stereoscopic postero-anterior.

(b) Two obliques (Pfahler's views).

(c) Lateral (stereoscopic where possible).

After the radiograms have been taken, the sinuses are drained and irrigated with sterile water. So far no untoward results have been encountered.

Bibliography—

Fig. XIV.—Case No. 19401—Lateral position after injection.

Fig. XIII.—Case No. 19401—Right oblique position after injection of left sphenoid.

Fig. XV.—Case No. 19453—Postero-anterior position after injection of right sphenoid.

Fig. XVI.—Case No. 19453—Right oblique position.

Fig. XVII.—Case No. 19453—Left oblique position.

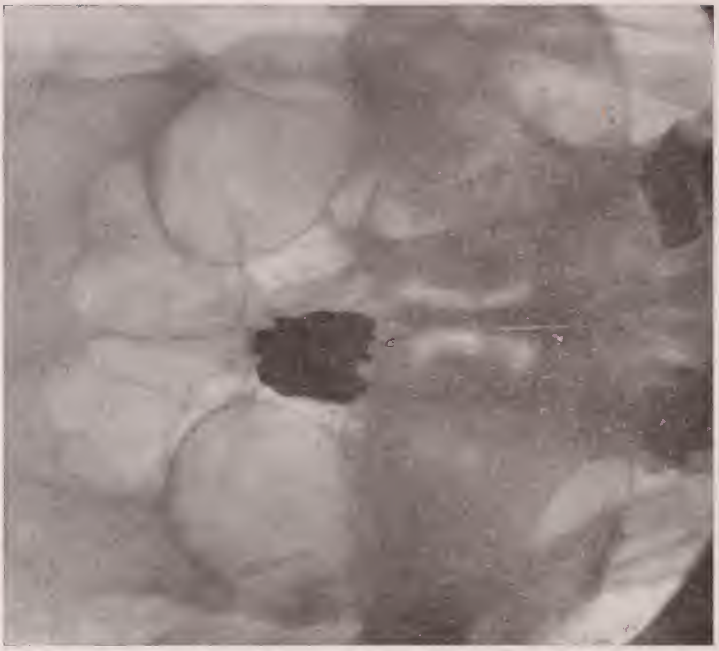


Fig. XIX.—Case No. 19453—Posterior-anterior position with left sphenoid injected.

Fig. XVIII—Case No. 19453—Left lateral position.

Fig. XX.—Case No. 19451—Right oblique position.

Fig. XXI.—Case No. 19451—Left Oblique position.

Fig. XXII.—Case No. 20111—Both sphenoids injected.

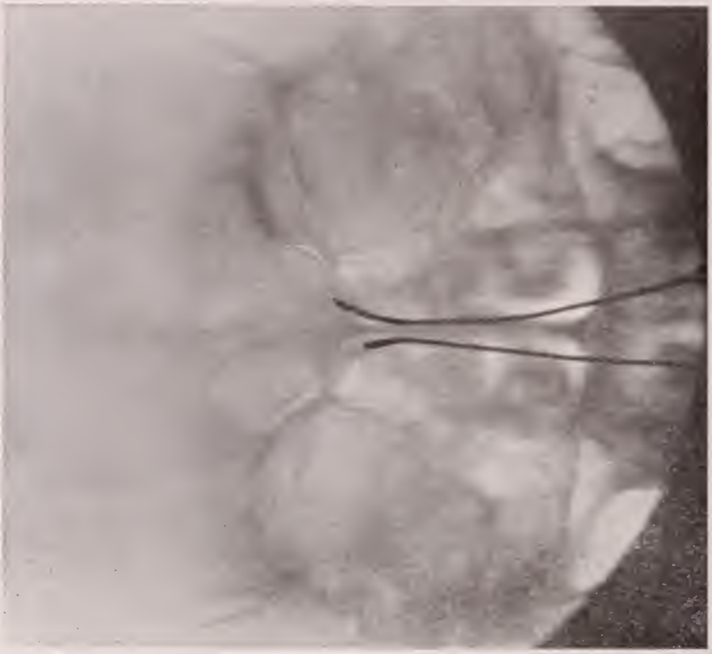


Fig. XXIII.—Case No. 20717—Probes in ostia of both sphenoids before injection.

Fig. XXIV.—Case No. 20717—Posterior-anterior position with both sphenoids injected.

Fig. XXV.—Case No. 20717—Left oblique position.

Fig. XXVI.—Case No. 20717—Right oblique position.

Journal of Radiology

A Journal of Ideas and Ideals.

Entered as second class matter, January 17, 1919, at the postoffice at Iowa City, Iowa, under the Act of March 3, 1879.

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Our Policy

WHEN, as sometimes happens, a careful observer of current affairs turns the pages of a scientific publication such as this, he may argue about the plan of mechanical production, or the technique of the general scheme of things, but if he is at all honest with himself, if he applies a few of the principles experience has taught many of us to use as a measure of our fellowmen's conduct, he will instantly admit that the thoughts, the ideas, and the opinions expressed are those of men animated by high purpose, by men whose constant urge is to add something really worth while to the sum total of practical scientific knowledge concerning the uses and benefits of Radiology. He will also admit, if he examines the pages of this particular publication at all carefully that more than all else, the men who delve into the hidden mysteries of the science of x-ray are human as he is human.

By way of preface, it is perhaps well to say that this is not a new publication. Its clothes—its general appearance has been altered somewhat in response to the breath of Spring, which has blown upon our cheeks so kindly during the past few days when we were walking in the shadow of the proverbial ground hog. All we are trying to do is to continue a very estimable undertaking, set in motion several years ago by some of the early members of The Radiological Society of North America. We are grateful to them because we are enjoying some of the benefits of that peculiar foresight and fine fortitude which was sufficient justification for their undertaking, and which enabled them to look far enough into the future to see the importance to the Society, to the medical profession generally, and to the public at large of a journal devoted exclusively to the advancement of Radiology.

Radiology is still in its infancy, so far as its uses and benefits have been discovered and applied. What shall we say of it, then, when those pioneers of the profession to whom we owe such a sensible obligation, conceived the Journal of Radiology as a medium for the interchange of ideas? How shall we compass their vision and their understanding? How shall we compensate their efforts, except in the one and only way they would have us compensate them, that is, by making The Journal a reproduction of the high ideals which sustained them in all their arduous labors?

Time is exceedingly fleet of foot. The problems of today are not those of yesterday. Consequently, there is an obvious value in this publication for those more active brains of the profession, those men who are constantly striving to co-ordinate and harmonize the best there is in Radiology with the accumulated knowledge of the centuries concerning the practice of medicine and surgery.

In this way only can we justify our claims on the time and efforts of those leaders of the profession, who, because they realize a deep sense of social duty, respond to that constant urge of scientific development and progress which decrees that their individual knowledge and experience shall become public knowledge and experience.

On behalf of those men who have so generously supported The Journal in times past, those who are now carrying its burdens, and those who will assume its responsibilities in future, we want to say that they have given and will continue to give the most recent thought on the subject of Radiology. They are men and women who stand in the forefront. Each name is a guarantee that what they have written is worth reading and that it is the product of mature thought. With no apology, because of their contributions The Journal has been and will contiue to be a well-balanced composite of the meditated opinions of the greatest specialists.

From all of which the policy and purpose of The Journal may be inferred. Let every man interested in Radiology, in any sense whatever, appreciate the increasing purpose which controls our every effort and give The Journal the consideration and support it deserves as an instrumentality devoted to the common good.

We believe that Radiology stands just now on the verge of an era of great accomplishment. Wherefore, we bespeak your tolerance if occasionally we seem so small of stature in a big field—we hope you will appreciate the thousand petty distractions which sometimes well-nigh overwhelm even those men who see big things in the future and endeavor by their greatness of view to prepare us for the full fruition of our opportunity.

We make no claim of belonging to that class. We are glad that charity permits us to pick up the crumbs which fall from the table at which master minds alternately feast and diet. But we are mindful, nevertheless, that each of us can and should add his mite so that our combined purpose will ultimately be achieved, and our ideals be thereby incarnated.

Summer Meeting

THE program for the Summer Meeting, which will be held at Hotel Lennox, at Boston, June 3rd and 4th, is well under way and promises some mighty fine things of an instructive nature.

Those contemplating attendance should make hotel reservations immediately by writing direct to the management. This admonition is worth considering, because the management informs us its accommodations are almost entirely engaged even at this early day.

So if you plan on going to Boston in June—and you cannot afford to do anything else—telegraph or write now for your rooms.

The Radiologist A Consultant

THE development of radiology during the past few years has been so rapid that there are many problems which are not quite definitely settled. Amongst these problems is the position of the radiologist in the medical profession.

The specialty of radiology is really such a broad one, touching every phase of medicine, that it necessitates the most thorough training in the fundamental subjects of medicine. It really means that the radiologist must be as well equipped as the internest in order to make correct interpretation of the findings in individual cases. The paper by Dr. S. B. Childs, published in this issue, brings to our attention this fundamental necessity. It is our opinion that radiologists themselves can really elevate the profession by preparing themselves, as Dr. Childs has suggested. The man who does not strive toward this kind of practice will really in time become little short of a technician. For years we have felt the necessity of this kind of preparation so that in our teaching we have used the following postulates:

The x-ray shows only three things—
1. Change in density.
2. Change in form.
3. Change in movability.

The interpretation of these changes must be based upon a knowledge of—
1. Anatomy.
2. Physiology.
3. Pathology.

Combined with—
1. The clinical history.
2. The physical findings.
3. The laboratory findings.

The man who is content to make only the x-ray picture follows the path of least resistance. He can never expect to rise to the position of a medical consultant.

Throughout the entire course which is given to medical students we constantly impress upon them the necessity of correlating all of the findings about the patient, using the x-ray findings along with the history, the clinical findings and the laboratory findings.

Right on the Nose

SPEAKING of the work of the League of Nations at Geneva, M. Viviani, head of the French delegation, said:

> "We would accomplish little, if in taking steps to prevent future wars, we overlooked the almost equal danger of Bolshevism. * * *
>
> The only preventative is *International Economic Harmony,* which must be accomplished throughout the world as it is now accomplished by individual states."

Thus, we have another straw pointing the direction toward which public opinion is blowing, and likewise, we have another indication that if the United States desires to maintain a place in the forefront of world affairs, commercially and financially, we must give serious consideration to both the possibilities and probabilities of international economics.

Certainly with all the facts before them, it is not the part of wisdom, foresight and intelligent future planning, for American business men to "pass the buck" and forget what the morrow may bring forth.

M. Viviani has hit upon the most profound principle of all, when he says that the future development and progress of the world must be based upon international economic harmony.

That may sound platitudinous, but even platitudes may border on the practical and contain a germ of intelligence. Civilization has always advanced in proportion to the security with which people obtain their bread and butter. We think the situation is no different now.

Watch "The Journal"—It Leads!

ABSTRACTS

New Roentgenotherapy in Carcinoma.

M. J. SITTENFIELD, M. D.

Jour. A. M. A., January 8, 1921, Vol. 76, Page 99.

THIS paper was written on observations made during a visit to Germany in the summer of 1920, and covers the advances made there in one and one-half years. Technique in deep therapy has made great changes. In particular the establishment of accurate measurements has made possible the exact dosage in malignant and benign tumors.

With old apparatus an effective penetration of 3 to 5 cm., 80,000 to 140,000 volts, absorption of all rays with 3 mm. of lead, were the limits. In order to secure sufficient penetration at all depths many portals of entry were required. Now there are being used newer types of apparatus capable of generating 180,000 to 220,000 volts, requiring 25 mm. of lead to stop the ray and having an effective radiation of 10 cm.

To stand the extra strain three new tubes have been produced.

1. The Lilienfeld tube.
2. The Muller Siede-rohre, a water-cooled tube.
3. The Furstenau-Coolidge, an improved Coolidge.

This improvement in apparatus has given for use a spark of at least 16 to 18 inches. It has made possible the production of a homogeneous ray. That is, there is a point in a bundle of rays where no longer is it possible to change the ray by further filtration without simply reducing all the rays. This is possible with .8 cm. of copper.

Two instruments for the exact measurement have come into use. They are the electroscope of Wulf and the ionizing chamber of the new iontoquantimeter of Szillard.

Thus it is possible with 220,000 volts to obtain a 30 per cent homogeneous ray at a depth of 10 cm. Add to this 10 per cent for secondary radiation, give this thru front, sides and posteriorly, and the total is over 100 per cent that all parts will receive. Biologically, 100 per cent is considered an erythema dose. 5 to 95 per cent will destroy cancer cells, 60 per cent sarcoma cells, and 25 per cent the ovaries. Thus with a pathological and anatomical knowledge of the patient, it is possible to give the full dose all at one sitting, thus preventing stimulation and damage to the skin and connective tissue. The protection of the bladder and rectum can be made effective. Fortunately they stand higher dosage than the skin.

In Bumm's clinic in Berlin, cancer of the uterus is radiated through four fields; one large one over the entire abdomen, one directed from the back and one from each side. The distance is 30 cm. and .8 mm. of copper for filtration; the voltage is 180,000 to 200,00 with a 16 inch spark gap; ninety minutes to an area, making in all 360 minutes. Thus a patient is treated continuously for six hours. On account of the severe blood changes, the patient receives blood by transfusion and rests a few days in bed. Wintz had treated about 3,000 cases of uterine cancer in seven years. Seventy per cent of cancers of the body were arrested over four years. In cervical cancers 45 per cent were alive after four years. The population of this town is but 27,000. Seven thousand radiations are made in a year, and eight roentgen apparatus of the latest type are running eight to ten hours a day.

In the gynecologic clinic of Opitz in Freiburg the focal distance used is 50 cm. Four fields of radiation are used at 120 minutes each, thus consuming eight hours. The results are astounding. Since January 1, 1919, no cancer of the uterus has been operated upon. Opitz reported on 63 cases of cancer of the uterus thus: 41 of the cervix, 21 of the body. Of the cervix cases, 22 had receded, 10 were not influenced, and 9 had died. Of the body cases, 17, or 80 per cent, receded; two were not influenced, and two patients died.

Carcinoma of the breast is treated by the same hard ray, but less depth is necessary and so the tube is farther away—70 to 90 cm. from the skin. One area over the breast, one over the supraclavicular area, one laterally and one over the back are used. The time runs from four to eight hours. Morphine and scopolamine are used. He saw in one day 35 patients who had been rayed two to four years before returning for observation, and all satisfactory. Now cases without axillary involvement are given roentgenotherapy rather than surgical treatment.

Carcinoma of the prostate is treated like a carcinoma of the uterus. Sarcoma does not require so much dosage. Osteosarcoma, tuberculous joints, fistulae and osteomyelitis are treated with gratifying results.

In uterine myomas the entire treatment is effected in one session of from one and one-half to two hours. One large field anterior and one posterior are taken. Each field is radiated for 40 minutes; in all 80 minutes. During the treatment exact measurements are read from the iontoquantimeter in the vagina. Compression is used by some. In fibroids, 85 per cent either shrink or disappear entirely, and in virtually all cases castration results. Malignant degeneration offers no contraindication.

SUMMARY

1. There have been constructed powerful high-tension transformers, and induction apparatus, with tubes to accept from 200,000 to 220,000 volts.

2. The determination of the homogeneous point and correct filtration through copper and zinc has brought about effective radiation.

3. Exact dosage for carcinoma tissue, 90 per cent of a skin erythema dose; for sarcoma 75 per cent, and for the ovary 25 per cent, has been established.

4. By the preoperative application of radiation the danger of transplanting cancer cells during operation is minimized.

5. Fibro-myomas respond to one treatment of from one and one-half to two hours, resulting in complete castration.

6. It is most important that all parts of the tumor receive an even and homogeneous radiation sufficient to destroy all cancer tissue and thus prevent recurrence.

7. Clinical knowledge as to the location of the tumor and its biology must accompany the skill of the roentgenologist, that he may intelligently select or combine surgery, radium, and the roentgen ray.

8. My own experience with this new technic since my return coincides at present with the work reported abroad, and I hope to give more detailed reports in the future.

Intracranial Aerocele Following Fractured Skull.

GILBERT HORRAX, M. D., BOSTON.

Annals of Surgery, January, 1921, Page. 18.

REPORTS of cases of air in the cranial cavity as a result of trauma are rare. In putting on record one case, an examination of the literature shows reference to x-ray evidence in cases reported by:

Luckett, W. H., Surg. Gyn. and Obst., 1913, xvii. 237.

Skinner, E. H., Jr. A. M. A., lxvi. 13, p. 954.

Holmes, G. W., Am. Jr. Roentgenology, 1918, v. p. 384.

Glenard and Aimard, Presse Medicale, xiv, March 10, 1919, p. 213.

Potter, H. E., Am. Jr. Roentgenology, vi. 1, 1919 p. 12.

May, A. J., Am. Jr. Roentgenology, vi. 4, 1919, p. 190.

Dandy has published the technic and findings in artificial ventriculography in Annals of Surgery, lxviii, 1, 1918, pp. 5-11. Also Bull. of John Hopkins, xxx. 336, 1919. Also Annals of Surgery, lxx, 4, 1919.

This patient was a girl, 19 years old, injured on June 9, 1919. An x-ray examination was made at the time, but no reference on the x-ray plate was made until July 8, 1919. By September, the air had disappeared and had caused no serious symptoms. There was a compound comminuted fracture of the skull involving the vertex and the base. No operative measures were indicated, and the patient was discharged. The following report is made on the roentgenogram:

> "In addition to this area (of defect) there was to be seen underlying the bony defect a lobulated shadow of decreased density which looked like a conglomerate mass of bubbles, the picture being such as to leave no doubt but that this irregular area represented an accumulation of air. Its extension backward within the cerebral tissue of the left frontal lobe for a considerable distance was shown by the lateral plate. The origin of this gaseous matter, presumably air, was unquestionably from a crack involving the frontal sinus."

Two Hundred and Fifty Operations on the Gall Bladder and Ducts.

EDGAR R. MCGUIRE, M. D.
BUFFALO, N. Y.

Surgery, Gynecology and Obstetrics. Dec., 1921, Page 716.

IT IS the purpose of the reviewer to call attention only to the roentgen aspects of this excellent paper. The author says that the diagnosis of gall stones is usually not a difficult matter. After a careful history the x-ray is second in importance in making the diagnosis. Its greatest value is in the negative information obtained. It eliminates the other causes of pain, such as gastric and duodenal ulcer. He believes that the time is near at hand when gall stones will be as accurately diagnosed by x-ray as renal stones are today.

Renal Tuberculosis in Twins

HERMAN L. KRETSCHMER, M. D.

Annals of Surgery, January, 1921, Page 65.

THE points of interest in these cases are:

1. The occurrence of renal tuberculosis in twin girls.
2. The youth of the patients.
3. In one of the cases a bilateral process was demonstrated.
4. The demonstration of extensive calcification in renal tuberculosis in young individuals.
5. Calcification in the bilateral case occurred in the right kidney.
6. In the unilateral case the right kidney was involved, and it showed extensive calcification.

The patient with bilateral involvement was not operated and died. The other had one kidney removed and is doing well. The author has this to say about the roentgen findings:

"The amount of calcification in both cases was rather extensive, as evidenced by roentgen plates. In other cases of renal tuberculosis, which roentgenologically showed evidence of calcification, the shadows seen were very much smaller than in either of the cases above mentioned.

"For several years past, all cases of suspected renal tuberculosis, as well as assured cases, have been radiographed as a routine. It is surprising how often areas of calcification in the kidney region are found; hence roentgen ray examinations are dependable in giving additional information which in certain circumstances is not only helpful but desirable."

The prints presented are pathonomonic of renal tuberculosis and alone sufficient for a diagnosis, although some primary and many secondary clinical results are presented.

The Roentgenology of Appendical Obliteration.

E. H. SKINNER, KANSAS CITY

Jour. A. M. A., Dec. 11, 1920,

Vol. 75, Page 1614.

THE purpose of this contribution is to postulate that the filling of an appendix lumen in an adult at least 30 years of age with an opaque meal is sufficient to nominate such an appendix as the seat of chronic disease. The degree of the pathology and the need of immediate or remote attention can only be told by the analysis of the case history and the elimination of other lesions by roentgen and clinical analysis.

The fermented milk and barium have no equal as a vehicle. The 48-hour period is the best time to observe the appendix. It fills by antiperistalsis, which is best seen in four hours, and also by sedimentation and mere gravity, due to a patent os.

In the analysis of appendiceal shadows the following points are pertinent.

1. Interrupted filling shadows caused by the presence of old non-opaque fecaliths or residues.
2. Narrowing of the lumen at the cecal end or along the appendical canal.
3. Bulbous end and narrowed neck.
4. Adhesions which kink, bind or distort.
5. Residues in the appendix after the cecum has relieved itself of opaque shadows.
6. Distinct tenderness over the appendiceal shadow.
7. A fixed appendiceal shadow in any part of its outline except the cecal end.

Authorities differ as to what the mere appearance of barium means.

Case says it is pathological; George that it is present in seven out of ten of all cases. Several others say that it does not pass into a normal appendix.

Appendices of children fill easily. But appendices over thirty years old are in dispute. In the discussion the following conclusions are reached:

1. The appendix is an organ of physiologic involution terminating in obliteration.
2. It is a lymphoid structure with a function.
3. It approximates and parallels the tonsils in its normal life history.
4. The appendix may be looked upon as an abdominal tonsil.

The pathologists are divided on their reports on the age of obliteration in appendix. The Europeans quoted seem to agree with the hypothesis as stated, and the Americans disagree. If found present after 30 it should be as carefully considered as a source of trouble as are the teeth and tonsils when looking for foci of infection.

SUMMARY

1. The appendix is a functionating organ.
2. It is a lymphoid structure.
3. It receives and expels colonic contents normally during childhood and adolescence.
4. It proceeds to physiological obliteration in adult life.
5. This obliteration is normally accomplished at about the age of 30.
6. Opaque filling of the appendix is easily secured in childhood and adolescence by meal and enema.
7. Appendiceal filling is a matter of sedimentation widely patent as an antiperistalsis. The three operate in childhood and adolescence. Antiperistalsis is more apparent with increasing years, and is the essential factor in the filling of appendices that are not obliterated after thirty years.

Roentgen-Ray Diagnosis of Intestinal Obstruction With Report of Cases

BY MAX KAHN, M. D., BALTIMORE, MARYLAND.

OBSTRUCTION of the intestines may be either congenital or acquired. Roentgenologically congenital obstruction is rarely seen. Congenital obstruction may be due to congenital stenosis, congenital deformities, strangulation by Meckel's diverticulum or the result of intra-uterine peritonitis forming peritoneal bands. Acquired obstruction is due principally to strictures following ulceration, intussusception, volvulus, strangulation by bands produced by peritonitis, by foreign bodies, by tumors extrinsic and intrinsic and tubercular peritonitis. Tubercular peritonitis is usually chronic and during its progress is apt to produce numerous and extensive adhesions about the intestines causing obstruction. The roentgen-rays offer material aid towards the diagnosis of obstruction, although the etiological factors may be difficult to determine The point of obstruction may at times be determined. The roentgenoscope will reveal without the opaque meal the distended bowel containing gas and fluid. This distention is usually quite marked in acute obstruction and can, as a rule, be easily recognized, so that in urgent cases this means alone may suffice for a diagnosis The opaque meal, however, visualizes the intestines more clearly and where possible should be employed. The use of the meal does not produce ill effects and does not endanger the patient. In the small intestines the point of obstruction is difficult to localize unless it occurs at either extremity In the large intestines the site of obstruction can frequently be determined with the opaque meal from above and the opaque enema from below. Roentgenoscopically one may be able to note the increased persistalsis proximal to the site of obstruction in addition to the distention. We have never seen anti-persistalsis in obstruction. In acute obstruction increased peristalsis is not readily seen. The roentgenological characteristics of obstruction of the small intestines are a distended bowel having a reticulated appearance containing gas and fluid. In one of our cases of chronic obstruction the distention of the small intestines at the end of eighteen hours was most marked and roentgenoscopically simulated the large bowel.

Case 1. This case was that of a white male, age 53. Family history is negative. Personal history, had the usual children's diseases, but no other sickness. He has always been in good health until a month previous to this examination. Wasserman, negative. Present illness complains of some rolling and excessive motion of the intestines two or three hours after eating. There is no regular nausea after meals, but he has frequent vomiting. He usually vomits three to four times on two to four-hour intervals. He vomits no food, but yellow and dark green fluid, occasionally of a brownish color. No dark coffee ground vomitus. No hematemesis. No soreness of abdomen. The roentgenological study of the gastro-intestinal tract May 20th and 21st, 1920, revealed an irregularity in the pyloro-duodenal region suggesting deformity due to adhesions causing stenosis and delay in the normal emptying time of the stomach. The small intestines at the end of eighteen hours were greatly distended, had a reticulated appearance and contained gas and fluid. Roentgenograms made at hourly intervals after eighteen hours revealed the small intestines constantly distended. The diagnosis of obstruction in the pyloro-duodenal region and of the small intestines, probably in the region of the

Case I.—Fig. I.—Note marked distention and reticulation of the small intestine. Obstruction due to adenocarcinoma of the jejunum. Also note the irregularity in the pyloro-duodenal region, due to a band of adhesions, causing stenosis.

jejunum, was made. Operation by Dr. Bloodgood May 31st, 1920. His notes of the operative findings are as follows: No fluid. A band of connective tissue with fat extends from the lesser to the greater curvature constricting the pylorus. When this was divided the patency of the pylorus was restored. The gall bladder was distended, walls thin, no stone present.

Case I.—Fig. II.—Same as Fig. I., several hours later. The distention and reticulation of the small intestine persisted for over thirty hours.

There were adhesions between the gall bladder and duodenum easily separated. The duodenum was not dilated but instead of it being huge it was a distinct S, suggesting it had been dilated, but there was no evidence of ulcer of duodenum or stomach. The stomach was somewhat dilated, but apparently empty. The appendix was long and free, the cecum normal. On lifting up the omentum and transverse colon, loops of rather collapsed intestines presented themselves. On introducing the hand, the operator felt and withdrew a huge loop of jejunum. It was of the diameter of an adult colon, thick walled and the distention extended up to the mesenteric vessels. There was a definite ring stricture. The length of this distended gut was about four feet. It is the gut which shows in the x-ray. There are no adhesions. Near the stricture is a palpable gland. Resection was done with isolation and ligation of the mesenteric vessels removing the glands. Two inches of the gut below the stricture and eleven inches above was removed. This long piece was removed because there was a patch of white tissue on the peritoneum, suggesting that it had been adherent to

Case I.—Fig. III.—Resected jejunum. Note patch on the peritoneum, suggesting that it had been adherent to the stricture.

Case I.—Fig. IV.—Another view of resected jejunum. Arrow points to stricture.

the stricture. The small jejunum below the stricture was inverted as the appendix is done, the larger closed, as colon. A lateral anastomosis, Bloodgood's method, was done, the ends pointing in opposite directions, interrupted silk sutures being used. The abdominal wound was closed with buried catgut. Silver wire through and through. No shock. Gross Pathology. At the position of the stricture there was a small area like cancer. The frozen section showed adeno-carcinoma. This is the first cancer I have observed in the small intestines.

Case I.—Fig. V.—Jejunum cut open, revealing stricture due to adeno-carcinoma.

Case 2. White male, age 51, married, occupation clerk. Personal history, he has had the usual children's diseases. Has otherwise never been ill excepting that he has been troubled with hemorrhoids for the past twenty-five years. Present illness: Three weeks ago intense pains in his abdomen began and lasted the four following days. The day after the beginning of the pains he vomited. The vomitus was fluid of a yellow color, no hematemesis, no coffee ground vomitus. He had no bowel movement for the four days from the beginning of the pains. Purgatives appeared ineffectual and caused vomiting. He was relieved of the pains after bowel movement, following an enema. At present he has very little pain, but has lost about five pounds in weight in the past three weeks. On palpating the abdomen immediately above the umbilicus, pain is elicited. No tumor mass at this time is palpable. A roentgenological study of the gastro-intestinal tract was made July 14th and 15th, 1920. The stomach was negative for organic lesion. There was a delay in the emptying time of the small and large intestines. At the

Case II.—Fig. VI.—Note distended and reticulated appearance of the small intestine. Obstruction due to a number of contracted rings shutting off segments about four inches long.

Case II.—Fig. VII.—Forty-eight hours after barium ingestion reveals the head of the barium column only as far as the right half of the transverse colon, suggesting possible obstruction of transverse colon.

end of twenty-four hours there was considerable barium in the small intestines, which appear markedly distended and apparently contain a small amount of gas and fluid, suggesting obstruction. At the end of forty-eight hours there was some barium remaining in the cecum, ascending colon and as far as the right half of the transverse colon. A barium enema visualizes practically the entire colon with the exception of an area in the sigmoid and a small area in the descending colon. These filling defects in all probability are not organic. Impres-

Case II.—Fig. VIII.—Barium enema proves there is no obstruction of the transverse colon. Arrow points to where band of adhesions was found in the sigmoid producing constriction.

sion—The delay in the emptying time of both the large and small intestines, with the marked distention of the small intestines is strongly suggestive of obstruction in the region of the lower jejunum or upper ileum. Operation by Dr. McGlannan July 27th, 1920. The operative note is as follows: Left rectus incision. The small intestine was spastic and there were a number of contracted rings shutting off segments about four inches long. The sigmoid was carefully explored and one band divided near its upper part. Nothing could be felt in the pelvis nor in the cecum. The small intestines were carefully explored, beginning at the cecum. About two feet away we brought up a loop from which there projected a little band which had evidently been recently torn. It was covered with a blood clot and situated opposite the mesentery on the wall of the bowel. This had evidently been the cause of the obstruction. This point was turned in and sutured with Pagenstecker. Nothing else was found in the exploration. Abdomen closed with #O chromic in all layers except the skin, where silk worm gut was used. Diagnosis: Chronic intestinal instruction. Inflammatory band.

Case 3. White female, age 45. Married. Personal history unimportant excepting that she has been operated on twice, once in July, 1901. The patient does not remember the nature of this operation. Operated on the second time in May, 1908, when the pelvic organs were all removed. She was at the same time operated on for hemorrhoids. Present illness began December 30th, 1914, at about 6 P. M., before patient ate supper, with severe pain in the lower part of the abdomen. The patient tried to eat supper but the pains became more severe. She was awake all night with intense pain. She saw her physician on the morning of December 31st, 1914, and called him twice later. The patient felt nauseated and vomited, but had no bowel movement. She was brought to Saint Agnes Hospital in the evening of December 31st suffering intense pain in the lower abdomen. A roentgenoscopic examination was made soon after the patient was admitted. The findings were as follows: The intestines appeared greatly distended with gas, and apparently also contained some fluid. The distention was particularly more marked in the small intestines. Owing to the condition of the patient it was thought inadvisable to subject her to further examination. Operation December

31st, 1914, by Dr. McGlannan. His note of the operative findings follows: High left rectus incision. Small amount of clear fluid. No obstruction found at splenic flexure. Dilated loop of gut felt in lower abdomen. Wound packed with large Boston pads and covered with a towel. Second incision, a low left rectus near the median line. Large amount of clear fluid. Long loop of ilium (two feet) near the lower end markedly dilated and discolored. There are adhesions between the loops of bowel and also adhesions between the bowel and parietal pelvic peritoneum. These adhesions (2) are very thick and the bowel had become twisted. The adhesions were cut and loops relieved. Diagnosis: Acute obstruction of the small intestines caused by post operative adhesions.

In summarizing, we feel that obstruction of the intestines can, as a rule, be demonstrated, and is characterized in the small intestines by distention, the bowel having a reticulated appearance of containing gas and fluid. The etiological factors concerned in obstruction and the points of obstruction in the small intestines are usually difficult of demonstration. In the large intestines the point of obstruction can frequently be demonstrated from above and confirmed by enema. In acute obstruction, where the condition of the patient prevents an extended study, the roentgenoscopic examination alone is of great help. Where possible roentgenograms should be made.

X-Ray Treatment of Epidermophyton Infection of the Feet

W. S. Lawrence, m. d., Memphis, Tenn.

THE suggestions offered in this paper were gathered from the treatment of not more than twenty cases of this disease, during the past eight months. The results obtained have been so highly satisfactory, that I feel inclined to offer them for your consideration, doing so, however, somewhat in the nature of a preliminary report.

Epidermophyton infection is by no means a rare or new disease. In fact, it is very common and without doubt very old. Still it is only within the last few years that it has been established as a separate entity, its cause determined, its course and symptons accurately described, and its treatment and cure worked out.

When Dr. Ormsby and Dr. Mitchell read their excellent paper on this subject before the Dermatological Section of the American Medical Association in June, 1916, Dr. Pusey remarked in the subsequent discussion that the disease was undoubtedly very common and equally undoubtedly seldom recognized.

Charles White in the Journal of Cutaneous Diseases for August, 1919, says that "half of the authors of recent treatises on dermatology write as if from hearsay rather than from first hand knowledge," and he believes that the bulk of the profession is still "ignorant of the very existence of this condition."

White also speaks of curing a patient *this year* who had suffered from this infection for thirty years. A man of wealth and prominence, who had suffered much at the hands of many physicians, who had sought relief and found it not—reminding one of the tortures of Napoleon, who in spite of all his pomp and power, scratched and swore for twenty years, because he was born before bacteriology and after scabes.

In view of these statements, I think it will not be going too much into detail at this point to give a brief description of the disease as it is generally seen, and to emphasize the several points of peculiarity which the disease presents when it attacks the feet.

The infectious agent in this disease is the epidermophyton inguinale. This was definitely proved and established by Sabouraud in 1910. There is still nothing definitely known as to how this micro-organism finds lodgement within the human skin. The name given by Sabouraud to this microscopic plant would indicate that the disease is confined to the inguinal region, but such is by no means the case. On the contrary, the disease may be encountered on almost any part of the body—thighs, toes and feet, fingers and hands, the axillæ, the genitalia, the flat surface of the trunk, and the scalp. By far the greatest number of cases, however, occur on the inner surface of the thighs and upon the feet.

The reaction of the skin to this invading plant varies considerably with the quality of the skin, its situation and the amount of moisture present. Therefore the clinical appearance of the disease is not the same in all parts of the body. There are two symptons, however, which are constant, itching and sharply localized areas of redness or copper-color. Itching, however, varies to a great extent. On the extensor surfaces it is mild, while between the toes and on the labia it is almost intolerable.

When this organism finds lodgment in the feet, the reaction ingendered presents a clinical picture far more characteristic and more readily recognized than in any other part of the body. Here the diagnosis can usually be made clinically, while in other parts of

Apart from the fact that this fungus is so easily influenced by the ray, there are two other reasons why this should be the agent of choice in treating this disease: First, the x-ray will remove the secondary pathology, and in certain diseases the secondary pathology persists after the primary has been overcome. In this case, the secondary pathology is the hyperhidrosis and the callous formation. The x-ray will control both. The second reason for using the ray is this: Most of these feet like most most feet in general, have corns, hard or soft, to add to their discomfort and suffering. There is no tissue in the body much more susceptible to the action of the x-ray than ordinary corns. Nor is there any other minor ailment which can render one more thoroughly uncomfortable.

In treating a severe case of epidermophyton infection of the feet with the x-ray we will be able to cure the disease rapidly, put a stop to the excessive sweating. remove all calosities, and incidentally rid the patient of all corns, both hard and soft.

The technique in the treatment of these cases is simple indeed. I mentioned above that the infecting organism is very susceptible to the action of the x-ray. For this reason small doses will suffice. I usually give at one sitting two-thirds of an erythema dose of the unfiltered ray to each area involved—using about seven and one-half inch penetration. Following the application of this dose, cessation of all symptoms sets in within twenty-four hours. I sometimes say to my patients go and scratch no more, and let me see you again in about three weeks.

Subsequent doses I think should be filtered, for deeper penetration which may or may not be necessary, and because the skin is less likely to be injured.

The results of the first dose are indeed brilliant and rapid. The patient is nearly cured in just a few minutes treatment, and this without sticky ointments which have likely been used for a long time with little or no benefit. But in spite of this brilliant beginning, the end is not yet. Some of the organisms seem to survive, or possibly the patient is re-infected from his own shoes, and in time these begin to multiply and a relapse sets in, which calls for further treatment. For this reason these patients should be kept under regular observation for some months.

I believe the best practice to be this: Give one, or possible two or three x-ray treatments at proper intervals to bring the disease rapidly under control and to relieve the feet of secondary pathology if present, and then prescribe Whitfield's ointment to help complete the cure and guard against relapses.

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The Roentgenologic Aspects of Osteitis Deformans Pagets Disease, with Reports of 15 Cases*

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Rochester, Minn.

Case 1 (106274)

Mr. O. O. P., aged 55, came to the Clinic May 19, 1914, complaining of weakness and numbness of the extremities.

Twenty-five years before the patient had measured six feet in height. For the past 10 or 15 years he had gradually decreased in stature. About five years before he noticed a slight pain in hands and feet, not constant, but associated with weakness and a general tired feeling. He continued to do his work until five months before when he was obliged to use crutches and then a wheel chair. He had been poisoned by wall paper, the arsenic causing swelling of the face and "weeping" from the legs and body. This lasted one summer. He had been a general house painter but stated that he had never had lead poisoning. His appetite had been good. He had been a heavy user of tobacco.

Clinical Findings.

The patient appeared poorly nourished, was four feet, five and three-quarters inches tall, with a marked kyphosis of the upper dorsal spine. A "cracking" sound was heard on movement of the spine; the neck and lumbar region were stiff; the chest had a marked barrel shape. There was a heart dullness of four and one-half inches with forcible diffuse impulse; rough systolic murmur was heard over the precordium with a maximum intensity at the aortic area. The patient's legs were slightly edematous; he had a large hydrocele on the left side. The lungs were negative. The systolic blood pressure was 165, the diastolic 105; the blood showed a secondary anemia, the hemoglobin being 60 per cent. The urine was normal and the Wassermann test was negative. No history could be obtained of enlargement of the cranium. The legs were bowed anteriorly, the deformity being more marked on the left side.

Roentgenologic Findings.

Osteitis deformans of the left tibia and spine. (Fig. 1).

Fig. I.—Case 106274—Tibia, showing irregular bone absorption, thickening, and trabeculation. Note bowing of the tibia and arteriosclerosis.

Case 2 (178377)

Mr. W. J. A., aged 51, came to the Clinic November 21, 1916, complaining of bladder trouble. Fourteen years before the right testicle had been removed on account of tuberculosis. The patient went home and returned to the Clinic April 26, 1917, when the right kidney was removed. Paget's disease was not diagnosed.

The patient again came to the Clinic April 3, 1919, complaining of pain in the right hip, down the back to the thigh and right leg. He had had these pains for four or five years and thought they had become worse since the nephrectomy in 1917. He had similar pain in the left hip although not so severe as in the right. He also complained of a feeling of weakness in the lower spine.

Roentgenologic Findings.

Osteitis deformans of the pelvis and the right tibia (Fig. 2).

Fig. II.—Case 178377—Roentgen findings similar to those in Figure I.

Case 3 (178770)

Mr. T. M. W., aged 62, came to the Clinic November 24, 1916, complaining of "tumor of the right thigh, old fracture of the upper part of the right femur and loss of motion of the right leg."

Twenty-five years before he had begun to have weakness and lameness in the right hip, which gradually became worse. The leg shortened and he wore an extra heel for correction. The right tibia had been growing thicker during the last 15 years. January 23, 1916 he made a mis-step and fell to the floor fracturing the right femur. He said he did not think the fall was enough to have broken a "sound leg". He was put to bed and his doctor told him he could do nothing for him. Eight months after this accident he noticed an increasing swelling of the right thigh.

Clinical Findings.

The patient was five feet, eight inches tall and weighed 150 pounds. He had a moderately firm tumor of the upper third of the right femur and thigh, the circumference of the leg was about three times normal; it was kept in a position of abduction and external rotation. There was loss of active motion; passive motion was slight and painful in any direction. The right tibia was twice the normal size. The Wassermann reaction was negative.

Roentgenologic Findings.

Osteitis deformans of the right tibia and lower part of the right femur. Mixed-cell sarcoma in the upper half of the femur with pathologic fracture (Fig. 3).

This patient died at his home six weeks after leaving the Clinic. Necropsy was not obtained.

Case 4 (212968)

Mrs. H. J. L., aged 44, came to the Clinic first November 5, 1917, complaining of pains in the elbows, hips, and fingers. For two years her left hip, knees, and ankles had been stiff. She gave a history of a genital sore, but the

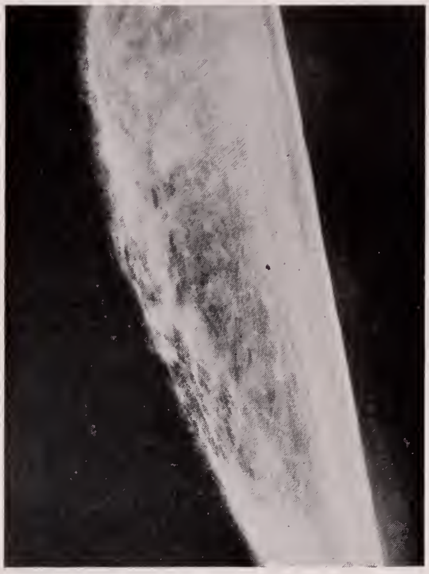

Fig. III.—Case 178770—Irregular rarefaction; thickening and trabeculation of the femur. This is especially marked along the convex surface of the bone.

Wassermann reaction proved to be negative. The general physical examination revealed nothing of importance. The roentgenologic findings were "marked increased density of the bone of the pelvis and upper part of left femur, with widening of the shaft; probably metastasis." The patient was sent home by the consultant after having been given a negative diagnosis.

January 22, 1919, the patient returned to the Clinic complaining that the left hip and knee had become stiffer and the fingers more painful. A roentgen diagnosis of probable metastasis was again made. The orthopedist considered the condition chronic osteitis, suggestive of an oncoming Paget's disease and advised re-examination in one year.

April 5, 1920, the patient again came to the Clinic with the same complaint. She was called home before her examination was completed, but the roentgenograms show the typical changes of osteitis deformans throughout the left femur and hip and involving the pelvis. No plates of the skull were made (Fig. 4).

Fig. IV.—Case 212968—Left hip. Ivory-like appearance, due to increased density and thickening.

Case 5 (213032)

Mrs. M. H. S., aged 45, came to the Clinic November 7, 1917, complaining of dizziness, pain in the head, and failing sight and hearing, first noticed about 1916. She began to suffer from headaches in the occipital and frontal regions and noticed that her head was enlarging. She had spells of dizziness and falling to the right side, which lasted about one minute; she was always sleepy and fell asleep in her chair while talking.

Clinical Findings.

The patient was five feet, one inch in height, and weighed 130 pounds. Her head was large and square looking and the temporal vessels were large and tortuous. The roentgenographic examination of the skull showed the skull bones increased in thickness and a rarefying process in the bony structure of the vault. There was a systolic murmur at the apex, not transmitted. Vision and pupils were normal, light reflexes were sluggish, the outline of the right disc was rather hazy, and the nerve head somewhat filled in. She had medium sized tonsils and an atrophic rhinitis. The ear membranes were thickened and retracted. The blood and spinal fluid were negative to the Wassermann test. There was a moderate jaw jerk. Arm, knee, and Achilles reflexes were slightly increased. Plantar reflexes and sensation were normal. The coordination of the left hand was somewhat poorer than that of the right. Pronation and supination tests were somewhat disturbed in the left hand; the gait was uncertain.

The Barany tests showed lack of reaction of the semicircular canals on both sides when stimulated by cold douching; a slight rotary nystagmus on the left side was manifest and there was tinnitus and vertigo on both sides, possibly associated with the bony changes in the skull.

Roentgenologic Findings.

Paget's disease of the skull.

Case 6 (237362)

Mrs. E. P., aged 60, came to the Clinic July 11, 1918 complaining of tumor of the left breast and pain in the right leg. The patient's left nipple had been burned with an electric needle 18 months before on account of "a pimple" that ulcerated and would not stay healed after being scabbed over.

About two months before the patient had noticed a lump in the breast. It had given no real pain but had enlarged. Pain in the right leg was first felt eight or ten years before. It was worse at night and interfered with sleep. Afterward it pained only when the patient first began to walk and when the full weight was put on the leg. She had noticed some discomfort in the left leg also.

Clinical Findings.

The patient appeared healthy and younger than her age. She weighed 124 pounds and was four feet, eleven inches in height. A tumor mass was noted in the upper half of the left breast. The right knee joint was enlarged and a little stiffened; the right tibia was enlarged, bowed forward and outward. The tonsils were moderately enlarged and exuding pus. The systolic blood pressure was 130, the diastolic 80. Examination of the heart, lungs, urine and other systems proved negative.

A radical amputation of the left breast was performed. Operative and pathologic reports showed diffuse carcinoma in the upper and inner quadrant of the left breast, probably secondary to Paget's disease of the left nipple, and fairly extensive glandular involvement.

Roentgenologic Findings.

Osteitis deformans of the right tibia.

Case 7 (238596)

Miss L. T., aged 37, was admitted to the Clinic July 18, 1918 complaining of aching in the legs with occasional sharp pains and paralysis of the left side of the face which had begun four years before with quivering of the facial muscles and pain behind the left ear.

The patient stated that she had had the pains and aching in the legs since childhood and that it was always much worse at night. Her general strength had decreased and she was unable to walk far. She had no earache or headache, but became dull of hearing in the left ear.

Clinical Findings.

The long bones were found roughened and enlarged and the skull was enlarged. The left seventh cranial nerve was paralyzed. Marked pyorrhea and enlarged tonsils with occasional plugs were found. The eyes were normal; the urine showed a small amount of albumin; the blood showed slight anemia. The systolic blood pressure was 116, the diastolic 76. The Wassermann and spinal fluid reactions were negative. The basal metabolic rate was -1.

Roentgenologic Findings.

Osteitis deformans of head, left tibia and fibula, right femur, both radii and ulnæ, several metacarpals, and lower jaw (Figs. 5 & 6).

Fig. V.—Case 238596—Increased thickening and density at the base of the skull and lower jaw.

Fig. VI. — Case 238596 — Marked thickening and density of the radius, ulna, and metacarpal bones. Note the areas of rarefaction, irregularity of outline, and absence of joint involvement.

Case 8 (252310)

Mrs. A. B., aged 66, came to Clinic December 2, 1918 complaining of pain, and stiffness in the left hip with shortening of the left leg.

Thirteen years before the patient began having pain in the left hip causing a slight limp. The pain continued, never very sharp but constant and becoming worse after exercise. The stiffness in the hip, shortening of the leg and the limping had grown gradually more marked in the last five years and she had not been able to walk without crutches. The right knee joint had been slightly stiff from acute arthritis 29 years before.

Clinical Findings.

The patient was unable to walk without two crutches; her color was good and she appeared well nourished and well-developed. Her upper teeth were artificial; in the lower teeth pyorrhea was fairly marked; the tonsils were enlarged, with plugs. The systolic blood pressure was 140, the diastolic 50. Urinalysis showed a moderate amount of albumin and some pus cells; the blood count was normal and the Wassermann test was negative. The left hip could not be rotated or abducted, but there was good flexion and extension. The thigh was curved outward and the left leg greatly shortened. An intra-uterine fibroid was causing metrorrhagia for which radium was advised. The examinations of the heart, lungs, abdomen, and other systems were negative.

Roentgenologic Findings.

Osteitis deformans of the left hip and thigh; the right ilium and femur showed marked bone changes. There was general calcareous arteritis (Fig. 7).

Fig. VII. — Case 252310 — Femur thickened and bowed.

Case 9 (302252)

Mr. F. C. P., aged 45, came to the Clinic January 10, 1920, complaining of dull aching pain in the abdomen, and a backache, of about four years' duration. Jarring of the spine caused pain in the back. He had occasional dull headache. Three years before he had been told he had tuberculosis of the intestines and for 18 months was given a tuberculin injection every six days.

Since the first year the pain had been limited to the lower abdomen and was practically constant. The patient became tired easily and when tired his legs ached and the muscles trembled. His appetite was fair, his bowels regular; there were no urinary symptoms.

Clinical Findings.

The patient was anemic and sick-looking and carried himself in a slightly stooping attitude. The heart and lungs were normal, pyorrhea was marked; the abdomen was slightly distended but no mass could be felt. The last ribs practically touched the iliac crests.

Examination of the eyes, ears, and throat showed nothing of importance. Urinalysis showed a small amount of albumin and the combined phenolsulphonephthalein test was normal. The examination of the blood was negative and the Wassermann test was negative.

Roentgenologic Findings.

The roentgenologic examination showed irregular absorption of the vertebræ and thickening in the pelvic bones, thought to be metas-

Fig. VIII. — Case 302252 — Head, showing thickening of the skull and irregular nodular deposits of bone.

Fig X.—Case 302252—Involvement of the sternum.

tasis. No primary malignant lesion could be found.

The patient was fitted with a back brace which gave relief from the pains. He returned to the Clinic November 26, 1920 for re-examination. He was slightly stooped over and both legs were bowed forward and outward. He said that his head is enlarging and that he is about three inches shorter than he used to be. When

Fig. IX.—Case 302252—Marked thickening of the pelvis and hips and rarefaction of the alae ilii.

his spine was rayed the plates showed marked thickening and eburnation of the spine and pelvis. Plates were then made of the skull and other structures and the characteristic bony changes of osteitis deformans were found in the skull, right clavicle, sternum, and tibiæ (Figs. 8, 9, and 10).

Case 10 (309410)

Mr. R. C. K., aged 60, was admitted to the Mayo Clinic March 18, 1920, complaining of disturbance of hearing and right sided facial spasm.

The present trouble had begun seven or eight years before with hammering in the right ear described by the patient as being "like the whistle in a peanut roaster", and loss of hearing in that ear. The ear had not ached or discharged. The hammering had been constant although not rhythmic with the pulse, but a rhythmic noise accompanied it like a muffled drum beat. These noises did not increase in intensity, but other symptoms developed in order of sequence as follows:

1. Twitching of the muscles of the right eye beginning at the outer corner gradually extended to involve the muscles of the whole right side of the face. Occasionally an involuntary spasm of the right facial muscles closed the right eye. A slight fullness of the left cheek was first noticed about six months before. The patient was unable to whistle well because of spasm of the facial muscles. He had never had double vision.

2. Symptoms of incoordination were noted. The patient could think well, but found difficulty at times in expressing himself. He had had no difficulty in writing, other than slowness and some unsteadiness of movements. His memory had been excellent for all events, recent and remote. During the past six months he had noticed difficulty in walking, was ataxic and uncertain of movements, without muscular weakness.

3. The patient had severe headaches at the base of the skull on coughing, associated with transitory blindness.

4. During the past five years the patient had decreased about three inches in stature, and his head had enlarged, necessitating a change in the size of his hat from 7 to 7⅝, which is now too small.

Clinical Findings.

The patient was five feet, four inches in height and weighed 135 pounds. His attitude was slightly stooping, his legs somewhat bowed, his head large and pyramidal in shape with the apex downward. The vessels of the scalp were tortuous and sclerotic. The examination of eyes and ears was negative. The urinalysis showed a small amount of albumin. The Wassermann and spinal fluid reactions were negative The blood count showed no abnormality and the basal metabolic rate was +14. The neurologic examination showed nothing of importance, the summary being: ptosis of the right eyelid, continual twitching from platysma to right orbicularis oculi, taste defective, salt and sour being —3 on both right and left sides, Rombergism, and sensory aphasia to slight degree. Mental and motor apraxia +1, +2, (gradations on a scale of 1 to 4). A tentative diagnosis of cortical lesion due to bony changes was made by the neurologists. The systolic blood pressure was 120,, the diastolic 60.

Roentgenologic Findings.

Paget's disease of the head and the left tibia (Fig. 11).

Fig. XI.—Case 309410—Skull enlarged, inner table increased in thickness and density, outer table increased in thickness, irregularity and finely porous. Nodular areas of bone scattered over the vertex.

Case 11 (318460)

Mr. G. H. P., aged 56, was admitted to the Clinic June 24, 1920, complaining of pains in the legs. The patient had had rheumatic fever 20 years before and again in five years. When he was 26 he had renal colic and passed a stone. He had had a fracture of the left elbow ten years before and both scapulæ were fractured five years later. He had had a chancroid at the age of 55.

The patient first noticed a dull painful aching in the right tibia at night about three years before; it was relieved by rubbing. Eight weeks before examination he began to have steady pain along both tibiæ accompanied by swelling at the lower third of both legs. Bowing of the legs had been noticed in the last three to four years and gradual enlargement of the head during the last five years.

Clinical Findings.

The patient was 5 ft., 6 ins. in height and weighed 133 pounds. The skull was enlarged, triangular shaped with its base above and frontal bones quite prominent; the clavicles were thickened and excessively curved; the iliac crests were thickened and the pelvis; widened, giving it an increased intercristal diameter; and the lower extremities were bowed outward and forward. The femora and tibiæ were thickened, more particularly the right tibia at its lower end. The arms appeared relatively too long. The palpable arteries were tortuous and sclerotic. There was a large sized inguinal hernia on the right side. The systolic blood pressure was 142; the diastolic 86. The eye examination was negative except for a very slight evidence of retinal vascular sclerosis. Repeated urinalysis showed a relatively low specific gravity 1013 and 1017, and a moderate amount of albumin and occasional red and white blood cells. The combined phenolsulphonephthalein test showed 30 per cent excreted in two hours and fifteen minutes. The hemglobin was 70 per cent; the erythrocytes 4,600,000, the leukocytes varied from 9,000 to 16,800, and 55 per cent of 200 cells were polymorphonuclear neuthrophils; 36 per cent were small lymphocytes; 8 per cent were large lymphocytes, and 1 per cent were eosinophils. The Wassermann test and the neurologic examination were negative; the basal metabolic rate was +24.

Roentgenologic Findings.

Paget's disease of the head, spine, pelvis, right and left femur and left tibia. On the roentgenograms of the kidneys, ureters and bladder a diagnosis of metastasis in the spine and pelvis was made.

Fig. XII.—Case 318460—Involvement of the lumbar spine and sacroiliac region. The density of bone similates bone metastasis.

Roentgenograms of the head disclosed the correct diagnosis of Paget's disease (Fig. 12).

Case 12 (327522)

Mrs. C. W. F., aged 49, was admitted to the Clinic August 3, 1920, complaining of general rheumatic pains and bow legs.

About six years before the patient began to have a general heavy sluggish feeling, especially when lying down. She consulted a physician who said the condition was due to lack of thyroid secretion and put her on thyroid extract which she says caused marked improvement in her health within one month. The treatment was discontinued for three months and the symptoms returned. She was again put on thyroid extract, one or two tablets a week, with improvement, which medication has been kept up for the last five years. Four years before the patient had had an acute attack of general neuritis, the pains being most marked in the left shoulder, and was confined to bed for three days. Since then she had had frequent pains over all the body, aggravated during cold weather. Two years before she sustained a slight injury to the right knee. Her physician drew attention to the fact that the bones of the legs were bowed outward. The injury to the knee was apparently trivial and the patient was up and walking in a few days. Subsequently, she had one or two slight injuries to the same knee, not accompanied by locking of the joint or swelling.

She thinks that during the last three years there has been a marked increase in the bowing of the legs.

Clinical Findings.

The patient was found to be well nourished, she weighed 115 pounds and was five feet, one and one-half inches tall. A systolic murmur at the apex of the heart transmitted to the axilla was noted. The abdomen and pelvis were negative; there was no evidence of thyroid disturbance. The systolic blood pressure was 150, the diastolic varied from 60 to 80. The eyes, ears, nose, and throat were normal. The urine and blood examinations and Wassermann reaction were negative. The basal metabolic rate was —5.

Roentgenologic Findings.

Paget's disease of both tibiæ.

Case 13 (328746)

Mr. L. E. S., aged 70, came to the Clinic August 12, 1920, complaining of pain and bowing of the left leg.

About seven years before he had noticed that his left leg was crooked and that it pained occasionally, becoming worse in the last two years and finally severe enough to interfere with sleep.

Clinical Findings.

The patient weighed 172 pounds. The left tibia was bowed forward and outward, was tender to the touch, and appeared thickened. The movement of the spine appeared slightly limited. The prostate was slightly enlarged. The teeth showed some pyorrhea. The heart, lungs, and other organs were negative. The urine contained a small amount of albumin with some hyaline casts. The Wassermann reaction was negative.

Roentgenologic Findings.

Paget's disease of the left tibia.

Case 14 (337496)

Mr. G. W. G., aged 50, came to the Clinic October 13, 1920, complaining of pain in the head and difficulty in walking.

Several years before the patient had been subject to severe headaches occurring two or three times a week. The headaches came on suddenly, lasted all day, and were severe enough to prevent him from working. The headaches had not been so frequent or severe during the last year. About two years before he had a fall on the street and was laid up for two days. Two weeks later he had an

Fig. XIII.—Case 337496—Rarefaction and trabeculation of the lumbar spine and sacro-iliac region.

attack of some kind and was unconscious. He was kept in bed for three months and during this time had a dull continuous pain in the lumbar region. He walked about with a cane, in a stooped position, and complained of pain and stiffness in the back. He had had to urinate four or five times during the night and three or four times during the day.

Clinical Findings.

The patient apparently had not decreased in stature and had no deformity of the extremities. His head was enlarged and pyramidal shaped. He had mature right and left senile cataracts. The systolic blood pressure was 125, the diastolic 70. The blood count was normal. The urine contained a slight amount of albumin and a few pus cells. The combined phenolsulphonephthalein test was normal. The Wassermann test was negative.

Roentgenologic Findings.

In the general examination of the patient plates were made of the kidneys, ureters and bladder. On the appearance of the spine and sacro iliac region a diagnosis of metastasis was made. The patient was returned to the roentgen laboratory for re-examination and attention was drawn to the size and shape of the head. Plates of the head were made and showed definite osteitis deformans (Fig. 13).

Fig. XIV.—Case 343042—Marked involvement of the pelvis, right hip, and femur, with early imvolvement of the left hip.

Case 15 (343042)

Mr. D. B., aged 46, came to the Clinic December 7, 1920 complaining of a tumor in the region of the left hip.

About 14 years before the patient began to notice that his right thigh was becoming bowed and his leg getting shorter. This progressed for three years, unaccompanied by pain or other symptoms. Six and one-half years before, while playing tennis, he had had a sudden attack of severe pain in the sacral region, not sufficient, however, to confine him to bed. Six months later when running to catch a boat, he fell and injured his left hip. He was in bed ten days, used crutches for three

Fig| XV.—Case 343042—Close-up view of the left ilium, showing enlargement, areas of absorption varying in size, and coarse trabeculation somewhat resembling giant-cell tumor. Absorption to this extent is an unusual finding in Paget's disease

months and a cane for one year. His physician said he had torn some ligaments. One year later. five years before examination, he noticed a rapidly growing tumor above the left hip; this did not cause pain.

Clinical Findings.

The patient appeared well nourished. His head was not enlarged; the spine was not deformed. The right femur was very markedly bowed forward and outward, and there was a large hard mass in connection with the left ilium. The skin over the mass was covered with distended veins.

The urinalysis showed a large amount of albumin and a moderate amount of pus cells; the blood count was normal and the Wassermann reaction negative. The systolic blood pressure was 132 and the diastolic 84.

Roentgenologic Findings.

The examination of the left ilium and hip showed osteitis deformans of the femur. The ilium was enlarged in all directions, and showed large irregular areas of bone absorption with coarse trabeculation between these areas. Further plates showed the disease in a very early stage in the skull and left femur, and to a marked degree in the spine, pelvis, and right femur (Figs. 14, 15 and 16).

Before entering on a discussion of the subject of this disease it may be of interest to call attention briefly to the eminent surgeon who first described it and whose name is associated with it. The original article is a masterpiece and the fact that none of the many subsequent writers has added anything to our knowledge of the disease is a great tribute to the accuracy of observation and the completeness and lucidity of the description.

Discussion

The British Encyclopedia gives the following account of Sir

James Paget. He was born in 1814 at Yarmouth, apprenticed to a general practitioner from 1830 to 1834, entered St. Bartholomew Hospital as a student in 1834, where he discovered the *Trichina spiralis* in the muscles

Fig. XVI.—Case 343042—Lumbar spine and sacro-iliac region. Note the chalk-like appearance of the bone, flattening and widening of the bodies of the vertebrae.

of the specimen he was dissecting as a first year student. From 1836 to 1843 Paget practiced general medicine, but found it necessary to prepare catalogs for the pathologic museum of the Royal College of Surgeons in order to make a living. He was curator of this museum from 1836 to 1838, after which he was demonstrator of morbid anatomy in the same institution. In 1841 he became surgeon to the Farisbury dispensary and in 1843 was appointed lecturer on microscopic anatomy. In 1847 he was made assistant surgeon and professor of surgical pathology, and through his lectures restored the Royal College to its former leading position. In 1851 he was elected fellow of the Royal Society and became eminent as a pathologist and physiologist. His best original work was a description of eczema of the nipple with subsequent mammary cancer, and the bone disorder, osteitis deformans, both of which are named after him. Later in life he became Surgeon Extraordinary to Queen Victoria, President of the Royal College of Surgeons, and Vice Chancellor of the University of London.

The preparation of this paper was stimulated by the fact that four cases of osteitis deformans were diagnosed by means of the x-ray as metastasis in bone. After further study and re-examination of other bones, more especially those of the head, a correct diagnosis was made. While no new facts or theories are brought out in this report, the disease is so rarely seen and so often unrecognized that we felt the subject would be of interest to clinicians and roentgenologists alike.

Sir James Paget, in 1876, reported five cases and in 1882 seven additional cases of an unusual bone condition which he termed osteitis deformans. In 1890, 14 years later, he had seen altogether 23 cases of the disease. From that time until the present approximately 250 cases have been reported in the literature. How infrequently the disease is seen may be estimated from the fact that three cases were observed in 38,000 admissions to the New Jefferson Hospital, Philadelphia, during seven years; three cases in 30,000 admissions to Johns Hopkins Hospital, and the foregoing series of 15 cases in 237,000 admissions to the Mayo Clinic in six years.

Etiology.

The cause of the disease is unknown. Arteriosclerosis, heredity, syphilis, trophic disturbances, and faulty metabolism have been mentioned by different writers as possible causes, but a study of the literature and of our cases does not substantiate any of these as etiologic factors.

Pathology.

The disease affects most frequently the long bones of the lower extremities and the bones of the skull. The bones become thickened and softened and those bearing weight become bowed. These changes are followed by the production of poorly calcified bone which after a period of years takes on an ivory-like hardness.

The bones of the skull show marked thickening, in some cases to four times the normal; the inner table is dense and the outer table finely porous, producing in the roentgenogram a fuzzy appearance of the calvarium. Nodular deposits of bone are irregularly distributed over the vertex. The marrow cavity is sometimes obliterated by the formation of fibrous soft-bone tissue which usually becomes trabeculated. There may be great rarefaction of bone in one extremity with increased density of bone in other extremities in the same patient. Writers are at variance regarding the beginning of the disease process, but all who have studied the pathology of the bone changes describe similar microscopic pictures. Packard, Steele and Kirkbride describe the process as follows:

"1. Absorption of the compact substance, causing enlargement and confluence of the Haversian canals.

"2. Formation of new bone which runs diffusely through the affected and adjacent healthy portions. This new bone remains uncalcified and is in turn reabsorbed.

"3. The conversion of the medullary substance into a vascular connective tissue containing fat cells, giant cells, and leukocytes. In a small proportion of cases cysts filled with gelatinous material and giant-celled sarcomas occur in the medulla.

"4. As a consequence of these three processes the ordinary relations of the compact substance and medulla are destroyed. The bones become greatly thickened and asymmetrical, but since the new bone tissue remains uncalcified, the elasticity permits of great deformity of the long bones from weight of the body, and fractures do not occur."

Morton Prince speaks of the pathology of the disease under three separate divisions, namely, (a) absorption of bone; (b) new formation of bone without calcification; and (c) new formation of bone with calcification. Any one process may predominate.

Clinical History and Physical Findings.

Osteitis deformans is a disease affecting the middle aged and the elderly, practically all the cases occurring in persons over 40. In Case 7 (238596) of our series the patient was 37 when the condition was diagnosed; the other 14 patients of the series vary in age from 40 to 70. Males are said to be affected more frequently than females. In this series there were nine males and six females.

The onset is insidious and the course of the disease slowly progressive. One of the first symptoms complained of by many patients is pain and aching in the legs. The pain is neuralgic or rheumatic in character and frequently complaint is made of a burning feeling over the tibiæ, accompanied by increased heat to the touch over the same areas. A number of cases have been reported in which there was no pain throughout the course of the disease. Twelve patients of our series had pain in the extremities, two complained of pain in the head, and one had no pain. Bowing of the legs is an early finding in cases in which the lower extremities are affected.

The general appearance and posture of the patient is quite characteristic. The head, which is increased in size, is carried forward and shaped like an inverted triangle. The increase may have been noticed by the patient himself, who finds that he requires a larger hat from time to time. The superficial vessels of the scalp are often prominent, tortuous, and sclerosed. There is loss of height, the shoulders are rounded, and the spine is curved forward, tending to bring the costal margin almost in contact with the iliac crests. The chest appears sunken and the abdomen pendulous; the pelvis is widened and seems disproportionate to the rest of the body. The legs are bowed forward and outward and they are everted when the patient is standing. The patient has a slow awkward gait.

Arteriosclerosis occurs frequently in case of osteitis deformans, and in the late stages of the disease myocardial changes are common. Paget emphasized the frequency with which malignancy, either of bone or other tissue, complicates the disease. Five of his eight patients who were traced to death, died of malignant disease. Since his observations several writers have drawn attention to this fact. Two patients in our series developed malignant disease, one carcinoma of the breast, and the other sarcoma of the femur, which bone was also affected with osteitis deformans. In four cases the basal metabolic rate was studied, but no conclusions could be made from the varying rates, +14, +24, —5, and —1. The accessory sinuses of the nose and the pituitary fossa revealed no abnormalities.

Spontaneous fracture in Paget's disease is considered rare by most observers. LeWald in a study of 14 cases encountered four in which spontaneous fracture had occurred. In one of our cases a pathologic fracture occurred through a sarcomatous tumor in the upper third of the femur.

In regard to the prognosis of the disease: The course is protracted and death occurs from some intercurrent disease.

Roentgenologic Findings.

Roentgenography has demonstrated that many bones are affected in osteitis deformans, the order of frequency being as follows: Tibia, femur, skull, pelvis, spine, clavicle, ribs, radius and ulna. It is rarely seen in the hands, feet, or bones of the face.

The whole architecture of the bone is altered, the essential features being porosis and the formation of new bone with hyperostoses, one or the other process predominating in different parts. In later stages the new bone tends to become sclerosed and takes on a dense white appearance, with a much decreased permeability to the x-rays. The structure of the bone appears to be almost entirely removed and laid down afresh on a different plan and in a larger mould.

According to the literature, the consensus of opinion seems to be that the bones of the face remain unaffected. In Case 7 (238596) the lower jaw showed the marked thickening and density of Paget's disease.

The long bones lose their clear cut outline; they become curved, and the thickening appears to be greatest on the convex surfaces. In some places subperiosteal thickening is seen, while in others decalcification beneath the periosteum has progressed irregularly. The small cysts frequently mentioned in the literature were observed but once in our cases.

The spine and pelvis, when affected, take on a dense white appearance, or the picture may be that of porosity with fine and coarse trabeculation, or there may be a combination of the two. The bodies of the lumbar vertebræ are flattened and widened compared with the normal. The joints are not involved; the process extends throughout the epiphyses, but there is no noticeable irregularity of the joint surfaces. There is no approximation of the articular surfaces that is suggestive of atrophy of the cartilages.

It has been said by some authors that the long bones of the lower extremities and the bones of the skull are most frequently affected, but it is probable that other bones would be found to be as frequently involved, except in the very early stages of the disease, if the patients were systematically examined with the x-rays. The multiplicity of bones that may be involved in one patient is shown in Case 7 (238596) in which the head, left tibia, left fibula, right femur, both radii and ulnæ, lower jaw, and several metacarpals were affected; and in Case 9 (302252) in which the skull, spine, pelvis, right clavicle, sternum, and tibiæ were involved.

Cases have been reported of single bone involvement under the name "mono-osteitic type." The question arises whether the x-ray might not have revealed the lesion in other bones as well. Beclere reports one case in which metacarpals and phalanges were involved. Goldthwait, Painter and Osgood describe a similar case. Case 7 (238596) shows involvement of the metacarpal bone of the index finger of the left hand and of the metacarpals of the index and middle fingers of the right hand.

Differential Diagnosis.

Osteomalacia.

The differential diagnosis of this disease and osteitis deformans should present little difficulty either from the roentgenologic or clinical standpoint. The bone change in osteomalacia is that of decalcification and when deformity occurs it is angular. The cortex of the bone becomes very much thinned and spontaneous fractures are common.

Syphilis.

In this disease there is marked periosteal overgrowth and increased thickening of the cortex at the expense of the medullary cavity. Codman has applied the name "bone-blister" to the localized periosteal elevations. The thickening of the cortex is most common along the convex side of the affected bone, producing the appearance of bowing as seen in the so-called "sabre-tibia."

The x-ray picture of the disease in the spine and in the skull is so different from that of osteitis deformans as to require no differentiation.

For additional proof we must rely on the history, the Wassermann reaction, and the examination of the spinal fluid.

Osteomyelitis.

In this disease there is tendency to formation of bone abscess in the early stages, and thickening and sclerosis with the formation of sequestra in the later stages. Porosity may be present, although not a characteristic of the disease, and results from non-use. The disease is usually confined to one bone and the history of the case is entirely different from that of Paget's disease.

Secondary Malignancy in Bone.

The osteoplastic type of metastasis is the one condition that may easily be mistaken from the x-ray standpoint for osteitis deformans, especially when the latter disease occurs in the lumbar spine and sacro-iliac region.

LeWald appears to be the only writer to mention the possibility of mistaking Paget's disease for bone metastasis, and he considers that possibility only when the Paget's disease is confined to one bone.

The bone lesion in four of our cases was mistaken for metastasis because of the dense white chalky appearance of the lumbar spine and sacro-iliac region. In Case 4 (212968) the x-ray appearance of the femur led to a diagnosis of metastasis in 1917. Fourteen months later the same diagnosis was made. However, in spite of this roentgen diagnosis the surgeon suggested the possibility of oncoming Paget's disease. In April, 1920, on re-examination of the patient, the same roentgen diagnosis was made. The patient was called home before her general examination was completed. During the review of this series of cases the plates of this patient were studied and the bone changes were found to be unquestionably those of osteitis deformans.

In Case 9 (302252) the roentgen diagnosis made January, 1920 was metastasis of the lumbar spine and pelvic bones. No primary malignancy could be found and the patient was fitted with a back brace which relieved the pain. This patient returned to the Clinic November, 1920. The spine was reexamined and revealed the dense, white appearance which we had learned to associate with Paget's disease. The patient was sent for and plates made of the skull and other bones, which showed the characteristic bone changes of osteitis deformans in the skull, right clavicle, sternum, and tibiæ. During this examination it was noticed that the man had many of the clinical appearances of the disease.

In Case 11 (318460), the clinician was investigating some urinary condition and requested an x-ray examination of the kidney, ureter and bladder areas. The appearance of the lumbar spine and sacro-iliac region in these plates led to a diagnosis of bone metastasis. For some reason a roentgenogram of the skull had been asked for also, and the bone changes that were revealed corrected the diagnosis.

In Case 14 (337496) during the general clinical examination roentgenograms of the kidney, ureter and bladder regions were asked for. The white, dense lumbar spine and sacrum again caused an incorrect diagnosis of metastasis. The clinician could find no primary lesion and asked for a reray. When the patient presented himself for examination attention was drawn to the size and shape of his head. Roentgenograms of the skull showed definite osteitis deformans and the correct diagnosis was made.

Because of the close similarity between osteoplastic metastasis and osteitis deformans when they occur in the spine and pelvis, a very careful search should be made for primary malignancy, and other bones, more especially those of the skull and the extremities, should be roentgenographed for evidences of osteitis deformans. If these bones show absorption and production of new bone, the lesion unquestionably is Paget's disease. As mentioned before, the bodies of the lumbar vertebræ are flattened and widened in osteitis deformans, whereas in malignancy there is little if any change in the shape of the vertebræ. If the skull shows the pathognomonic changes of osteitis deformans, that is, thickening and density of the inner table, thickening and the finely porous appearance of the outer table, with scattered nodules of bone over the vault, the diagnosis is certain.

In the osteoclastic and mixed osteoplastic and osteoclastic types of metastasis the differentiation should not be difficult as in these lesions areas of extreme density and destruction of bone may be seen.

Conclusions

1. As the clinical diagnosis of osteitis deformans is not always possible, especially in the early stages of the disease, careful roentgenographic study should be made of many bones, particularly of the skull and long bones, of all patients suffering from bone deformity or bone pain.

2. The possibility of bone metastasis should be kept in mind when osteitis deformans is diagnosed in the spine and pelvis.

3. Many bones are involved by the disease process and the bone changes when seen in the skull are pathognomonic.

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Possibilities of Intra - Vaginal X - Ray Therapy With Description of Technique*

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THE intra-vaginal application of the x-rays is by no means an innovation in x-ray therapy. For one reason or another the method has fallen into disuse and at the present time it is the exception rather than the rule to treat intra-vaginal conditions by directing the x-rays into the vagina.

The author is cognizant of the superiority of radium in treating the cavities, but this substance is not within the reach of all and even when it is, there are probably some cases where the x-rays would be preferred—if they could be used conveniently.

Assuming, then, that the above premise is correct, it follows that the most convenient method of employing the x-rays with respect to accessability of part treated, distance, and patient's comfort, is the one to be adopted.

Any measure that offers even a modicum of assistance in the successful management of malignant disease is thankfully received, and with respect to radiant energy in general the dictum may at this time be safely promulgated that the quantity to be delivered in a given case of malignancy is that which stops just short of accomplishing more harm than good.

During the past summer the urgent need for radiotheraphy in a certain case of inoperable carcinoma of the vagina and cervix, prompted the use of the x-rays by a technique with results which apparently justify more than passing notice.

Mrs. W., age 39, was first seen by Dr. A. B. Little of Takoma Park, D. C., April 26, 1920, who recognized the condition promptly and referred her to Drs. G. Dent Townsend and E. M. Parker, Washington, D. C., for surgical treatment. Dr. Townsend's report is as follows:

"There was a profound cachexia and emaciation which was in keeping with the alleged 35-pound loss of weight during the previous five months of her illness. Vaginal examination showed a cauliflower mass involving the cervix, which bled easily and from which exuded a sero-sanguineous, offensive discharge. The anterior vaginal wall showed ulceration and induration for half its length and the posterior wall to a lesser degree. The uterus was enlarged with absolute fixation and no satisfactory opinion could be given with reference to the adnexa on account of invasion in that region. The rectum was apparently not involved. The bladder was negative excepting for tenderness and frequency of urination which was increased by my examination. There was a rather profuse hemorrhage the day following the examination, which was controlled by a pack.

Fig. I.—Close up side view, showing the method of supporting the legs and the x-ray tube in position.

I considered the case inoperable and in consultation with Dr. Parker referred the case for x-ray therapy. After the first application of the x-rays I removed a small fragment of the tumor for laboratory study, and received a report from Dr. Lester Neuman to the effect that it was a "flat cell carcinoma".

"Again in October I examined the patient and found a complete disappearance of the cachexia with a gain in weight of 25 pounds. The mass in the vagina was replaced by apparently healthy healed scar tissue, and the remnant of the cervix was represented by a small granulating surface corresponding to the internal os from which there was a muco-purulent discharge. The thickened walls of the cul-de-sac made examination of the uterus difficult, but it could be quite readily found retro-displaced and normal in size. For a case that seemed hopeless in April the results so far are very gratifying."

Treatment: The patient was admitted to Garfield Hospital, May 25, 1920, and received intra-vaginal x-ray treatments from then to November 8, 1920, at varying intervals—a total of one hour and 50 minutes unfiltered x-ray from a Coolidge tube passing 6 ma. at an anode cervix distance of 12 inches, back up an eight-inch gap for 15 and 20 minutes at each treatment.

In addition to this, cross-firing through skin areas—four anterior and four posterior—was resorted to with the ordinary deep therapy technique at the usual intervals. The very definite improvement in the appearance of the growth at the time of the second intra-vaginal raying leaves no room for doubt that the malignant cells were rapidly responding to the rays directed into the vagina, as the cross-firing from without was wholly inadequate in this brief period to have excited any material change.

Fig. II.—View looking from the head toward the feet, showing the method of suspending the legs in slings and the method of taking care of high-tension wires.

The intra-vaginal treatments were followed by nausea identical with the well-known x-ray sickness, and rather more apparent than when treatments were given through skin areas. The results were all that could be expected. There was a return to normal weight, a normal blood picture, and a general feeling of well-being.

As an additional factor of safety, on November 11, 1920, the patient received 1,000 mg. hours of radium applied to the interior of the uterus,—and additional treatments are contemplated. Under date of December 6, she writes from New York that she has gained an additional three pounds, now weighing more than ever before.

Technique: The apparatus required for this method of intra-vaginal raying, in addition to the usual transformer, treatment or other convenient table and treatment stand, consist of two six-inch lag screws with hook turned at one end; two small iron pulleys; one three-inch T bandage; one glass speculum of special design; a square of lead with hole to admit speculum; two roller towels, and enough rope of the kind commonly sold as "clothes line", to reach double the distance from a substantial bracket on wall

Fig. III.—View showing how close the tube is brought in between the thighs without danger of short circuiting the high-tension wires.

or base-board to the pulleys, which are fastened to the lag screws previously placed in the ceiling. The pulleys and screws should be so placed that the ropes when taut will clear the overhead wiring system and extend downward, forward and inward at approximately 45 degrees to the patient's knees. The patient occupies the dorsal position with the hips well elevated by sandbags suitably covered. The towels are adjusted to either leg by making a noose and passing it over the leg to support same by the full width of the towel—the free ends being tied to the ropes which are drawn through pulleys, and are then fastened securely to wall brackets, bringing the thighs at right angles to the body.

The speculum is then inserted through the lead mask into the vagina—the folds of the vaginal wall being pushed aside by dressing forceps and gauze sponge if necessary. The tail of the T bandage is brought forward over the base of the speculum and pinned or tied to the abdominal portion. The treatment stand is fitted with a cone one and one-half inches in diameter and brought to the side of the table and so adjusted that the beam of light from the filament is directed into the speculum, which should just clear the cone. The only remaining adjustment is to fasten a string to the lower high tension wire and pull it clear of the tube when it may be fastened to any convenient object.

The speculum was constructed according to the author's design by a Philadelphia Glass company. It is a cylinder of glass two and three-fourths inches on one side and four inches on the other. It has at its base a flange of glass three-fourths inch wide and the diameter of the aperture is one and one-half inches. The speculum is inserted through a hole slightly larger than its diameter in a square or lead sufficiently large to protect the perineum. The glass is approximately one-eighth inch in thickness.

Patients readily submit to this treatment and complain only of the discomfort produced by the speculum. Exposures of 20 minutes are easily borne. This method obviates the danger of accidental contact with high tension currents, permits the treatment cone to be brought practically into contact with the external genitalia and assures definite radiation to the walls of the vagina, as well as the cervix and adjacent structures. At a 12-inch distance the diameter of the intra-vaginal area receiving the full intensity of radiation is three inches. And with the formula 6x8x20-12x12, without filter, each treatment amounts to approximately 12 skin units,—using the standard for one skin unit as designated by Drs. Wm. D. Witherbee and John Remer of New York. However, the earlier treatments in this case were administered with the idea of delivering a maximum quantity of x-rays and it was not until their article appeared in the American Journal of Roentgenology that the actual number of skin units was determined.

*—Read at Annual Meeting Radiological Society of North America, Chicago December, 1920.

Department of Technique

IT IS the purpose of this department to render a personal service to all subscribers of the Journal. In view of this fact, we hope that all of the readers may feel free to ask questions of us. If you will send these questions to the Journal office, you will receive answers to questions in the following issue of the Journal.

In order that one may have his technique properly systematized, it is necessary for him to adopt certain fundamental rules which shall govern the examination at all times. For a number of years we have adhered to the following rules in our office:

1. Plates of all fractures should be made in two planes.

2. Stereoscopic plates should be made of all heads, shoulders, wrists, sacro-iliac region, foreign bodies and chests. Others as indicated.

3. In sinus examinations, all of the sinuses should be examined as a routine.

4. In gastro-intestinal work, not less than three plates should be made of the stomach at the first examination. Others as indicated. There should be at least one plate of the colon. The opaque enema should be used as a routine in colon examinations, which should be followed by stereoscopic plates.

5. All chest plates should be made with the film and double intensifying screen, with the patient in the upright position unless the patient is extremely ill, the two exposures being made instantaneously while the patient holds the breath. The patient should not be allowed to breathe between the two exposures.

6. The dark room should be kept scrupulously clean. If chemical solutions are spilled about and allowed to dry, the chemicals contained in the solution become powdered and float about the room and will be deposited on the plates and other material, causing a fog which is hard to trace.

7. Fresh developing solution should be made at intervals not longer than two weeks when tank development is used, oftener, if needed.

8. Fresh hypo solution should be made once a week in tank development, oftener, if needed.

9. The temperature of the developing solution should be kept between 65 and 75 degrees Fahrenheit. A thermometer should be used to determine the temperature.

10. Distilled water should be used in making all chemical solutions.

Opaque Meal in the Liver Ducts

F. B. Stephenson, M. D., Denver, Colo.

My reasons for reporting this case are its novelty and the bearing which the unusual phenomenon observed may have upon our conception of the etiology of inflammatory conditions of the liver and its ducts. I have not been able to find a similar case reported except one which is described by Carman and Miller.* In that case, however, there had been adhesions of the gallbladder to the duodenum with rupture so that the barium meal was thought to have entered the bile ducts by way of the gallbladder.

Mr. A. V. A., age 56, was referred to Dr. L. H. Wade and myself by Dr. J. N. Hall, January, 19, 1920, for roentgen gastrointestinal examination. He complained of having had stomach trouble 18 years. In January, 1916, his gallbladder and appendix were removed; no stones were found. He was said to have had a "mulberry" gallbladder. Previous to his operation he had been troubled for some years with pains across the upper abdomen but mostly on the left side, which would come on two or three times a day and last a few hours; he would be free from pain a few days at a time. He had never vomited but belched "hot" stomach contents. He was not relieved by the operation, but the character of his pain is now somewhat different. It wakes him up about daylight so that he can sleep no longer and he arises. Occasionally the pain will come on in the day time. It is epigastric in location and makes him "catch his breath". Eating or drinking relieves it and it comes on again if he goes as long as five hours without eating. The clinical diagnosis of Dr. Hall was ulcer. The x-ray examination was confirmatory but somewhat doubtful on that point, because the spastic deformity seen could be due to other reflex causes; but he was treated for ulcer with immense relief and gained 12 pounds in the year following his examination. About one month ago he began having trouble again and it was found he had stopped his dietary regimen.

In the course of this patient's original x-ray examination it was seen under the fluoroscope that the barium began to travel upward in unusual channels. Plates taken afterwards showed that it was unquestionably in the larger bile ducts at first and that it passed progressively into their ramifications. This led us to study the case with particular care and we secured a series of plates which are shown. One year later I prevailed upon the patient to allow me to give him a second examination and found the same condition to exist as was present the year before. It will be seen on the six-hour plate that there is present a residue in the duodenum which by some writers has been looked upon as a duodenal diverticulum and by others is considered to be a dilated ampulla of Vater. This was present on the 24-hour plate. The writer has a number of records on file showing a similar condition, but in none of these cases did the barium traverse the bile or pancreatic ducts. I have endeavored to find out whether there was a connection in this case between the common ducts and this duodenal residue, but could not do so.

It is interesting to speculate upon how a person can go along day after day with duodenal contents going up into his liver regularly, as must be the case with this man, and yet have no symptoms of infection of the ducts. While it seems impossible that the stomach contents, as they enter the duodenum, should constantly and regularly be sterile (for we know that the stomach begins to empty itself almost immediately after eating and many pathogenic organisms must at times enter the

No. 1—20 minutes after barium ingestion barium in larger branches of bile ducts.

duodenum in a live state), nevertheless, the ducts in this patient being vulnerable and yet giving no symptoms of infection would seem to point to such sterility. In many cases of ruptured duodenal ulcer there has been found to be little, if any, infection of the peritoneum, a moderate inflammatory reaction being attributable to chemical and mechanical irritation. The supposed sterility of the escaped contents in such cases has been laid to the excessive hyperacidity which attended the condition. In this case, while there had been hyperacidity it was afterwards regularly relieved by alkaline treatment and the stomach juices so neutralized could hardly be quickly germicidal. This man has pain, to be sure, but it is relieved by eating and by alkalis and is probably due to ulcer.

It is possible that following his cholecystectomy, five years ago, this man has developed a dilated common duct as has been shown to happen in many cases following gallbladder removal and that this dilatation has extended within the duodenal wall and resulted in an open stoma which offers no resistance to the backward passage of duodenal contents. The barium was found to leave the ducts

No. 2—35 minutes.

rather slowly when the patient was erect and when he would lie down it would again fill them. Is the secretion of bile so slight during stomach digestion that the ducts are practically empty? They must have been fairly free of bile into the duodenum varies considerably in the normal. The variations in the formation of the ampulla were studied with reference to this case, but they do not throw any light upon the phenomenon in question. Whether a part of this

No. 3—40 minutes. The common duct is here plainly to be seen.

in this case to allow the barium mixture to extend into the finer branches, and the secretion sluggish to permit of its remaining as long as it did. The anatomy of the common and pancreatic ducts at their point of union or opening barium was in the pancreatic ducts was not determinable. The remarkable feature of the case is that while the condition has existed at least over a year the patient at present has no evidence of hepatitis or choledochitis.

No. 5—6-hour plate. Some of the finer branches still filled.

No. 4—4-hour plate.

No. 6—One year later. Larger branches again barium filled.

The X-Ray Diagnosis of the Diseases of the Alimentary Canal

ALBERT M. PFEFFER, M. D., WICHITA, KANS.

IN 1895 Roentgen (1) announced that the salts of metals, either solid or in solution, obstructed the passage of his new rays. Within two months Dutto (2) proposed the possibility of rendering hollow viscera visible by injecting them with salts. A month later Becher (3) published a roentgenogram of a dead guinea-pig in which he had distended the stomach and a loop of small intestine with lead subacetate. Hemmeter (4) accordingly devised an intragastric bag and proposed that the bag be pushed into the stomach and filled with lead subacetate, thus enabling the shape of the stomach to be outlined on a roentgenogram. W. B. Cannon (5) of Harvard, at the meeting of the American Physiological Society in Boston, December, 1896, made the first public demonstration of the movements of the alimentary canal when he exhibited the phenomena of deglutition by feeding a goose with gelatin capsules filled with bismuth subnitrate. In April 1897, Rumped (6) rendered a pathologically dilated oesophagus visible by pouring into it 300 cc. of a 5 per cent suspension of bismuth subnitrate. To the Harvard Laboratory falls the credit of being the first to use the heavy metal salts mixed with food for x-ray purposes. Observations of gastric peristalsis were presented by Professor Bowditch (7) of Harvard at a meeting of the American Physiological Society in Washington, May, 1897. Roux and Balthazzard (8) at a Paris meeting of the Societe de Biologie, July, 1897, reported similar observations in dog and man. For their human subjects they use 15-20 grams bismuth subnitrate in 100 cc. water. They could, however, only observe the lower part of the greater curvature. In 1903 Williams (9) published the results of roentgen work on the alimentary canal comprising observations on stomach, small and large intestines. In 1905 Rieder (10) reported his thorough study of the human alimentary canal by the x-rays.

X-ray revealed much pertaining to the physiology and pathology of the gastro-intestinal tract. The passing of ingested food along the lesser curvature as observed by the fluoroscope gave W. J. Mayo (11) the suggestion for his irritation theory of the causation of carcinoma of the stomach, namely, that the constant irritation and changes of hot and cold food substances affecting the lesser curvature explain the occurrence of ulcer and cancer in that region in 80 per cent of the cases.

While the opaque meal has since been changed from the subnitrate to the subcarbonate and the latter substituted by barium sulphate, yet the principles are the same, and all the modern achievements in x-ray diagnosis of the alimentary canal rest on the foregoing fundamentals.

General Considerations.

The x-ray diagnosis of the diseases of the gastro-intestinal tract depends upon the introduction into the alimentary canal of an opaque substance which completely fills the lumen, and observing its passage through it. The evidences obtained are direct and indirect. The direct evidences are abnormalities in contour, size, and position, viz:

Filling defects
Projections into the lumen
Niches
Diverticula
Hour glass deformities
Dilatations or narrowings
Changes in positions of organs.

The indirect evidences are abnormalities in function, viz:

Changes in emptying time.
Stasis
Spasms
Hyperperistalsis or antiperistalsis.

The different x-ray findings in the various organs under consideration in this thesis will be discussed separately with the diseases peculiar to them.

The Opaque Substance.

The opaque substance commonly used is "Barium Sulphate for X-ray Diagnosis," superseding the bismuth subcarbonate, which by its alkalinity interfered with the normal re-actions, and the still earlier bismuth subnitrate which was toxic. It is administered as meals by mouth, and as enemas per rectum. The following requirements are laid down by Carman: [12]

1. It should be more or less palatable.

2. Thick enough to hold the salts in suspension.

3. Thin enough to fill all recesses.

4. Not stimulating or neutralizing gastric secretions.

5. Not productive of early pyloric closure.

6. Must be an even, smooth emulsion, not lumpy.

7. Of definite composition to give uniform results.

8. Should be easily and quickly prepared.

The most commonly used formula for gastric and small intestinal examination is: seven ounces of chemically pure barium sulphate stirred into one pint of buttermilk made from the whole milk. Where this cannot be obtained an emulsion of mucilage of acacia and barium sulphate with water can be substituted. The amount, however, varies with the size of the individual.

The x-ray examination of the oesophagus presents a special problem because of the rapidity of emptying. The most used is the suspension outlined by Hirsch (13) which, due to its high content of mucilage, adheres well to the walls of the oesophagus, especially to any ulcerated surface, and can be easily washed off. A unique method, described by Bassler (14) and Nines (15), consists of the introduction of a rubber tube with an inflatable bag at the end, into the stomach. This is then filled with water and pulled into the cardiac orifice. Thus the oesophagus can be kept filled with the barium meal and roentgenograms can be taken. Spangler (16) inflates the stomach with gas, in examinations of the oesophagus, thus obtaining the best view of the cardiac orifice. If a diverticulum is shown, the pocket is best demonstrated by the usual barium meal.

Preparation of the Patient.

Smithies (17) washes the stomach, gives a purgative the day before examinations, and keeps the patient on a liquid diet for 12 hours. But it is generally condemned because the normal function is masked. No catharsis is is allowed in upper tract examinations. For the opaque enema the colon is flushed previously. The patient should present himself, however, with an empty stomach. All drugs having any stimulating or inhibitory effect upon the digestive tract should be withdrawn at least 24 hours before the examination. Only where it is necessary to differentiate between spasm of reflex and of organic origin, belladonna, in the form of the tincture to tolerance, or 1-100 gr. atropine hypodermically is used at the time of examination.

The Oesophagus.

The normal oesophagus is best observed through fluoroscopy. Abnormalities of the oesophagus are:

1. Diverticula.
2. Benign strictures.
3. Malignant new growths.
4. Spasms.

Diverticula may lie anteriorly, posteriorly or laterally and should be viewed from all sides. The symptoms are: Swelling in neck, periodic emptying of putrefactive food, and gradual emaciation. X-ray findings show a shadow to one side of the lumen remaining after the oesophagus is empty.

The benign strictures usually result from irritating caustics such as phenol or lye passing down the oesophagus in attempted suicides or taken by mistake by children.

The malignant growths are made evident by the x-ray by the amount of obstruction as well as by the site of the lesion which can be easily demonstrated. A diagnosis of malignancy is made by the "bitten out" appearance of the growth and by its location at the cardiac end. At times stomach involvements may be shown.

Not infrequently foreign bodies lodge in the oesophagus, especially in children and the insane. Portions of food, coins, fish bones, pins, plates of false teeth are the usual articles. Both diagnosis and removal are often possible by the fluoroscope.

Spasms.

Hysterical strictures arising chiefly in neurotic women at times associated with some slight abrasion or ulceration originating from impaction of a fish bone are of common occurrence. The symptoms are: difficulty in swallowing, and the "globus hystericus" are intermittent in character. Usually, reflex spasms will relax by administration of belladonna.

The Stomach.

The normal stomach varies in size and position in different individuals. Several types are recognized; the high traverse stomach of fat people, the cow horn type of medium weight, and the fish hook type common in thin individuals. There are slight changes in the normal motility of these normal stomachs. George and Leonard [18] observed that the normal stomach possesses individuality and with the same technique the same stomach will appear alike in successive examinations. Normal outline may be interfered with by pressure of neighboring organs as: distended colon, hypernephroma, enlarged duodenum, enlarged gallbladder and from the spine.

Gastric Ulcer.

The peptic ulcer is usually a circumscribed area, varying in size, situated about the pylorus, and with few exceptions involves the lesser curvature or the posterior wall. The ulcer usually becomes chronic and produces induration with deformity.

To demonstrate these ulcers the prone and lateral positions are used. The prone position shows in profile the greater and lesser curvatures, while the lateral position shows the anterior and posterior walls. Of course, proper examinations for peristalsis and general outline are made by the fluoroscope.

X-ray of stomach affords both direct and indirect evidence of gastic ulcer pathology. The direct evidence is based upon the following variations from the normal:

1. Bismuth in the ulcer crater. When found is pathognomonic, but may not often appear because of the crater being filled with secretions and food debris.

2. Passage of bismuth through the wall in perforations. Bismuth is found outside the wall of the stomach in a small pouch or pocket, usually of connective tissue. Often-times it contains a bubble of gas. Haudek in 1910 was the first to describe this phenomenon, after whom it was named, Haudek's niche.

3. Filling defect in shadow from induration about the ulcer, due to a local rigidity in the wall showing no evidence of peristaltic waves over an area usually on lesser curvature about two inches

in diameter. Repeated exposures of one-quarter second will usually produce a blurred outline of the wall due to the presence of peristalsis, but over the indurated area the outlines will be definite, because of absence of peristalsis. The fluoroscope and palpation are used for corroborative evidence.

4. Hourglass deformity: Hourglass deformities must be ascertained whether functional or organic, and if organic must be determined whether due to the induration of chronic ulcer, or due to new growth and adhesions. According to Crane the following differentiation is made between the hourglass of chronic ulcer and the new one of new growth:

Chronic Ulcer.

Hourglass, Sacculated.
Sulcus, band-like and smooth.
Connecting isthmus, eccentric nearer lesser curvature.

New Growth.

Funnel-like, broad and irregular.
Centrical, with symmetrical annular defect.

5. Pyloric obstruction, other than from new growth, cases of 24-hour residue are usually due to the following causes: (1) benign cicatrix of long duration as proven by an associated secondary dilation with hypertrophy of the stomach, and violent peristalsis; (2) new growth, differentiated from cicatrices by their own characteristic appearance, and because of short duration there is no marked dilatation of the stomach.

The indirect evidence of gastric ulcer, non-positive evidence, is based upon the following:

1. Delayed emptying time of the gastric residue by spasm of pylorus, usually after eight or ten hours.

2. Incisure on greater curvature suggest ulcer in opposite side.

3. Abnormalities of peristalsis, and tender points over gastric shadows during fluoroscopy, are of lesser significance.

Franklin W. White [19] is of the opinion that none of the signs of indirect evidence can be relied upon for diagnosis, as spasms, six-hour residue, and changes in peristalsis may be produced reflexly from gallbladder disease or chronic appendicitis or neuroses.

New Growth of the Stomach.

The technique and routine are the same as in ulcer. Fluoroscopy is used while the patient ingests the meal, and observations as to hypermotility, peristalsis, and antiperistalsis are made. Then a series of plates in various positions is taken.

The diagnosis is based upon the presence of a filling defect in the gastric shadow. In the greatest percentage of cases it is found at the pylorus, especially when early. In some cases it is found in the cardiac end.

The defect is usually annular, and in the early cases appears as an elongation of the pyloric gap. The annular appearance distinguishes this from the gastric ulcer of the same region. The filling defect when found in plates of lateral positions definitely eliminates the question of pressure defects, by gallbladder, liver, etc.

The defect is usually irregular and serrated in outline. When this is present it is of pathognomonic significance. The later cases present a more extensive and more pronounced picture of the earlier ones. The canalization is extended over a greater portion of the stomach. The irregular "bitten out" outline presents now fingerlike projections into the shadow.

George and Leonard report cases of carcinoma where the stomach walls were very rigid and a tubular canal extended its whole length. On the screen peristalsis appeared to be absent. In such cases although the emptying time is very rapid the patient can eat but very little at a time.

The hour glass appearance resulting from new growth should be differentiated from the one resulting from chronic ulcer (vide supra).

In conditions of degenerating chronic ulcer a roentgenogram presenting carcinoma appearance is of greatest significance, as a resection rather than a mere gastroenterostomy is to be performed.

The negative plate with the proper technique is very positive in eliminating carcinoma.

Rarer Stomach Lesions.

D. C. Balfour [20] reports a case of polyposis of stomach which becomes quite evident by x-ray methods. A number of cases of polyposis of the stomach with accompanying roentgenograms have been reported also by George and Leonard. George W. Holmes [21] calls attention to the presence of pedunculated tumors of the stomach easily diagnosed by fluoroscopy. He reports two cases, one having been diagnosed pathologically as a fibrosarcoma, the other as lymphangio endothelioma. He remarks that Fenwick reported the only other case in the literature of fibrosarcoma of the stomach. Von Posvic [22] observed that in syphilis of the stomach the administration of antispasmodics causes an unusual discomfort, nausea, and depression.

Albert M. Cole [23] of Indianapolis reports a case of a diagnosis of hourglass stomach by x-ray methods after four days' administration of 80 to 120 minims of the tincture of belladonna, which was found to be spasmodic in origin and was due to a diseased appendix.

[24]. He also reports a rare case of hourglass stomach with adhesion of the second portion of the duodenum to the cardia, and communicating with it through a perforated ulcer. The condition was diagnosed by observing the process of filling on the screen.

A. F. Tyler [25] reports a case of a jejunal ulcer at the site of a gastroenterostomy performed four years ago and the Murphy button having been retained since. He adds the interesting remark that the opaque meal and a course of bismuth subnitrate proved to be of therapeutic value.

Cases of diaphragmatic hernia have been reported by Andrew J. Grant [26] as a result of gun shot wounds. He described a case of soldier who suffered pain of any description immediately after taking food, and had been treated for many months as a case of gastritis. At an x-ray examination it was found to be a diaphragmatic hernia of the stomach reaching to the level of the third rib. A number of cases following gun shot wounds have been reported in the war literature. In children it occurs congenitally. They are mostly diagnosed by x-ray.

The Duodenum.

The duodenal ulcer—Cole bases the diagnosis of duodenal ulcer by x-ray methods upon the following:

1. If normal, the first portion of the duodenum can always be demonstrated on the plate with characteristic shape and smooth outline.

2. Ninety-five per cent of all duodenal ulcers occur in the first portion.

3. A constant defect in the duodenal cap on the plate means a pathological condition, either; (a) ulcer, (b) adhesions due to cholecystitis, or anatomical or accidental abnormalities as pressure from adjacent organs.

4. Any duodenal ulcer other than a simple erosion will distort the outline of the barium mass.

5. With the exception of the minute recent ulcer, a normal "bulbus duodeni" rules out a chronic indurated, or surgical, ulcer. It, however, may have a minute recent perforated ulcer.

Conditions interfering with the demonstrations of the first portions of the duodenal are: (a) pyloric spasms; (b) pressure from adjacent organs such as enlarged and distended gallbladder, enlarged lobes of the liver, etc.; (c) spasms due to chronic appendicitis, obstructive conditions of the intestines.

At times a number of plates must be taken in various positions.

George and Leonard state that an incisura opposite the ulcer is found in the duodenum in cases where the musculature and connective tissue have become involved.

Dr. Wm. J. Mayo [27] published a number of cases of duodenal ulcers of the anterior wall showing merely a pin point defect on the mucosal surface with some mucous membrane heaped upon it. But the amount of callus and induration is, however, much greater, and is therefore shown on the plate under the proper technique. Carman of the Mayo Clinic lays less emphasis upon the direct evidence in duodenal ulcers, but employs mainly the indirect evidence based upon a major and minor group of signs. The major group of signs consists of evidence of hyperperistalsis, six-hour gastric residue, and demonstrable diverticulum of the duodenum. These signs are worth more than 95 per cent in the diagnosis of duodenal ulcers, according to Dr. Carman. His group of minor signs includes hypermotility, hypertonus of the stomach, pressure tender points, lagging of bismuth, and deformity of the outline of duodenal cap. He has, however, later on admitted laying chief emphasis upon the direct evidence found in the change of the outline, recognizing it as the most important sign.

Other abnormalities of duodenum—Payne and Thayer [28] report five cases of barium stasis of six hours and longer, one case as long as 48 hours which could have easily been interpreted as penetrating ulcer or diverticulum, but proved to be a dilated and patent common duct resulting from a general visceroptosis and relaxation of the ampulla by previous passages of gall stone.

Case [29] likewise calls attention to the fact that barium stasis in the common duct and in the smaller duct of Santorini in certain cases of abnormal dilatation or patency.

W. A. Downes [30] reports a case of giant duodenum in a child four and one-half years old. Weighed six pounds at birth, 29 pounds on admission to hospital. Had frequent fits of vomiting at intervals. At operation the duodenum was found enlarged to the size of the stomach. The entire length was involved. The enlargement stopped abruptly where the gut passed under the superior mesenteric artery. The condition was diagnosed by x-ray.

Pauchet [31] reports a case of dilatated duodenum with kink and dilatation of the last loop of the ileum. X-ray showed an enlarged duodenum emptying with difficulty. A last loop of ileum emptied after 30 hours. The condition seems to be due to ptosis with traction on mesentery and vessels causing stasis and chronic toxæmia.

Vanderhoof [32], Bloodgood [33] and Kellogg [34] called attention to a condition of angulation of the duodenum due either to mesenteric bands pulling it to the liver, or to an exaggerated visceroptosis, resulting in an obstruction. The clinical picture is vomiting, pain in the right hypochondrium, obstinate constipation with almost colorless stools, and vague toxic symptoms. The roentgenological findings are:

1. Marked retention in duodenum.
2. Writhing and twisting of the duodenum.
3. Reversed peristalsis.
4. Tenderness at the angle of Treitz.
5. Dilatation of duodenum.
6. Some cases will be relieved by change of position.

H. P. Ritchie [35] reviews 75 cases of diverticula discovered roentgenologically, one case being a pseudo diverticulum caused by sacculation of an ulcer scar. He also reports a case of his own where a very large diverticulum was found in close proximity to an ulcer in the first portion of the duodenum.

Gallbladder

The technique is the same as for soft tissue work and the value of the plates depends upon their completeness in showing the greatest possible degree of detail. Usually no catharsis is advised as the resulting gas is more confusing than possible fecal concretions. With a small cone pointed obliquely downward parallel to the under surface of the liver, so that the under surface appears as a clear cut line, the gallbladder can usually be detected. Stereoscopic plates may be taken. The plates should show the entire region between the eleventh rib and the crest of the ilium. Along with the examination of the gall bladder, an entire set of plates of the gastro intestinal tract should be made for the demonstration of bands of adhesion, or for other concomitant lesions.

Cholelithiasis: There are three types of stones: (1) calcium stones, they usually show easily; (2) cholesterine; (3) mixed, nucleus of one with coating of the other.

George and Leonard state that with the modern technique, 85-90 per cent of cholelithiasis can be demonstrated on the plate. At times the superimposed plates are matched together thus intensifying whatever evidence cannot be recognized otherwise. Lantern slides made of superimposed roentgen plates may some times accentuate and bring out details. A magnifying glass may aid especially in bringing out the faceted side of a calculus.

Identification of the gallbladder aids materially in detecting calculi. The shadow cast by the long periphery of the stone makes it visible, explaining the fact why only one of a series of plates shows the stone better than all the rest.

Biliary calculi may be confused with: (1) fecal concretions; (2) calcified mesenteric glands; (3) costochondral ossifications; (4) stones in kidney and liver; (5) food in the duodenum or colon at hepatic flexure.

The clinical history with characteristic gall stone symptoms does not always agree with the x-ray diagnosis.

Small Intestine.

Pathological conditions demonstrable by x-ray of the small intestines are: (1) malpositions, either congenital or acquired; (2) functional diseases; (3) organic diseases, ulcer, new growth; (4) displacements, leading to diagnosis of enlarged spleen, kidneys, tumors (extraintestinal), aneurysm or enlarged mesenteric glands.

Exposure must be very short as the intestine is constantly in motion.

Stasis in the small intestine is diagnostic of obstruction, and may lead to the diagnosis of various mechanical causes.

Various intra-abdominal herniæ may be easily diagnosed. Many reports have been made by various roentgenologists of stasis at the lower end of the ileum due to Lane's [43] kink. The symptomatology of Lane's kink often simulates appendicitis in causing pain and tenderness about the site of the appendix.

Adhesions causing stasis can often be diagnosed but x-ray only must not be relied upon.

Ulcer of the jejunum has been studied by Carman, and was found in a definite percentage of the cases. These occur chiefly at the site of a gastroenterostomy.

Diverticula.

Diverticula in the small intestine are not as common as in the large. Meckel [37] was the first to point out that disturbances in the involution of the omphalomesenteric duct may lead to the formation of a diverticulum near the ileocecal valve. King [35] reports two cases where umbilical tumors were found directly communicating with Meckel's diverticulum.

In new growth of the small intestine there is obstruction, filling defect, and dilatation of the proximal portion where it simulates large intestines. It is differentiated by the characteristic shadow of the valvulæ of the intestine. Adhesions obstructing the lumen will simulate new growth, but are most apt to occur in the right lower quandrant in connection with appendicitis and diseases of pelvic organs.

H. G. Sloane [38] after reviewing 50 cases in the literature, reports one of his own of a cystic degeneration of the small intestine diagnosed by x-ray.

Appendicitis

Pfahler [39] bases the diagnosis of appendicitis upon the following signs:

1. Localized tenderness—most valuable sign, elicited either by direct palpation with the gloved hand or by a (distinctor), tenderness may be movable by moving around the appendix. When appendix is invisible palpation is made of the cecum.

2. Demonstration of the appendix. Case [40] reported demonstrable appendices in 273 out of 763 cases. George and Gerber [41] visualized it in seven out of every ten. George and Leonard state that in every case where the lumen of the appendix is not obliterated the barium in buttermilk will fill the appendix and render it visible. They use 90 grams of bismuth or equivalent in barium in a pint of buttermilk. Case emphasized the horizontal position and the taking of front and back plates. Sometimes a retrocecal appendix may be shown by a lateral oblique position.

3. Fixation: Appendix found to be immovable may be bound up by adhesions to various adjacent organs.

4. Position: Normally downward. Where otherwise is probably due to inflammatory products.

5. Kinking or angulations.

6. Constriction and dilatation or irregularity in lumen.

7. Abnormal retention.

8. Incompetency of ileocecal valve seen by opaque substance regurgitating through it into the ileum, signifies reversed peristalsis.

Other roentgenological evidence of pathology in the right lower quandrant is:

1. Enteroliths in cecum, demonstrated in cases by Stamm and Pfahler, gave rise to pain and recurrent diarrhoea.

2. Adhesions of cecum to rectum caused symptoms of chronic constipation with constant desire for rectal expulsion.

3. Carcinoma of cecum—gave roentgenological localized tenderness in addition to the filling defect. It is differentiated from appendiceal abscess by its characteristic serrated outline.

4. Psoas abscess: Simulates chronic appendicitis by its local tenderness, but the normal roentgenological findings lead to an examination of the spinal column and to the diagnosis.

6. Urinary calculus: Roentgenological findings usually determine the diagnosis.

Hertz [42] recommends that a screen examination of the appendix should always be made before the opaque substance is administered to determine the presence of fecal concretions.

The Large Intestine.

For examination of the normal colon and for stasis the usual meal is employed, but for particular colon pathology the enema is used. The opaque enema is passed into the large intestine through a soft rectal tube inserted about two inches. The container should never be higher than three feet above the patient. Following are the conditions diagnosed:

1. Constipation: Bismuth is found after 48 or even 96 hours after the meal. The diagnosis of the chronic or spastic colon can easily be made by the appearance of the shadow. Where stasis is due to mechanical obstructions the cause can usually be located.

2. New growths: Appear as distinct and permanent filling defects usually annular or funnel-shaped with proximal dilatation. Swartz observed that frequently a growth will not offer obstruction to the meal, but will obstruct the enema. He explains this phenomenon by the fact that the growth has adapted itself to the natural direction of the stools and became funnelized.

The fluoroscopic observation is important, as tumors can often be palpated at the place of obstruction to the enema. Care must be taken not to confuse with some normal pressure defects due to spine or diverticula.

3. Adhesions: Produce effects similar to those of new growths and must be differentiated by the history. The hepatic flexure is

one of the most frequent locations for such adhesions resulting either from gallbladder lesions, or from the congenital Jackson's [44] membrane. Albert M. Cole [45] reports a case of pericolitis sinistra or a band of adhesion at the splenic flexure corresponding to the Jackson's membrane. The appendix region is another favorite location for bands. Postoperative adhesions in pelvic diseases may cause distortion of normal outline and obstruction.

4. Displacements: May be caused by enlarged intra-abdominal organs or tumor. A pneumoperitoneum will often help to diagnose.

5. Colitis: Mucous: Can be demonstrated by a coating of bismuth remaining after the passage of the meal, the coating adhering to the mucus on the walls.

The ulcerative colitis is demonstrated similarly.

Lawrason Brown and Homer L. Simpson [46] report analyses of 175 cases examined by x-ray for tuberculosis colitis. The chief criteria are hypermotility and filling defects. These conditions could not be diagnosed otherwise. Of the 175 cases 44 were positive, 28 of the 44 were operated upon and in 27 the diagnoses were confirmed.

6. Diverticulitis: By the aid of x-ray this condition has been diagnosed quite commonly. Multiple diverticulitis is found in the descending colon and sigmoid shadows occurring in groups and under the screen can be manipulated to show their relation to the wall of the bowel. They usually retain the opaque substance for four or five days. Case reports one with retention of 16 days. Diverticula will often cause difficult problems to the surgeon. George F. Straub [47] reports a case where a diverticulum of the descending colon caused pressure upon the left ureter and produced intermittent hydronephrosis, the patient emptying a large amount of urine after the evacuation of the diverticulum which took place regularly every five days. Straub diagnosed the condition by the opaque enema.

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The May Issue

THE May issue of the Journal will be a special Boston number and will contain interesting material relative to the city of Boston, featuring points of interest to medical men, especially. There will also be the usual amount of scientific material, together with a brief historical survey of the part the Boston medical profession has played in medical history. A biographical tribute will be paid the late Walter J. Dodd and Oliver Wendell Holmes, and a resume of the work done by W. B. Cannon, on the examination of the gastro-intestinal tract by the use of opaque substances, will also be given. These facts alone, speak for a number which will be extremely interesting to every physician whether he is engaged in radiology or not.

The Boston Meeting

A GREAT deal of interest is being manifested by the members and friends throughout various parts of the country in the meeting which is to be held at Boston, June third and fourth.

The matter of hotel accommodation is one to which we wish to call your attention at this time. We are just in receipt of a letter from the American Medical Association saying that we would probably get quicker hotel reservation by addressing Dr. Stephen Rushmore at the Boston Medical Library, 8 The Fenway, Boston 17, Massachusetts. Dr. Rushmore has charge of the hotel reservations for the American Medical Association and those who wish to stay over for the two meetings would do well to write at once for reservation.

The Radiological Society will meet at the Copley Plaza Hotel.

Department of Technique

THE editors of the Journal feel that a department of technique would be especially appreciated by the subscribers. The purpose of this department is to take up the actual routine which is necessary for successful diagnostic and therapeutic work. It is the hope of the editors that all subscribers will use this department and in order to make this possible, we shall welcome any questions which you wish to have answered regarding any points in technique. If you will address these questions to the Radiological Publishing Company, 511 City National Building, Omaha, they will be taken care of.

Intra-Vaginal Treatment

DR. MERRITT has called attention on another page to a method which he has devised to give x-ray treatment intra-vaginally. We want to call special attention to the technique mentioned by the doctor as we feel that this is a step in advance and overcomes much of the difficulty which has previously been experienced in attacking cancer of the cervix and vaginal wall with the x-ray. Of course, if one has access to both radium and x-ray, the radium can easily be used intra-vaginally. The same results can be obtained by pointing the x-rays through the speculum, as described elsewhere by Merritt.

THOSE who have not yet made arrangements for the summer meeting at Boston may find it advantageous to get in touch with the Harlan-Spears, Tours. These people will run a Radiological Society section, leaving Chicago, Wednesday evening, June 1st, via the Michigan Central, as a part of the American Medical Association Excursion. A number of members of the Radiological Society have already registered with Harlan-Spears. The itinerary furnished appears interesting and offers an excellent vacation trip, while providing excellent accommodations for the summer meeting.

Correspondence

BECAUSE of numerous inquiries I have received concerning the application of an erythema skin dose (E. S. D.) with our domestic apparatus I feel that an explanation is necessary.

Using the same make transformer and otherwise like conditions as focal distance of 35 cm., 5 milliamperes, 100 kilovolts, 10 mm. aluminum filter, we must be absolutely certain that the voltage is determined by a sphere gap and that the milliamperemeter has been tested with a control instrument.

The science of physics speaks always in linevoltages, while the clinician, especially in Europe, speaks of peak or maximum voltages. Since the most penetrable radiations depend on the highest or peak voltage, it is really correct to use peak voltage measurements. They may be obtained by multiplying line voltage with 1.4. For instance, 100,000 volts measured by our indicators means 140,000 peak or maximum voltage. This was suggested by Dr. Coolidge in a recent interview.

Having determined the accuracy of the measuring instruments we must next proceed to obtain the erythema skin dose. We began with a line voltage of 80 Kv. equal to 107.5 max. Kv. and found that the duration of exposure to obtain an E. S. D. was three hours. Using a peakvoltage of 126 Kv. equaling a line voltage of 90 Kv. we obtain an E. S. D. in about 60 minutes. Using a peakvoltage of 140 Kv. or 100 Kv. line voltage, the time of exposure is 50 minutes. Therefore, it becomes necessary that each therapeutist determine the duration of application of x-rays to produce an E. S. D. for his apparatus.

We are at present making investigations with an intensimeter of Furstenau placed at my disposal through the kindness of the Victor X-ray Corporation. Using a current of 126 peak voltage and a load of 5 milliamperes, focal distance of 35 cm., a filter of 10 mm. aluminum and 6 mm. of sole leather, we obtain six Furstenau units per minute. The E. S. D. is obtained in 60 minutes, hence it takes 360 F. to obtain an E. S. D. The same measurements, of course, should be obtained under like conditions. Hence, if another machine produced 8 F. in 1 minute under like conditions, it would mean that an E. S. D. would be obtained in 360 divided by eight equals 45 minutes.

However, until we have a measuring instrument it will be necessary to determine the E. S. D. under always like working conditions.

HENRY SCHMITZ, M. D.

Abstracts and Reviews

The purpose of this department is to furnish its readers a succinct epitome of current interesting articles and books. We will be glad to review articles which have been presented for publication or any manuscript or book sent us.

The Roentgen Diagnosis and Localization of Peptic Ulcer, R. D. Carman, California State J. Med., XVII, 378.

THE medical and surgical treatment of peptic ulcer has long been a subject of controversy; the method of treatment depends on proper diagnosis. The surgeon has the advantage in that he can see, feel, and demonstrate the presence of ulcer before he decides on the method of operation. Few medical men can be certain of the condition, unless the ulcer can be demonstrated by roentgen-ray. Treating ulcers diagnosed on clinical findings and treating those diagnosed on roentgen findings are different matters. Although the roentgen-ray is not infallible and may not distinguish simple from malignant ulcers, it can point to the fact that a lesion is present and frequently is the means of earlier diagnosis.

The general opinion that duodenal ulcer has a more exact symptomatology than gastric ulcer may be due to the fact that it is about four times as common as gastric ulcer. Moreover, many patients may have learned the ulcer symptoms from former examinations, and thus influenced, recite a history typical of ulcer.

The localization of peptic ulcer has an importance apart from diagnostic accuracy. In 245 cases diagnosed gastric ulcer by the roentgen-ray and operatively confirmed during 1918 and 1919, 33 (14.47 per cent) were found to be carcinomatous. Twelve (8.6 per cent) of these were not recognized as malignant before operation. Only six primary malignancies were found in 4,500 operations on the doudenum. Since diagnosis is the basis of treatment, diagnostic separation of gastric from duodenal ulcer should be of invaluable assistance to the physician from the standpoint of prognosis.

Three thousand eight hundred and ninety of 23,598 patients examined at the Mayo Clinic from July 1, 1918, to January 1, 1919, complained of gastric symptoms sufficient to warrant roentgenologic study. Operation was done in 343 of 528 cases diagnosed peptic ulcer and diagnosis was confirmed in 337 (98.21 per cent). Four hundred and seventeen of these were diagnosed duodenal ulcer by the roentgen-ray and 111 gastric ulcer, a ratio of 4 to 1. Two hundred and fifty-five of the 417 cases diagnosed ulcer were operated on; in 246 (96.47 per cent) the diagnosis was confirmed. Operations were performed in 88 of the 111 cases diagnosed gastric ulcer; in 84 (95.45 per cent) diagnosis was confirmed. The discrepancy between the percentage of confirmed peptic ulcer (98.21 per cent) and the confirmation of duodenal (96.47 per cent) and gastric ulcers (95.45 per cent) independently, is due to the incorrect diagnosis in two cases of gastric ulcer and five cases of duodenal ulcer.

There were 21 cases in which a definite pathologic condition was shown, but accurate localization was impossible. The final diagnosis in the 18 patients brought to operation was gastric ulcer, four; duodenal ulcer, three; gastric and duodenal ulcer; one; cancer of the stomach, eight; cholelithiasis with marked adhesions, one; lump of questionable nature in the pyloric muscle, one.

Sixty-seven cases were diagnosed "indeterminate", which signifies that from a roentgen-ray standpoint it is impossible to express either a negative or a positive opinion. Twelve of these were operated on with findings as follows: duodenal ulcer, five; gastric ulcer, one; cholecystitis, two; cholecystitis with stones, one; cancer of the stomach, one; lesion at ring, one; nodule in the liver, one.

Exploration of the stomach and duodenum was done during operation for various abdominal conditions in 351 of 3,105 cases diagnosed "negative stomach and duodenum." The diagnosis was confirmed by the surgeon in 336, or 95.76 per cent, of the cases.

Deformity of the luminal contour, either organic or spasmodic, is the principal roentgenologic sign of disease of the digestive tract. It reveals not only the lesion, but also its location, size, and often its character.

Four types of gastric ulcer may be distinguished at operation:

1—Small mucous erosions and minute, slit-like ulcers.
2—Pentrating ulcers with relatively deep craters.
3—Perforated ulcers, with or without the production of accessory pockets.
4—Carcinomatous ulcers.

The roentgen-ray signs of gastric ulcer may be divided into three groups:

1—Direct signs (pathognomonic)
 (a) The niche.
 (b) The accessory pocket.
2—Indirect signs (diagnostic).
 (a) Organic hour-glass stomach.
 (b) Spastic manifestations.
  1—Spasmodic hour-glass stomach.
  2—Gastro-spasm.
3—Corroborative signs (not diagnostic).
 (a) Retention from the six-hour meal.
 (b) Gastric hypotonus.
 (c) Alterations of peristalsis.

The niche is a bud-like projection from the barium-filled stomach and is an index either of a penetrating or of a perforated ulcer. The accessory pocket is a pouch-like excavation ranging in diameter from 1 to 5 cm. Both niche and pocket are obviously signs of advanced ulcer.

Organic hour-glass stomach is an occasional sequence of penetrating or perforated gastrict ulcer. Roentgenologically it can be distinguished from the spastic type of hour-glass stomach. It is persistent at all examinations, constant in situation, and remains unaltered after the patient has been given an antispasmodic to physiologic effect.

There are two types of spasmodic hour-glass stomach, the intrinsic and the extrinsic. For the differentiation of intrinsic and extrinsic spastic deformity tincture of belladonna is prescribed. Belladonna or atropin will not differentiate spasmodic and organic forms of hour-glass stomach, but they will differentiate intrinsic and extrinsic spasm.

A distinct residue in the stomach from the six-hour meal is seen in 55 per cen of he gasric ulcer cases. Practically 90 per cent of all gastric ulcers occur in he vertical portion of the stomach above the incisura angularis. The retentions which they produce have been assigned respectively to pylorospasm excited by the ulcer, to impairment of peristalsis, and the hypotonus.

Gastric hypotonus, as shown by sagging and expansion of the lower gastric pole is a frequent accompanimen of ulcer. Hypotonus alone possesses little significance, but if it does not accord with the habitus of the patient, the possibility of an ulcer should be considered.

The variations of peristalsis met with in gastric ulcer include weak peristalsis, hyperperistalsis, absence of peristalsis from the ulcer-bearing area, and anti-peristalsis. None of these is peculiar to ulcer, but all of them are more or less suggestive of a gastric lesion.

Differentiation of ulcer and cancer is rarely difficult, roentgenologically. Usually ulcers project from the gastric contour, while in carcinoma the growth with its resultant irregularity extends into the gastric lumen. In border-line cases, in which carcinoma cells are found in the ulcer, differentiation may be impossible.

An ulcer crater, with a base of extreme size, is to be suspected of malignancy. A niche 3 cm. or more in diameter is likely to show microscopic signs of carcinoma.

Fully 95 per cent of duodenal ulcers are found in the first 4 or 5 cm. of the duodenum, usually on the anterior wall. Judd is impressed with their frequent multiplicity.

The roentgenologic indications of duodenal ulcer may be classified as follows:

1—Direct signs.
 (a) Deformity of the duodenal bulb.
 (b) Duodenal diverticulum.
2—Indirect signs (diagnostic).
 (a) Gastric hyperperistalsis.
 (b) Gastric retention from the six-hour meal (the combination of hyperperistalsis with gastric retention and a normal gastric outline is diagnostic of duodenal ulcer with obstruction).

Deformity of the duodenal contour stands first among the roentgenologic signs of diagnostic value. The deformities more or less characteristic of duodenal ulcer may be due to (1) general distortion, (2) a niche, (3) an incisura, (4) a diminutive bulb, (5) an accessory pocket, or (6) a diverticulum. All these deformities are typical and pathognomonic of ulcer.

Hyperperistalsis consists of three or more waves running along the stomach on both curvatures. The phenomenon of hyperperistalsis is not limited to duodenal ulcer, for it may accompany disease of the gallbladder or appendix, or be seen normally in the hypertonic stomach.

Technique for Removal of Foreign Bodies Under Direct Fluoroscopic Guidance, L. W. Grove, M. D., Atlanta, Ga. Annals of Surgery, March, 1921.

THE following method was accepted as the best by long experience in the army. While chief of the Surgical Service, Base Hospital 202, Orleans, France; and while associate chief of service, General Hospital 41, Staten Island, New York, this method was used 485 times without a failure. The usual dark fluoroscopic room and table, a sharp-pointed metal indicator, a head-light for the operator and a screened light for the anesthetist were used.

A preliminary study with the fluoroscope is made to determine the course of action. Exact localization is done in the following manner: With the patient asleep the foreign body is localized between the tube and screen in the direct ray. The metal indicator is placed directly over the foreign body, the tube is shifted in the long axis of the field, and the relative rate and distance of movement of the foreign body and indicator are noted. The indicator is raised or lowered until by the rate and distance it can be determined that the body is in the same plane as the indicator. Thus the depth can be determined. This is very similar to one of the methods of localization described in the army manual and used by some of the roentgenologists in their service experience.

In addition to the exact localization, at the same time a skin incision is made and a heavy jaw forceps forced through the tissues until the foreign body is reached and seized. It is removed and the wound sutured or drained.

The forceps can be introduced at right angles in the plane with the foreign body. But if that is impossible, in the hands of the expert, the foreign body is soon reached by learning the technique described.

The 485 extractions covered occurred in the following locations: Pericardium, three; lung and pleural cavity, twelve; bone and joint, fifteen; soft tissue, 455. In the pericardium and neck open dissection is best. This is the same, only dissection is done under guidance of the eye. In the lung, extraction was done by producing a pneumothorax. Normal intrathoracic pressure is maintained and less hemorrhage results. Drainage tubes can be placed in abscess cavities at the same time. In a position where the blind method seems unsafe, the open can be combined with it. Foreign bodies in the brain were not treated in this way.

E. W. ROWE, M. D.

Roentgenographic Studies of Bronchietasis and Lung Abscess After Direct Injection of Bismuth Mixture Through the Bronchoscope. H. L. Lynah, M. D., and W. H. Stewart, M. D., New York, Annals of Surgery, March, 1921; page 362.

DR. STEWART'S discovery of the use of bismuth in the study of the bronchial tree was made, as many others made it, accidentally about 1915. Gradually it was learned that bismuth could be introduced without any serious difficulty. But Dr. Lynah in 1920 was the first to attempt to outline lung cavities by the injection of opaque substances through the bronchoscope. These two cases, with three others, are fully reported with the following important deductions:

1. Bismuth mixtures can be injected into the bronchii and lungs of a living patient without danger.

2. The injection of an opaque substance into the lung of the living patient will open an enormous field of usefulness in the study of cough, the expulsion of substances from the lung, and lung drainage. Bronchial structures and lung cavities can be outlined and will aid the surgeon.

3. A definite lung abscess is seldom seen bronchoscopically. Pus is seen coming from a bronchus when the abscess may be around the corner. An injection of bismuth mixture or some other opaque mixture will clear up this error.

4. Bismuth, when it enters the abcess cavity, is recognized by its metallic lustre. When it is in tubular tissue it is a dull opaque.

5. Eight cc. of bismuth subcarbonate in olive oil, one or two parts, was used. The mixture is rendered sterile by boiling.

6. The injection should be made slowly and not by squirts, to avoid soaking the surrounding lung tissue.

7. It seems from these preliminary studies that cough and cilia are not the only means of expelling secretions.

8. Although the bismuth was injected for diagnostic purposes, it seemed to have a therapeutic benefit to the five patients upon whom tried. No harm was done.

9. Fluoroscopy was important, but stereoroentgenographic examination was found the best way to localize the cavitations.

10. Experience shows that the roentgen examination should be made almost immediately after the removal of the bronchoscope, otherwise the patient, in a fit of coughing, will remove such of the bismuth from the involved lung.

E. W. ROWE, M. D.

The Thyroid and Its Diseases. Charles H. Mayo, Rochester, Minnasota. Surgery, Gynecology & Obstetrics, March, 1921.

MORE is known of this gland than of any other. Kendall has isolated the chemical compound causing the toxicity. He has prepared it synthetically. Plummer, Boothby and Sandiford have shown by 18,000 tests that hypothyroidism lowers the metabolic rate and that hypersecretion raises it.

Two marked differences in hyperthyroid cases are noticed. There is the type arising with adenoma, or upon long-standing goiters, often without exophthalmos. This type is common and occurs at about an average age of 43, coming to operation at 48. The other type comes at 36; exophthalmos occurs early, 50 per cent in a few months and 90 per cent in two years. The epinephrin test is not reliable and is often dangerous. Adenomata with hyperthyroidism average about 17 to 20 per cent of all cases of goiter with hyperthyroidism. Testing the metabolic rate is the most accurate method.

The thyroid gland is made up of a mass of encapsulated alveoli held together by a strand of connective tissue. The secretion of the gland can escape only by pressing it through the glands that produce it. In exophthalmic goiter there is no retention of secretion. In goiter of adolescence or simple goiter, retention may occur. The administration of iodine in simple goiters is beneficial.

Few patients with exophthalmic goiter make good recoveries without operation. Others make partial recoveries, with damaged hearts, kidneys, etc.

The elaborate preparations for operation are justified by the lowering of the mortality rate. A patient with a metabolic rate of plus 66 and caught on a subsiding curve is a better risk than one with plus 66 on the ascending curve.

With x-ray treatment, remission may occur just as remissions occur without treatment. Our experience has been failure or but temporary benefit. It is possible that the ray treatment may destroy the gland and product hypothyroidism. It is difficult to regulate the dosage, and its use adds to the difficulties of operation. It is to be hoped that radiotherapy may be developed into a safe and effective method of securing a cure or relief in preparation for surgery.

Operation is usually done under ether anesthesia. In 1919, 1704 of 2205 operations were under ether, 135 novocain, and 366 by combined methods. The death rate has steadily lowered in 20 years. Patients are coming earlier to operation. Only 20 per cent came in late stages. Selection of cases has lowered the mortality as much as the surgeon's skill. Mortality varies from 0 to 3 per cent in various groups.

E. W. ROWE, M. D.

Compression Fracture of the First Lumbar Vertebra with Delayed Symptoms, Rudolph V. Gorsch, M. D., New York City.

MANY back injuries are passed off without serious consideration. It seems sufficient that they be called "sprains," "arthritis," or contusions. Even when roentgenograms are made the mistaken diagnosis frequently results. The x-rays offer the only positive means of making an early diagnosis. Late diagnosis months or years afterward can be made easily. Roentgenograms are typical and distinctive. It is inferred that more cases should be examined properly by the x-ray, the spine being taken in small sections in both lateral and antero-posterior positions.

E. W. ROWE, M. D.

X-ray Bulletin, Treasury Department, U. S. Public Health Service, A. J. Paccini in charge.

A BRIEF review of several issues of this bulletin is worthy of consideration. One issued January 15, 1921, and one February 15, 1921, have been carefully read. The first contains a full and concise review of "Technique and Interpretation of Roentgenograms of Tuberculosis and Complications", by Howard E. Ashbury, M. D., F. A. C. S., Baltimore. This gives us an individual's technique and his own way of making the interpretation. There are few places where one may go for this information. The remarkable thing is that all of it is so well standardized that there will be little ground for criticism. Such matters are fast reaching the stage where they might be introduced in text-book style and remain the model for all teaching. Major Ashbury is thorough and exceedingly systematic. He gives up his own technique for making the stereoroentgenograms, his routine study of the plates and his manner and basis of interpretation, the different diagnoses, and in a full and complete summary comments on rules for use in diagnosis. A few samples: "When tuberculosis of the parenchyma is present to the extent of giving physical signs, it will be shown in a good x-ray plate as groups of tubercles with thickened bronchial tree markings leading from the hilus out to the area involved like a spray of goldenrod." "When tuberculosis does exist, the characteristic roentgenographic tubercle will appear somewhere in the field." "The tendency to speak of the bases of the lungs as non-tubercular area is a convenient way to consider base lesions, and will usually react in the right direction, but it is not infallible."

"Finally, the roentgenologist is safer when he describes the lesions and groups the possibilities and permits the clinician to diagnose the case. The clinician is not justified in making a definite diagnosis from the x-ray plate alone." "It is thought that the roentgenologist in his report should describe the changes in the lung, mention the location of the lesion, but permit the clinician to make the diagnosis."

A second article by Dr. Charles Eastmond of Brooklyn, New York, details in a careful manner his technique for examining the appendix, the direct and indirect evidence which he considers fully and logically. Among the many good points mentioned are: "The term pathological appendix is selected in preference to chronic appendicitis because the term appendicitis suggests that there is still an inflammatory condition existing; whereas the term pathological appendix merely means that there has been a pathological process which has brought about certain abnormal changes in the organ. The existing pathological condition may be quiescent and productive of no symptoms, either local or remote, or there may be changes of function in adjacent parts of the gastro-intestinal tract, without the presence of any local clinical manifestation of disease."

"Direct evidence consists of:

1. Lack of homogeneity of the appendiceal lumen.
2. Irregularities of lumen.
3. Abnormal fixation.
4. Tenderness of appendix upon palpation.
5. Abnormality of form in the way of angulations.
6. Retention of contents beyond the emptying time of the cecum.

"The indirect evidence is based on:

1. Adhesions of the terminal ileum.
2. Abnormal fixation of the cecum.
3. Functional disturbances."

"About 90 per cent of all appendices may be rendered visible."

If any reader is anxious to secure in condensed form the latest review of "The Principles of the Therapeutic Application of Radiation," then the full paper of Dr. Henry K. Pancoast, Professor of Roentgenology, University of Pennsylvania, Philadelphia, should be procured. The latest conception of the physics of radiant energy is lucidly explained. This is followed by a summing-up under 14 points of all that is known concerning the therapeutic action of radiation. There is little that is new in the latter, but it is in such form as will make it easy to review the subject.

E. W. ROWE, M. D.

Peristalsis in Health and Disease, Walter C. Alvarez, M. D., San Francisco, Calif. Am. Jr. Roent. Jan. 1920., Page 1.

PRACTICAL problems are often unsolved because we do not go back far enough. Before beginning his work on the gastro-intestinal tract the doctor found he must study the lower animals first. Helpful hints were obtained from snails, sea-cucumbers, anemones, jelly-fish, clams, worms and crawfishes. Medical indices are not of much use. What is helpful is often hidden behind unsuggestive titles.

The thesis with which he starts is this: "The forces which bring about, modify and control peristalsis must be looked for within the gut itself." In his summary he gives the main points which he has discussed most fully, and after reading carefully one feels he has made a real contribution to pure science that must have practical value.

Summary.

1. The digestive tract is largely autonomous, and the forces underlying peristalsis must be looked for mainly within the gut itself.
2. The tendency of writers to explain everything on the basis of nervous reflexes and ganglionic control is unfortunate, and paralyzing to further progress.
3. Recent biologic work has shown in numberless ways that the main function of the nervous system is conduction.
4. It has been shown conclusively that the rhythmical contractions of the intestinal muscle are myogenic in origin.
5. Auerbach's plexus serves to conduct stimuli and to co-ordinate the activities of different parts of the tract. It contains no reflex arc.
6. Current theories about the antagonism between the vagus and sympathetic nerves are shown to be pseudoscientific, and out of harmony with the facts as determined by the leading anatomists and physiologists of the world today. The sympathetic is an integral part of the central nervous system and not an outlying, antagonistic "brain."
7. Many of the conclusions based upon the supposed actions of drugs on nerve-endings and "intermediate substances" must be revised in the light of recent work.
8. The extrinsic nerves of the intestine serve to communicate between the body and the bowel, and between the bowel and the brain.
9. The digestive tract can work quite normally after section of all the extrinsic nerves.
10. The key to an understanding of peristalsis is to be found in a study of the smooth muscle in the wall of the bowel.
11. There are different types of muscles, suited to different functions in the different parts of the body and in different parts of the digestive tract.

The name "gradient" is introduced and used to express the direction of the wave movement in peristalsis.

Gradients:

(a) A peristaltic wave spreads both ways from a stimulated spotlike ripples from a stone thrown into a pond. Most of the muscular tubes are so constructed that the ripples can travel in one direction better than in another.

(b) It may be a law for all tubular organs that the transport of material in one direction depends upon gradients of rhythm, irritability, tone and metabolism. Such gradients can easily be demonstrated in the walls of the stomach and intestine.

(c) A bolus moves aborally in the digestive tract because the pressure is greater on the upper than on the lower side. This difference is due probably to the graded characteristics of the muscle.

(d) The peculiarities of peristalsis in different parts of the tract are explainable on the basis of local differences in the structure of the neuromuscular mechanism.

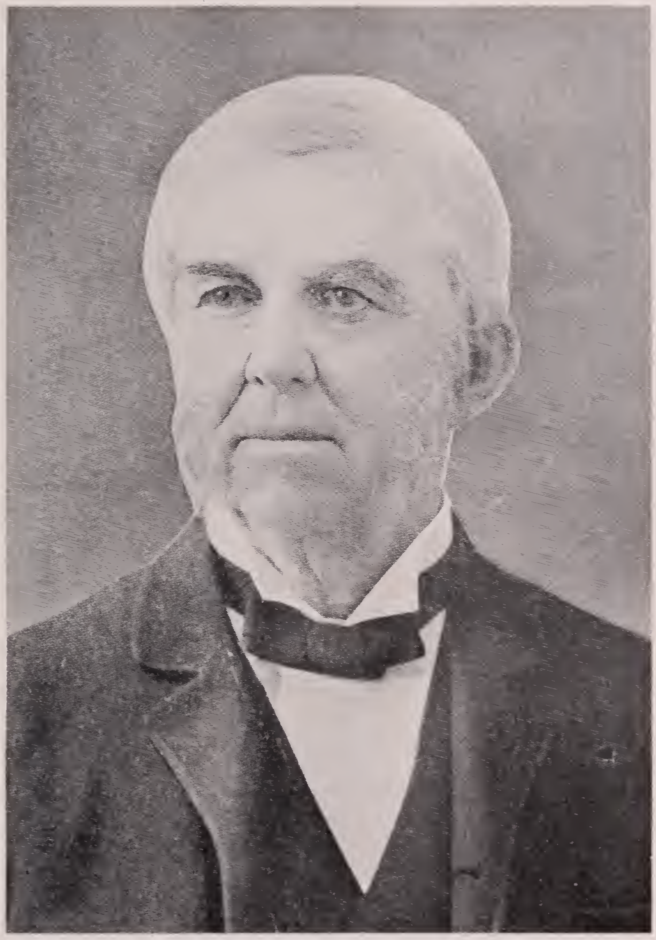
(e) It is shown how the gradients may be upset in disease, and how these theories can explain pathologic pneumonia.

E. W. ROWE, M. D.

Quick, Douglas, The Combination of Radium and the X-Ray in Certain Types of Carcinoma of the Breast. (Surg. Gynec. and Obst., Vol. 32, No. 2, Feb., 1921).

THE writer reviews the existent literature briefly, and quotes some interesting early results. He notes that in the past, radium and x-ray have not been sufficiently combined. He describes the technique in use at the Memorial Hospital for burying emanation tubes in the tissue; presents an outline of the histologic changes which follow such a procedure and which furnish a rational basis for radium therapy. He thinks that the results following the burial of small emanation tubes (2 or 3 mc.) is better than those following the same total dosage delivered in a shorter time. Filtration, in this method, is through a thin glass wall only, and this permits the use of nearly all of the beta radiation—a very important factor. Subsequent x-ray treatment is carried out as though no radium treatment had been given. During the past two and one-half years, seventy-eight cases of carcinoma of the breast have been thus treated at the Memorial Hospital. Of these seven show complete regression, and have remained well for periods of from three months to two years. Twenty-one cases show a partial regression, and are still progressing. No case in this group has been observed less than five months. Twenty-four cases showed temporary benefit; nineteen of these have died, but without lighting up of the original process. Ten cases showed no improvement. These were far advanced cases with widespread metastases, nine cases were not followed. Seven cases have been under observation too short a time for any report. Twelve of the foregoing cases are reported in detail, with micro-photographs illustrating the histologic changes occurring. Fifty-eight of these cases were treated for recurrences and metastatic growths. Only one of these was operable. He notes that radium seems to control the pleural pain better than x-ray. He concludes that the x-ray is useful in the treatment of every case of mammary carcinoma, that radium may be combined with x-ray to great advantage in a certain number of cases; that radium is useful mainly in flat or bulky recurrences, avillary involvement, inoperable primary cases, and in cases refusing operation; and that radium and x-ray may convert an inoperable case into an operable one at times.

LOWELL S. GOIN, M. D.



OLIVER WENDELL HOLMES

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A Plea for a Routine X-Ray Examination of the Gallbladder Region in Every Chronic Abdomen

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I SHALL attempt to show, in the brief time allotted, that the competent roentgenologist can be of invaluable assistance in eliminating or sustaining a diagnosis of gallbladder pathology in practically every chronic abdomen.

Much has been written in the last few years concerning the value of the roentgen study of the gallbladder and a varied array of statistics and opinions has resulted. Some men report that the roentgen methods can only show a very low percentage (as low as ten per cent) of gall stones and that negative roentgen findings mean nothing, while other men claim that in their hands the roentgen methods will show from 85 to 95 per cent of pathological gallbladders. George states that the roentgen methods of diagnosing pathology in the gallbladder have become so accurate that if there be no direct roentgen evidence of gall stones, or indirect evidence of adhesions involving the stomach, duodenum or colon, as a result of cholecystitis, the surgeon should have a preponderance of clinical evidence as a warrant in operating for gallbladder pathology.

Gall Stones

It has only been in the last few years that gall stones could be detected by the roentgenologist to any extent and for that reason most roentgenologists did not recommend roentgen ray examinations and only made them when urged to do so. Fortunately, however, men like George, Case, L. G. Cole and others, found that gall stones containing calcium could be detected much more frequently than they had suspected, which fact stimulated the search. While as yet few roentgenologists have published their reports, the general opinion among several roentgenologists is, I believe, that from 60 to 90 per cent of gall stones will show.

It is considered impossible to demonstrate a pure cholesterine stone on the x-ray plate or film; but it is probably safe to say that a pure cholesterine stone rarely, if ever, exists. The dense calcareous gall stones áre very easily demonstrated by most any technique used, but this type of gall stone is in the minority. This fact may account for the reason why the study of gallbladder by roentgen methods has made so little progress. By far the greater number of gall stones consist of a cholesterine center with a calcareous periphery. If the calcareous layer is thin, which is true in about 50 per cent of the cases, the stones are more difficut to detect.

Gallbladder Disease With or Without Stones.

In the past and even at the present time too many roentgenologists only search for gall stones, instead of searching carefully for any direct or indirect evidence of gallbladder pathology other than the mere presence of stones. And furthermore, the gallbladder region is usually examined by a great many roentgenologists only when the referring physician requests such an examination, which is in a very small percentage of cases referred; for the great majority of physicians are of the opinion that roentgen methods are of no value in gallbladder pathology. Even a great many roentgenologists are still of the opinion that they are wasting time and material in searching for gallbladder pathology and when they do go after a gallbladder they do it in a half-hearted way, doubting if they will find any pathology even though it be there. Unless a man attempts this work carefully and believes in its merits and is confident that his investigation is thorough, he had better not try it. We think that the reason some men still have no faith in the roentgen ray methods is because they are not developing a careful technique and are only finding the dense calcareous gall stones instead of making a careful systematic search for any pathology of the gallbladder with or without stones in every case that is referred for an abdominal study. We feel quite confident that if every competent roentgenologist will make a careful routine search for gallbladder pathology in every one of his gastro-intestinal and other abdominal studies, that the statistics reported so far will soon be more generally accepted and probably improved upon.

We not only attempt to demonstrate gall stones, for they are usually of secondary importance, but also attempt to demonstrate any pathology of the gallbladder, with or without stones. We should be able by the density of the gallbladder shadow to detect thickened or enlarged gallbladder, filled with small stones or bile of very high specific gravity and by giving the patient a barium meal we should be able to demonstrate a cholecystitis with adhesions and also frequently outline the pressure of an enlarged gallbladder against the stomach. duodenum or colon.

Technique.

Time will not permit going into any elaborate details concerning our technique. The referring physician is instructed to give every patient the following instructions, if time permits: Take two drachms of compound licorice powders at bedtime each night for three or four nights previous to the examination and eat no supper the day previous and no breakfast on the morning of examination. We first make from three to six exposures of the gallbladder region (including area between crest of ileum and tenth rib), varying the penetration, time, etc.; but being careful that the darkroom assistant develops all the plates or films for the same length of time thereby insuring plates of varying densities. The above preparation and examination is made on every patient that is examined for any abdominal condition. We then give a barium meal in the fluoroscopic room and search carefully with the fluoroscopic screen for any indirect signs, which are enumerated later on. We then make from three to six more gallbladder exposures in order to pick up any adhesions or pressure involving the stomach and duodenum, or any other findings that might have been missed on our first series of gallbladder plates. The region of the hepatic flexure of the colon is studied at twenty-four hours.

A good gallbladder plate or film should show a wealth of detail of soft structures and one of the most important factors is the absolute stillness of the patient during the exposure. We invariably carefully drill the patient before starting the exposures. The Bucky-Potter diaphragm should be a very valuable asset in this work and will undoubtedly make possible the obtaining of plates of still finer quality than before.

We attempt to impress the referring physician that we also need his clinical help and I think that we, as roentgenologists should consider ourselves as consultants and require when possible a complete clinical history of every case. If such a history does not accompany our patients we take a history in the course of our examination, so that this may be consulted as well as our x-ray findings in arriving at our final conclusions

Interpretation.

Any shadow on the x-ray plate or film which we interpret as a gallbladder shadow represents in our opinion, a pathological gallbladder and is so reported.

Even if no suspicious gallbladder or gall stone shadows are present, a number of roentgen ray findings following a barium meal are of invaluable assistance in the roentgen diagnosis of pathological gallbladder, with or without stones, namely:

1. Hepata-fixation of the stomach, the pyloric region being

drawn to the right and upward in a significant manner.

2. Characteristic deformity of first portion of duodenum and possibly the second portion due to adhesions pulling the duodenum to the right and outlining the gallbladder.

3. Outlining of enlarged gallbladder due to pressure against duodenum or antrum of the stomach.

4. A definite small area of pain to pressure accurately localized to the outer side of the shadow of the duodenum, usually accompanied by a lag in the emptying of the duodenum.

5. The pressure of Riedel's lobe of the liver, when demonstrable following gas distention of the stomach and colon, is another contributory sign of gallbladder disease, in which jaundice is not present.

6. The emptying time of the stomach following a barium meal is usually much shortened, and the outline of the duodenum is well seen owing to a delay in the emptying time of the duodenum, or to a too rapid out-pouring of the stomach-contents through the duodenum. It was formerly supposed that this unusual visibility of the duodenum strongly suggested duodenal ulcer, but Case states that in his experience, it may occur in any duodenal affection or in gallbladder disease.

Time will not allow taking up differential diagnosis.

Surgical Investigation

It quite often happens that the roentgenologist will report gallbladder pathology with or without stones, only to have the surgeon inform him that he palpated the gallbladder at operation and found it normal. We wish to say here that we do not believe that the roentgen ray or any other evidence of gallbladder pathology should be considered wrong until the accused gallbladder is at least opened or better still, has been removed and submitted to a histological examination, for is it not a fact that it is impossible for the average surgeon to determine by palpation alone, if the gallbladder is normal? We believe that it has been definitely proven that it is. Dodd reported a case from the Massachusetts General Hospital where both the surgeon at operation and the pathologist at post-mortem failed to palpate the stones which were later found in the distended bladder.

Statistics

During the past 18 months we have examined 421 patients in which we have made a complete roentgenological study of the gallbladder. We reported gallbladder pathology, with or without stones in 168 cases or in approximately forty per cent of the cases studied. It should be borne in mind that the gallbladder pathology was suspected by the clinician in less than ten per cent of the 421 cases. We have been able to obtain the operative findings found in 128 of these cases. In these 128 cases the roentgen conclusions were not confirmed in only nine cases so that in this small series our conclusions were correct in approximately 92 per cent of the cases operated. In four of the nine failures the surgeon reported that the gallbladder was normal to palpation, the other five were unquestionably errors in our interpretation of our roentgen findings. We also realize that this is a small series and that as it grows the percentage of failures may increase.

Conclusions.

1. We are not justified today in making the diagnosis of "Gallbladder Pathology" without having taken advantage of all the methods at our disposal which can throw light on the diagnosis, including a roentgen study. This was excusable a few years ago when a man had to depend largely upon his own ability to do everything. But now there are very few medical centers of any size that do not have a trained and competent roentgenologist—and we must insist that he be competent, for if he is not, the use of the roentgen ray will do more harm than good in this work as well as all other branches of roentgenology, by the incompetent man arriving at the wrong conclusions.

2. As in all other branches of diagnostic roentgenology, the most important factor in this work is the correct interpretation of the various shadows as seen upon our x-ray plates and screens.

3. The roentgen methods must be more thorough and plates must be used freely.

4. It is our opinion that by the skillful use of the roentgen methods alone, in the proper hands, it is possible to detect from 80 to 95 per cent of all pathological gallbladders.

5. We do not think it is fair to condemn the use of the roentgen methods just because every man who possesses an x-ray machine is not able to show gall stones or gallbladder pathology, as it might be the man, and not the x-ray that is at fault.

6. The roentgen methods of detecting gallbladder pathology are so valuable that a very careful routine roentgen examination of the gallbladder of every chronic abdomen should be made.

Case Reports

Case No. 1194.

Female, age 57 years.

Roentgen Conclusions.

Large pendulous gallbladder with stone in cystic duct and at least nine small stones free in gallbladder. Pathological appendix. Operated by Dr. C. M. Mix, Muncie, Indiana.

Operative Findings.

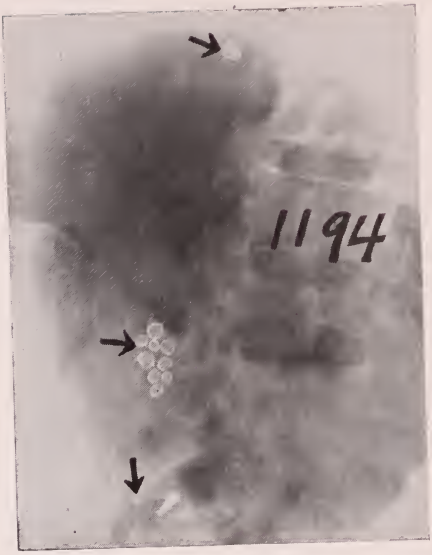
Roentgen conclusions confirmed. Ten gall stones were found, as described above.

Case No. 1416.

Male, age 36 years.

Roentgen Conclusions.

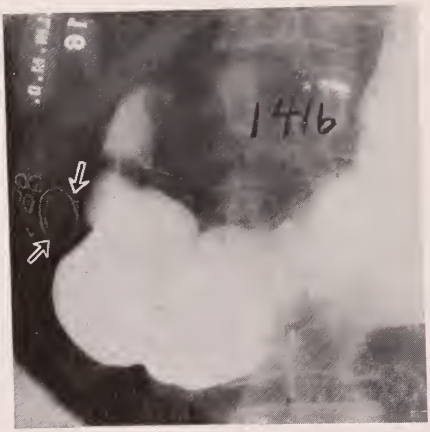
Distended gallbladder with large gall stone. Adherent appendix. Unquestionably a surgical abdomen. Operated by Dr. Ed Clark, Indianapolis, Ind.



Case No. 1194—Upper shadow is stone in cystic duct; nine shadows represent nine gall stones found in fundus of gallbladder; below is seen the shadow of a pathological adherent appendix.

Operative Findings.

Large, thickened gallbladder with stone corresponding in size to one seen by roentgen examination. Five small gall stones. Densely, adherent appendix. The five small gall stones can be seen on x-ray plates, but were overlooked before the operation.



Case No. 1416—One large gall stone is shown, also five smaller ones, immediately to right of large one. Note pressure of gallbladder against pylorus.

Case No. 1074—Pathological gallbladder filled with gall stones. Pathological appendix.

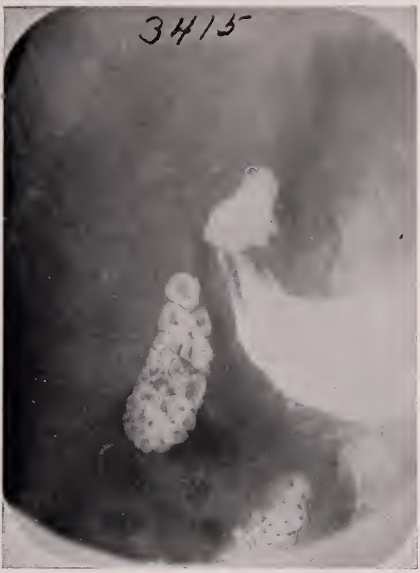
Case No. 1074.

Female, aged 31 years.

Roentgen Conclusions.

Pathological gallbladder filled with gall stones and a pathological appendix. Operated by Dr. C. M. Mix.

Case No. 1299—Note the shadow cast by gallbladder filled with small stones.



Case No. 3415—Large, distended gallbladder filled with very dense stones.

Operative Findings.

Gallbladder thickened. Sixteen gall stones, size of ordinary dice. Bulbous, obliterated appendix.

Case No. 1299.

Female, age 40 years.

Roentgen Conclusions.

Pathological gallbladder with probable gall stones. Pathological appendix. Operated by Dr. C. M. Mix.

Case No. 3415—Roentgenogram of gallbladder after its removal.

Case No. 3311—Showing gallbladder and large gall stone.

Operative Findings.

Large, thickened gallbladder filled with very small stones. Large, adherent appendix.

Case No. 3415.

Female, age 58 years.

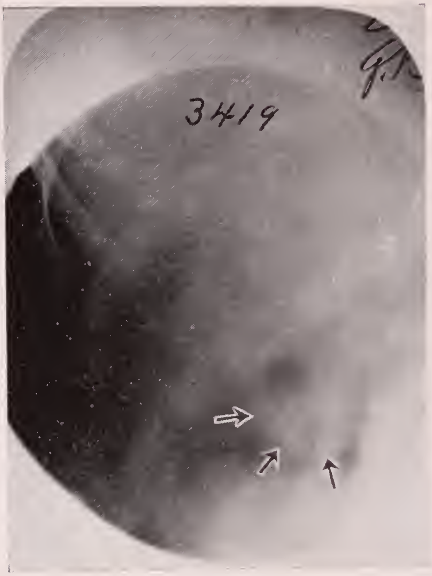
Roentgen Conclusions.

Pathological gallbladder filled with very dense gall stones. Liver and gallbladder quite low. Pathological, adherent appendix. Operated by Dr. W. C. Moore.

Operative Findings.

Roentgen findings confirmed.

Case No. 3311—Roentgenogram of removed gallbladder, showing one gall stone, which casts a positive shadow, and seven which cast negative shadows.



Case No. 3419—Visualized, distended gallbladder.

Case No. 3311.

Female, age 55 years.

Roentgen Conclusions.

Pathological, enlarged gallbladder with stone. Operated by Dr. C. M. Mix.

Operative Findings.

Thickened gallbladder with eight gall stones, seven of which gave negative shadows. (See illustration.)

Case No. 3419—Roentgenogram of gallbladder after its removal.

Case No. 3380—Visualized, distended gallbladder, but no gall stone shadows seen.

Case No. 3419.

Female, age 34 years.

Roentgen Conclusions.

Pathological distended gallbladder, with or without stones. Operated by Dr. Will C. Moore.

Operative Findings.

Empyema of gallbladder, no stones.

Case No. 3380—Roentgenogram of gallbladder after its removal, showing two large gallstones which did not show on roentgen examination. Part of one casts a negative shadow. This case illustrates the importance of examining plates and films for gallbladder shadows rather than for gall stone shadows.

Case No. 3451—Visualized, distended gallbladder.

Case No. 3380.

Female, age 47 years.

Roentgen Conclusions.

Pathological gallbladder with or without stones. Operated by Dr. Will C. Moore.

Operative Findings.

Thickened gallbladder containing two large stones. One stone cast a negative shadow. (See illustration.)

Case No. 3099—Showing gallbladder with stone.

Case No. 2794—Two large, dense calcareous gall stones.

Case No. 3451.

Female, age 20 years.

Roentgen Conclusions.

Distended gallbladder with or without stones. Pathological appendix. Operated by Dr. E. H. Clauser.

Operative Findings.

Distended gallbladder, no stones. Chronic adherent appendix.

Case No. 3523—Visualized, distended gallbladder.

Case No. 2408—Pathological gallbladder with a large gall stone.

Case No. 3099.

Female, age 54 years.

Roentgen Conclusions.

Pathological gallbladder with stone. Operated by her brother, Dr. Tom Noble, Indianapolis, Ind.

Operative Findings.

Thickened gallbladder with large stone.

Case No. 1964—Pathological, adherent gallbladder filled with stones. Pathological, adherent appendix.

Case No. 2794.

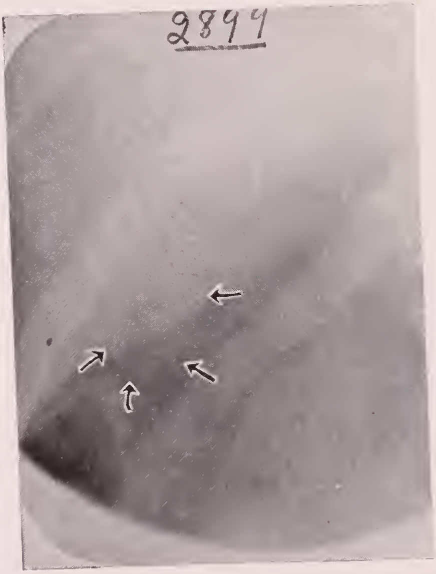
Female, age 57 years.

Roentgen Conclusions.

Two large gall stones. Operated by Dr. C. M. Mix.

Operative Findings.

Two large gall stones.



Case No. 2899—Visualized, pathological gallbladder.

Case No. 1883—Not distinct, owing to fact that patient moved.

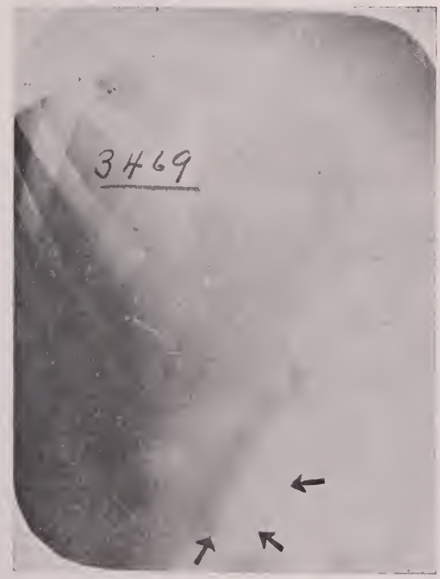
Case No. 2808—Note deformity of pylorus due to gallbladder adhesions.

Case No. 3523.

Female, aged 42 years.

Roentgen Conclusions.

Pathological, distended gallbladder with or without stones. Operated by Dr. E. H. Clauser.



Case No. 3469—Visualized, distended gallbladder. Note extremely low position of liver and gallbladder.

Case No. 3468—Visualized, pathological gallbladder.

Operative Findings.

Empyema of gallbladder, no stones.

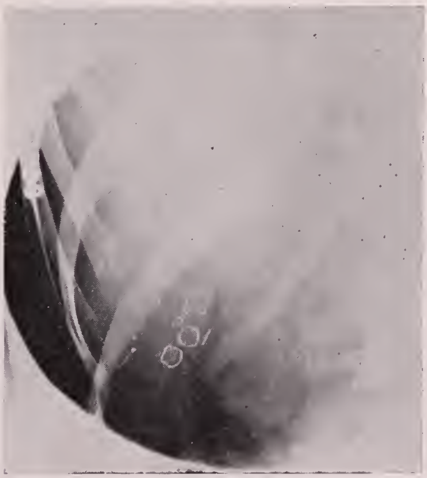
Case No. 2408.

Female, aged 40 years.

No gallbladder symptoms or history.

Roentgen Conclusions.

Pathological gallbladder with a large gall stone.



Case No. 2203—Pathological adherent gallbladder with stones. Pathological appendix.

Operative Findings.

Not operated yet.

This case was referred to us for roentgen examination of left kidney as surgeon suspected pathology in that region. Illustrating value of routine examination of gallbladder.

Case No. 2899.

Male, age 40 years.

Roentgen Conclusions.

Pathological gallbladder, with or without stones. Operated by Dr. G. R. Andrews.

Operative Findings.

Thickened gallbladder filled with heavy bile. No stones.

Case No. 1964.

Female, age 45 years.

Roentgen Conclusions.

Pathological, adherent gallbladder filled with stones. Pathological, adherent appendix. Operated by Dr. G. R. Andrews, Muncie, Indiana.

Operative Findings.

Densely adherent gallbladder which contained 32 sharp-edged stones. One stone in duct. Appendix densely adherent.

Case No. 1883.

Female ,aged 57 years.

Roentgen Conclusions.

Pathological gallbladder filled with gall stones. Operated by Dr. C. M. Mix.

Operative Findings.

Thickened gallbladder containing many small stones.

Case No. 2203.

Female, age 27 years.

Roentgen Conclusions.

Pathological adherent gallbladder with stones. Pathological appendix. Operated by Dr. E. H. Clauser, Muncie, Indiana.

Operative Findings.

Densely adherent gallbladder, which contained two stones one cm in diameter and several smaller stones. Appendix not explored.

Case No. 2808.

Female, age 47 years.

Roentgen Conclusions.

Pathological gallbladder with extensive adhesions involving the pylorus and duodenum. Operated by Dr. Will C. Moore, Muncie, Indiana.

Operative Findings.

Thickened gallbladder surrounded with dense adhesions involving liver, pylorus and duodenum.

Case No. 3469.

Male, age 43 years.

Roentgen Conclusions.

Pathological, distended gallbladder with or without stones. Liver and gallbladder quite low. Pathological cecum and appendix. Operated by Dr. Hebert Sperry, Muncie, Indiana.

Case No. 1814—Showing four gall stones.

Operative Findings.

Elongated gallbladder. Jacksonian membrane enveloping cecum and appendix.

Case No. 3468.

Male, age 38 years.

Roentgen Conclusions.

Pathological gallbladder with or without stones. Pathological appendix. Operated by Dr. A. W. Adson at Mayo Clinic.

Case No. 2746—Showing two gall stones.

Operative Findings.

Definitely pathological gallbladder, no stones. Chronic, pathological appendix.

Case No. 1814.

Female, age 68 years.

This case had been diagnosed and treated for "Hypochlorhydria" in two large medical centers. Roentgen study of gallbladder had not been made previously. All symptoms were gastric.

Roentgen Conclusions.

Pathological, elongated gallbladder with gall stones. Chronic, inactive, pulmonary tuberculosis.

Operative Findings.

Not operated due to pulmonary findings and age.

Case No. 2746.

Female, age 33 years.

Roentgen Conclusions.

Pathological gallbladder with stones.

Operative Findings.

Large pendulous gallbladder with four gall stones.

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*Read at Annual Meeting of the Radiological Society of North America. Chicago, December, 1920.

A Comparison of Important Factors in the Diagnosis of Gastric and Duodenal Ulcer

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Introduction

THIS study is undertaken with the object of reviewing the essential factors in the diagnosis of gastric and duodenal ulcer as we have found them in our clinic. It begins with a detailed tabulation of all the cases in which the diagnosis of gastric or duodenal ulcer has been made, followed by a more detailed study of the operated cases, as well as those operated in which the roentgen examination has been a factor in making the diagnosis. It includes in all 204 cases which have been examined during the last five years.

Local conditions may affect our run of cases. In particular, working with surgeons and internists having different conceptions of treatment alters the ratio of operated cases to surgical cases. A great number of patients have themselves refused the surgical care of their ulcers. But in the main this will show that a detailed study of the patients has increased the accuracy of diagnosis, and the roentgen examination as a routine has been the greatest factor, after the careful consideration of the history in the case, in giving to the clinician exact information.

The place of the roentgen examination is already accepted. This is not meant for a defense of this newest method in gastroenterology, but an effort to further illustrate the value of its correlation.

General Discussion

Case records of gastric ulcers go back to the tenth century, but Cruveilhier, in the early part of the nineteenth century, first gave it a clear description. English and American surgeons, in developing the surgery of the upper abdomen, have been the means of stimulating the wonderful advance of recent years in the diagnosis of gastric and duodenal ulcers. Statistics are quite valueless to determine the exact numbers occurring among the civilian population. Autopsy reports clearly indicate that vast numbers are unrecognized, and herein lies a fertile field for further study. A record of 59,000 autopsies shows an incident of over four per cent.

It is a disease that belongs to the third decade in life, usually unrecognized until the fourth. The ratio of sexes shows that one female to three males is afflicted. A few years ago this was reversed Especially in the occurrence of duodenal ulcers is the male sex predominant. The classical expectancy has been that 20 per cent will be diagnosed clinically and the remainder at the operating table. Careful study of the 75 per cent diagnosed by the surgeon has reduced this number to less than ten per cent.

This is still the transition stage from older methods to the new. Some are discarding the stomach tube entirely, some relying on only the roentgen method, and some still plot beautiful curves of secretory function which only a physiologist knows much about. A careful diagnostician may make a high number of accurate diagnoses playing to any one method. A more sane view is to correlate all the essential diagnostic points, keeping in mind that some are speaking in terms of large currency and others in coins of small value. The stomach tube and blood tests are still essential, though they may have lost their relative value in the final diagnosis.

Moynihan did much in calling our attention to the value of the history. Though he said it, he hardly meant to infer that the diagnosis could be made by correspondence. The more careful the analysis, the more clearly is this truth established. Every ulcer case history contains a syndrome of ulcer. Routine laboratory tests are secondary, even though essential. They tell more of the secretory function, which information is of greater value in the treatment. The determination of motor function is more important. This the roentgen examination shows with greater ease and accuracy. Besides, it usually reveals the anatomical defect of an ulcer and then locates accurately the lesion in the duodenum or the stomach. Without this, the choice and course of medical and surgical treatment is blindly made and empirically followed.

Textbooks devote a considerable space to etiology, giving trauma, thrombosis and chemical theories undue prominence. The infectious theory has assumed rightfully and easily the preference, as shown by animal experimentation, the presence of foci of infection elsewhere in the body, and the finding of streptococci in the ulcer tissue.

History.

Eusterman, in the analysis of 2,400 cases, found that gastric ulcers occurred twice as frequently in the male as the female. The average age of the patient with the gastric ulcer was 47. The patient with the duodenal ulcer came for study four years earlier.

Symptoms divide easily into those of primary and those of secondary importance. Of greatest value is the history of pain. This pain occurs periodically and gives rise to chronic distress with free intervals. At first the attacks are in the spring and fall and the periods are short. Every attack is clear-cut and always the same, lasting from four to six weeks. The pain is in the epigastrium to the right of the center. Hunger pain is characteristic and usually corresponds to the painful area.

The nearer the pylorus, the shorter the period after eating before it begins. In the majority of duodenal ulcers the time elapsing between intake of food and the beginning of pain is three to four hours; in the majority of the gastric ulcers the time is only one-half to two hours. Soda, food, posture or vomiting give relief. There may be a fear to eat, though the desire is strong. General abdominal distress, if present, is often relieved by defecation and belching.

The secondary symptoms of gas eructation, constipation and vomiting are mostly the results of disturbed motility. Vomiting of blood is important, but not the rule. Tarry stools observed by the patient seldom prove to be evidence of value. Nocturnal pain occurs only in two per cent of the cases. Gastric ulcer symptoms are like duodenal. In general they are less severe; and, on each point compared, less sharply defined and hence less accurate. Without further confirmation, it is unsafe to make a positive statement as to location on the basis of the history alone. Yet an accurate history is the key to the study of all cases. It still remains the most reliable means of diagnosing ulcer, and is one from which a provisional diagnosis can usually be made.

Physical Findings

Positive physical findings follow the history fairly well. But they are less distinct, less characteristic, and hence not very important when taken alone. The tender point in a sensitive epigastrium, generally over the painful area, speaks for the peritoneum made sensitive by the presence of ulcer inflammation. It is definite, localized, and constant. It differs in nature from the tenderness of the gallbladder, which is more to the right and under the costal arch. Muscle rigidity, if present, is slight. Rarely can an ulcer be palpated. Visible peristalsis means obstruction. A palpable gastric mass nearly always means malignancy. There is slight tenderness all over the abdomen at the crisis of motor activity. Outlining of the stomach margin is inaccurate. Inflation gives but little idea of the actual size. The intestines hide the stomach. Obstruction is best told by other means.

Perforation and its signs do not belong in this discussion.

The physical examination should be complete to rule out tuberculosis, chronic nephritis, tabes and other diseases with gastric symptoms. Also it should include a comprehensive survey of all possible fields where foci of infection might be located.

The Clinical Laboratory Findings

The gastric analysis is essential, though its importance is not primary. All the evidence obtained from it may be classified as (1) Motor; (2) Secretory, and (3) Blood. The Ewald test meal is now standard and allows of general comparison, thanks to the widespread adoption.

The most valuable information concerns the motor activity, and it usually conforms to the ulcer syndrome in the history. Gastric distress from ulcer reveals increased peristalsis and muscle activity in the stomach wall. Obstruction, just as well as the usual increase in gastric unrest, can be studied better with the barium meal.

The curves obtained from the frequent withdrawal of gastric contents by the Rehfus tube are valuable in determining the secretory function. By a graphic representation of a full gastric cycle, much more can be told than by a cross-section of the curve which a single examination tells. In two-thirds of the cases with hperacidity, ulcer will be the cause. The remaining one-third will be secondary to gallbladder or appendix. Higher curves, running above 80 and even to 100, may be entirely normal. But a high acidity, or even a low one, in the final analysis may be the turning point in the diagnosis. Unusual and striking extremes in high acidity are more characteristic of duodenal than of gastric ulcer.

Actual bleeding from gastric or duodenal ulcer is easily told. Blood is nearly always present in traces in the chemical analyses of gastric contents or feces. Chronic ulcers do not often bleed. To be of value, blood should be in the feces and stomach contents in definite quantities and constantly present on repeated examinations; and then, the test positive generally means carcinoma and not ulcer. Tests for occult blood are of little value in the routine examination of ulcer.

The Roentgen Findings

There is no intention to discuss roentgen technique. Only general mention can be made of the value of this method as compared with the others. A few years have seen the roentgen examination develop into a valuable and exact science. Everyone should have a knowledge of roentgenograms and understand fluoroscopy of the alimentary canal. So intimately connected are the technique and interpretation that the special work must be left to the hands of a roentgenologist. The study of the gastro-intestinal tract has not been a popular one even with those who work daily with the roentgen ray. This is due largely to the lack of correlation between the internist and the roentgen worker. In no field is there greater need for the careful collaboration of history, physical findings, chemical analysis and roentgen study. Yet in private practice and in the larger clinics each one is often worked out so nearly alone that the pleasure and exactness of co-operation is lost.

The normal stomach must be kept clearly in mind. This varies just as much as people are tall and thin, short and fat, or flabby and muscularly developed. The findings, if positive, are generally definite and quickly seen. The acuteness of observation is lost by prolonged study.

Roentgenograms are important as set stages of different phases of form and motor activity. The fluoroscope is essential to connect these phases and the living activity of normal or pathological changes. It also permits, in keeping with cleverness and knowledge of technique, a study of things never seen on plates. The two must be used as complements of each other.

Roentgen interpretations often fail, as do all other clinical tests. Seldom are conditions seen like the clear textbook illustrations. The patient may be fat or cranky or the plates poor. Technique influences very much the value of the evidence. The human element enters in to an enormous degree. Obtaining the information is a part of the art in examination, and often it taxes heavily the ingenuity and the intelligence of the worker.

The cardinal points in the gastric examination may be summarized as defects in contour of the luminal outline expressed in the following descriptive terms: Filling defects, projections, niches, diverticula, hourglass deformity and spasms. Ulcer changes are easily seen on the greater and lesser curvatures. It is difficult to demonstrate them on the posterior wall. Fortunately 90 per cent are found in the positions easy to locate. The same is true with duodenal ulcers. Ninety per cent are found in the first one and one-half inches of the duodenum. There are also indirect signs of gastric and duodenal ulcers. These serve to give the impression that ulcer is present, but more exacting study demands that the actual ulcer be demonstrated by tissue change. Obstruction often seen is due to actual tissue contraction in less than ten per cent of the cases (C. H. Mayo).

Every patient with an ulcer should be studied at least once a year, whether the treatment has been medical or surgical. Ulcers should be re-examined for changes. No patient should be subjected to an exploratory operation until a complete examination has been made. Often the operation will be unnecessary. A negative diagnosis of ulcer is a most convincing argument that none is present. By no other means is it possible to locate with exactness the ulcer in the stomach or the duodenum. Other problems of surgical attack may be consistently worked out. An ulcer larger than a quarter situated in the stomach is potentially malignant, for 60 per cent of these have been proven to be cancer (Mayo). Barring extreme ptsosis with flabby stomach walls, a residue at the end of six hours usually means pathology, and if the search is rigidly maintained the reward is rather certain. Gastric ulcers, so far as pathonomic signs are concerned, may disappear under treatment, and this doubtless means healing; but chronic indurated ulcers of the duodenum never disappear. Gastroenterostomy generally renders demonstration of the deformity difficult if not impossible.

When should the roentgen examination be made? It should be the routine when any serious disease of the gastro-intestinal canal is suspected, in all patients in the cancer age who have any suspicions of carcinoma, in all long-standing gastric disturbances which have not yielded to treatment, and in neurotics to encourage their treatment. It should replace the exploratory operation so far as possible.

Summary

1. A careful history should precede all study of any gastro-intestinal lesion. A history is present, even though not diagnostic, in 90 per cent of all ulcers.

2. The physical findings follow constantly a positive history. While less valuable, they add to the weight of evidence.

3. Clinical laboratory results are the weakest of all, but if characteristic they may turn the tables toward an exact diagnosis.

4. The roentgen findings are the most exact of all, but do not in any sense supersede the history.

5. The careful correlation of history, physical findings, clinical laboratory results and roentgen evidence has raised the percentage of accuracy from about one-third to nearly one hundred per cent.

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*Read at Annual Meeting of the Radiological Society of North America. Chicago, December, 1920.

TABLE NO. I-A—GASTRIC ULCERS

KEY TO LETTERING

M—Male.
F—Female.
P—Positive.
N—Negative.
G—Gastric.
D—Duodenal.
D—Doubtful, in Table I (A and B)
Q—Doubtful, in Subsequent Tables.

Patient's Name	Number	Sex	Diagnosis	History	Physical Findings	Clinical Findings	Roentgen Findings	Fractional	Operative Findings
1—N C B	A-2750	M	G	P	P	N			D. U. Chr. App.
2—M E	A-2948	F	G	P	N	N	P		
3—G G	A-3138	M	G	P	P		P		Perigastric Adh.
4—E J S	A-3302	M	G	P	P	P		Yes	
5—F M M	A-3735	M	G	P	N	P	D P	Yes	
6—F M	A-4004	M	G	P	P				A. C Perf. G. U.
7—B B A	A-4646	F	G	P	P				
8—B C	A-4738	F	G	P	P				G. U. and G. B.
9—G E	A-4795	M	G	P		P		Yes	G. U. Death
10—N G	A-4842	F	G	P	P		D P		
11—M E P	A-5056	M	G	P	P	P	P		
12—Mrs. R	A-5086	F	G	P	P		P		G. U.
13—E S S	A-5107	F	G	P					
14—F W M	A-3396	M	G	P	P		D P		
15—R B W	A-5176	M	G	P	P				
16—C B	A-4698	M	G	P	P				
17—M I	A-4878	F	G	P	P	N	P	Yes	Chr. Appendicitis
18—J H G	A-4830	M	G	P	P				Perforated—G. U.
19—F J	A-4909	M	G	N	N				Perforated—D. U.
20—W H Y Y	A-507	M	G	P	P				
21—S M	A-546	M	G	P	P				
22—Mr. P	A-572	M	G	N	P				Perforated G. U. (Death)
23—B A	A-575	F	G	P	D				
24—Miss B	A-576	F	G	P	P	P	P		
25—A K	A-587	M	G	P	D				
26—E D	A-599	F	G	P	P				
27—Mr. A	A-601	F	G	P	P	N	P		
28—H S	A-1246	M	G	P	D				
29—T N E	A-1875	M	G	P	D	N			
30—W P B	A-566	M	G	P	P		P		Gastric Ulcer
31—L D	A-2793	M	G	P	D				
32—L P	A-3723	M	G	P	P				Perf. G. U. Death
33—F D	A-3833	M	G	P	P	D	P	Yes	
34—J A K	A-3963	M	G	D	D				
35—G S	A-4093	M	G	P	P				
36—W M C	A-4369	M	G	P	P	N	P		
37—O A H	A-4872	M	G	D	N				
38—A K	A-4928	M	G	P	N		P		Gastric Ulcer
39—C C M	A-5006	M	G	P	D				
40—J H	A-5446	M	G	P	P				
41—W E N	A-5423	M	G	P	P	D	D P	Yes	
42—D R C	A-5407	M	G	P	P	P	P	Yes	
43—A J R	A-5281	M	G	P	P				
44—W T V	A-5915	M	G	N	P	D	P	Yes	
45—Mrs. M	A-4946	F	G	P					
46—G R	A-2037	F	G	P	P				
47—O N	A-5015	F	G	D	D				
48—F P	A-5031	M	G	P	D	P	D	Yes	
49—C B	A-577	M	G	P	D				
50—J D M	A-3381	M	G	D	P	N	N		Perigastric Adhns.
51—T O T	A-3995	F	G						Gastric Ulcer
52—S B R	A-5688	F	G	D	P	P	D	Yes	
53—E H G	A-133	F	G	P	P				
54—P J	A-282	F	G	P	D				
55—G D	A-6031	F	G	P	N				
56—F M B	A-6013	F	G	P	P	N	D	Yes	
57—A H	A-6080	F	G	P	P	N	P	Yes	
58—D S	A-6119	M	G	P	N	P	P	Yes	
59—J E	A-6219	M	G	P	P	P	P	Yes	

TABLE NO. I-B—DUODENAL ULCERS

Patient's Name	Number	Sex	Diagnosis	History	Physical Findings	Clinical Findings	Roentgen Findings	Fractional	Operative Findings
1—D A B	A-3651	M	D	D			N		
2—A J	A-4512	M	D	P	N		N		
3—B E C	A-4757	M	D	D	N	N		Yes	
4—G N	A-4981	F	D	D	N		P		
5—G P	A-5071	M	D	P	N		P		
6—M R	A-5089	F	D	D	D				
7—J M H	A-5832	M	D	N	N	P	P	Yes	
8—R L P	A-5295	M	D	P		N	P		
9—W R	A-5432	F	D	P	D	N	N	Yes	
10—E G W	A-5478	M	D	P	N		P		
11—C F	A-5482	M	D	P	P	N	D	Yes	Gall Bladder
12—J B	A-5765	M	D	P	P	P	P	Yes	
13—A E B	A-5766	F	D	D	D	N	P	Yes	
14—Mrs. B	A-5778	F	D	D	P	N	G P	Yes	
15—G C	A-5793	F	D	P	P	P	P		
16—R A H	A-5833	M	D	P	N	P	P	Yes	
17—C E H	A-5834	M	D	P	N	P	P	Yes	
18—F C	A-1882	F	D	P	N	N	P	Yes	
19—R L M	A-5872	M	D	P	P	P	P	Yes	
20—L N	A-4882	F	D	D	P		P		
21—A F G	A-148	M	D	P	P	N	P		
22—C S	A-161	F	D	D	P	N	P		Chronic Appendicitis
23—Mrs. S	A-171	F	D	P	N				
24—J P A	A-19	M	D	P	P	N	P		∫ No Opn. Death later.
25—W E S	A-203	M	D	D	P	P			⌊ Perforated D. Ulcer
26—F A T	A-232	M	D	P	N				
27—F H	A-288	F	D	P	P	N			
28—R P	A-358	F	D	D	D	D			
29—C V M	A-381	M	D	P	P				∫ Chr. Appendicitis
30—H M M	A-398	F	D	P	P				⌊ Pericholecystitis
31—J M C	A-401	F	D	P	P				
32—R B M	A-452	M	D	P	P	N	P		Chr. Ap. D. Peri Bands
33—G E P	A-491	M	D	P	P	N	P		Chr. D. Ulcer
34—Mr . C	A-559	F	D	P	P	N	P		Chr. D. Ulcer
35—Mr. F	A-560	M	D	P	P		P		Chr. D. Ulcer
36—A C	A-561	M	D	P	D				Chr. Ap. Syph.
37—C A P	A-562	M	D	P	P	P	P		Chr. D. Ulcer
38—E M	A-564	M	D	P	P	D	P		Chr. D. Ulcer
39—R T C	A-567	M	D	P	N				Chr. D. Ulcer
40—P B	A-568	M	D	N	D	N			Duodenal Bands
41—F G	A-570	M	D	P	P	N	P		Duod. 2d Portion
42—L D	A-571	M	D	P	N		P		Chr. D. U.
43—J A E	A-574	F	D	P	P		P		
44—H E B	A-578	F	D	P	P				
45—H R C	A-579	M	D	P	P	P	P		
46—E J D	A-580	F	D	P	N				
47—P C K	A-586	M	D	P	P	N			
48—J K	A-588	M	D	P	P	P	P		
49—Mr. J	A-590	M	D	P	D				
50—E H	A-591	F	D	P	P				
51—H H	A-592	M	D	P	P				
52—W G	A-593	M	D	P	P	N	N		
53—C B	A-577	M	D	P	D	N			
54—H. F F	A-595	M	D	P	N	N	N		
55—W C D	A-597	M	D	P	D				
56—C L D	A-598	F	D	P	P				
57—C H A	A-600	M	D	P	P	N			
58—S R D	A-603	F	D	P	P	N	P		
59—H W A	A-604	M	D	P	D	P			
60—H S	A-613	F	D	P	P	P	D		
61—H W B	A-648	M	D	P					
62—W A.	A-660	M	D	P	P				
63—C H B	A-693	M	D	P	P				
64—G D	A-734	F	D	P	P				
65—C B C	A-696	F	D	P	N	N	P		
66—O B M	A-887	M	D	P	P				∫ Obstruction Bowels
67—O N M	A-890	M	D	D	D	N	D		⌊ D. U. Chr. Ap. Death
68—J M	A-922	M	D	P		P			
69—G P	A-946	M	D	P	P				
70—E M R	A-977	F	D	P	P	P	P		Chronic D. U.
71—G M S	A-1233	M	D	P	D				Op. ∫ Intestinal Obstr.
72—Mr. B	A-1284	M	D	P	P	P	P		⌊ Death 6 months later
73—Sis. B	A-1288	F	D	P	P	N	P		Duodenal Ulcer

TABLE NO. I-B—DUODENAL ULCERS—(Continued)

Patient's Name	Number	Sex	Diagnosis	History	Physical Findings	Clinical Findings	Roentgen Findings	Fractional	Operative Findings
74—J D	A-1324	F	D	P	P	P	P		D. U. 1914; G. 1910; Op.
75—J K	A-1404	F	D	P	P	P			
76—W H N	A-1447	F	D	P	D	P	N		
77—W C	A-1512	M	D	P	D				
78—C S P	A-1542	F	D	P	P	D			
79—F J S	A-1660	M	D	D	P	P	P		
80—H W Q	A-1704	M	D	P	P	P	P		
81—J W	A-1776	F	D	D	P	N			
82—W T Z	A-1790	M	D	D	P	P	P		
83—P L	A-1935	F	D	P	N				
84—A S	A-1936	M	D	P					
85—F D S	A-1941	M	D	P					
86—B J M	A-1980	M	D	P	P				
87—A W	A-2067	F	D	P	P		P		
88—S W	A-1780	F	D	P	P	N	N		
89—H S	A-2209	F	D	P	P	N	P	Yes	Chronic D. U.
90—J P	A-2239	F	D	P	P		P		
91—K D	A-2247	F	D	P	P		P		
92—C K O	A-2248	M	DG	P	P				Chr. D. & Chr. G. U. Perf.
93—C C O	A-2255	M	D	P	P	N	P	Yes	
94—G E H	A-2374	M	D						
95—L R M	A-2396	F	D	P	P	P	P	Yes	
96—T J P	A-2419	M	D	P	P		P		Elsewhere no report
97—A H R	A-2433	M	D	P	P	N	P		
98—J C M	A-371	M	D	P	P	N	P	Yes	
99—C A H	A-1833	M	D	P	P	P	P		Duodenal Ulcer
100—O W S	A-2456	M	D	P	P	N	P	Yes	
101—F S	A-2458	M	D	P	P	P	P	Yes	
102—F L S	A-2461	F	D	P	P	D	P	Yes	Duodenal Ulcer
103—H S	A-2465	M	D	P	P	N	P		Duodenal Ulcer
104—E E T	A-2492	M	D	P	P	P	P		
105—F H	A-2122	F	D	P	P	N	P	Yes	
106—G U G	A-2953	F	D	P	P				
107—R C E	A-3100	F	D	P	P				
108—W A M	A-4021	F	D	P	P	D	P		
109—A J W	A-2527	M	D	P	P	P	P	Yes	
110—E H J	A-2996	F	D	P	P		P		
111—J W B	A-3049	M	D	P	P	N	D	Yes	
112—E L H	A-3183	M	D	D	P	P		Yes	
113—W W P	A-3210	F	D	P	P	N	D		
114—C B T	A-2483	M	D	P	P	P	P	Yes	Duodenal Ulcer
115—F W J	A-3336	M	D	P	P				
116—A O L	A-3378	M	D	P	P	P	P	Yes	Duodenal Ulcer
117—E S W	A-3428	M	D	P		P		Yes	D. U. 2d portion
118—I R K	A-3533	M	D	N	N	P	P	Yes	
119—H A	A-3650	F	D	P	D				
120—A J R	A-3725	M	D	P	P				
121—A F D	A-3834	M	D	P	P	P	P	Yes	
122—B H	A-3887	F	D	P	P	N	P		
123—L B H	A-3902	M	D	P	N	P	P	Yes	
124—C H H	A-3929	M	D	P	D				
125—Mrs. M	A-4029	F	D	D	P	N			
126—B J M	A-4136	F	D	P	P	P	P	Yes	
127—A W B	A-4674	M	D	P		P	P	Yes	
128—L R	A-4586	M	D	P	P		N	Yes	
129—J R W	A-5214	M	D	P	P	P		Yes	
130—F P	A-5276	F	D	P	P	N	P	Yes	
131—W E R	A-4581	M	D	P	P	P	D	Yes	
132—Rev. E W	A-5338	M	D	P	P	N	P	Yes	
133—S F C	A-6212	M	D	P	P	N	P	Yes	
134—J P H	A-6213—	F	D	P	N	P	D	Yes	
135—J K	A-6214	M	D	P	P		P		
136—H K	A-6215	M	D	P	P	N	P	Yes	
137—O R	A-6216	M	D	P	P	P	P	Yes	
138—F H T	A-6217	M	D	D	N		N		
139—W D	A-6218	M	D	P	P	P	P	Yes	
140—H T W	A-6220	M	D	P	P				
141—M Y	A-2221	M	D	D	P		P		Umb. Hernia; Op.
142 M B	A-6019	F	D	P	P				
143—D E	A-6038	F	D	P	P				
144—A C S	A-6129	M	D	P	P		P		D. U. Chr. App.
145—Mrs. T. B.	A-6211	F	D	N	P	N	P	Yes	

TABLE II.—STATISTICAL REVIEW

(Analysis of Table I.)

			Gastric Ulcer	Duodenal Ulcer	Total
A.	Total Number of Diagnoses		59	145	204
	Total Number of Histories	Positive	50	122	172
		Negative	8	21	29
		Not Given	1	2	3
	Total Number of Physical Findings	Positive	37	97	134
		Negative	18	39	57
		Not Given	4	9	13
	Total Number of Clinical Findings	Positive	10	38	48
		Negative	12	48	60
		Not Given	37	59	96
	Total Number of Roentgen Findings	Positive	21	75	96
		Negative	3	16	19
		Not Given	37	54	89

TABLE III.—STATISTICAL REVIEW

(Analysis of Table I.)

		Gastric Ulcer	Duodenal Ulcer	Total
B.	Total number of Operations	15	32	47
	Receiving Medical Treatment or Refusing Surgical	44	113	157
	Mortality Immediate (per cent)	13	0	1
	Total Number of Males	38	92	130
	Females	21	53	74
	Ratio of Gastric Ulcer to Duodenal	2	5	...
	Males to Females	5—3	9—5	7—4

TABLE IV.—OPERATIVE CASES

Patient's Name	Number	Sex	Diagnosis	History	Physical Findings	Clinical Findings	Roentgen Findings	Surgical Report
1—N C B	A-2750	M	G	P	P	N	P O	D. U. Chronic Appendicitis
2—G G	A-3138	M	G	P	P		P	Perigastric Adhesions
3—F M	A-4004	M	G	P	P			Acute Perforated G. U.
4—B C	A-4738	F	G	P	P			Gastric Ulcer
5—G E	A-4795	M	G	P	N	P		Gastric Ulcer
6—Mrs. R	A-5086	F	G	P	P		P	Gastric Ulcer
7—M I	A-4878	F	G	P	P	N	P	Chronic Appendicitis
8—J H G	A-4830	M	G	P	P			Perforated—G. U.
9—F J	A-4009	M	G	N	N			Perforated—G. U.
10—Mr. P	A-572	M	G	N	P			Perforated—G. U.
11—W P B	A-566	M	G	P	P		P	Gastric Ulcer
12—L P	A-3723	M	G	P	P			Perforated—G. U. (D)
13—A K	A-4928	F	G	P	N		P	Gastric Ulcer
14—J D M	A-3381	M	G	Q	P	N	N	Perigastric Adhesions
15—T O T	A-3995	F	G					G. I.
16—C F	A-5482	F	D	P	P	N	N	G. B.
17—C S	A-161	F	D	Q	P	N	P	Chronic Appendicitis
18—H M Mc	A-398	F	D	P	P			Chr. App. Pericholycystitis
19—O N M	A-890	M	D	Q	Q	N	Q	D. U. Chr. App.
20—E M R	A-977	F	D	P	P	P	P	D. U.
21—Mr. B	A-1285	M	D	P	P	P	P	D. U. Op. Aft. for Ob. Bowel
22—Sis. B	A-1288	F	D	P	P	N	P	D. U.
23—J D	A-1324	F	G	P	P			D. U. (G 1910; D U 1914)
24—H S	A-2209	F	D	P	P	N	P	D. U.
25—C K O	A-2248	M	G D	P	P			Chr. G. U. Perf. Concom.
26—R B M	A-453	M	D	P	P	N	P	Chr. App. Periduodenal
27—J E P	A-491	M	D	P	P	N	P	D. U. Adh. Chr. App.
28—Mrs. C	A-559	F	D	P	P	N	P	Chr. D. U.
29—Mr. F	A-560	M	D	P	P		P	Chr. D. U.
30—A C	A-561	M	D	P	Q	N		Syphilis; Chr. App.
31—C A P	A-562	M	D	P	P	P	P	Chr. D. U.
32—E M	A-564	M	D	P	P	Q	P	D. U.

33—R T C	A-567	M	D	P	N			D. U.
34—P B	A-568	M	D	N	Q	N		Duodenal Bands
35—F G	A-570	M	D	P	P	N	P	D. U. 2d Portion
36—L C	A-571	M	D	P	N		P	D. U.
37—T J P	A-2419	M	D	P	P		P	Op. Elsewhere; no report
38—C A H	A-1833	M	D	P	P	P	P	D. U.
39—F L S	A-2461	F	D	P	P	Q	P	D. U.
40—H S	A-2465	M	D	P	P	N	P	D. U.
41—C B T	A-2483	M	D	P	P	P	P	D. U.
42—A C L	A-3378	M	D	P	P	P	P	D. U.
43—E S	A-3429	M	D	P			P	D. U.
44—J D	A-1324	M	D	P	P	P	P	D. U.
45—A C C	A-6129	M	D	P	P		P	D. U. Chr. App.
46—J P H	A-6213	F	D	P	N	P	Q	D. U. and G. B.
47—M Y	A-2221	M	D	Q	P		P	Umb. Hernia

TABLE V.—STATISTICAL DEDUCTIONS FROM TABLE IV.

		Gastric Ulcer	Duodenal Ulcer	Total
Number of Histories	Positive	13	27	40
	Negative	3	4	7
	Not Given	1	0	1
				48
Number Physical Findings	Positive	13	24	37
	Negative	3	6	9
	Not Given	1	1	2
				48
Number Clinical Findings	Positive	1	10	11
	Negative	3	13	16
	Not Given	13	9	22
				49
Number Roentgen Findings	Positive	6	23	29
	Negative	1	3	4
	Not Given	10	5	15
				48
Total Number Diagnoses (two concomitants, 5 per cent)		17	31	48
Total Number Males		11	22	33
Total Number Females		6	9	15

NOTE—Although in nine of these cases the diagnosis of ulcer is not sustained by operative report, nevertheless all were surgical cases and justified operation. Where perigastric and periduodenal adhesions are mentioned, they might have arisen from ulcer perforation or inflammation.

Case 2 diagnosis is not sustained, but the operative report is D. U., agreeing with the roentgen report.

Case 7 is a clear miss, not possible to explain.

Cases 14, 17, 34 and 47 are misses, and should be, as the evidence was entirely inadequate.

Cases 16, 18 and 30 are misses, and should be, as examination was incomplete. Criticism should not be so severe, however, as the evidence is strong.

TABLE VI.—OPERATIVE CASES WITH ROENTGEN FINDINGS

Patient's Name	Number....	Sex........	Diagnosis...	History.....	Physical Findings...	Clinical Findings...	Roentgen Findings...	Surgical Report
1—N C B	A-2450	M	G	P	P	N	P D	D. U. Chr. App.
2—G G	A-3138	M	G	P	P		P	Perigastric Adhesions
3—Mrs. R	A-5086	F	G	P	P		P	G. U.
4—M J	A-4878	F	G	P	P	N	P	G. Chr. App.
5—W P B	A-566	M	G	P	P		P	G. U.
6—A K J	A-4928	F	G	P	N		P	G. U.
7—J D M	A-3381	M	G	Q	P	N	N	Perigastric Adhesions
8—C F	A-5482	M	D	P	P	N	Q	G. B.
9—C S	A-161	F	D	Q	P	N	P	Chr. App.
10—O R N	A-890	M	D	Q	Q	N	P	D. U. Chr. App.
11—E N R	A-977	F	D	P	P	P	P	D. U.
12—Mr. B	A-1285	M	D	P	P	P	P	D. U.
13—Sis. B	A-1288	F	D	P	P	N	P	D. U.
14—D A J	A-2209	F	D	P	P	N	P	D. U.
15—R B M	A-453	M	D	P	P	N	P	Periduodenal; Chr. App.
16—J E P	A-491	M	D	P	P	N	P	D. U. Chr. App.
17—Mrs. C F	A-559	F	D	P	P	N	P	D. U.
18—Mr. F	A-560	F	D	P	P		P	D. U.
19—C A P	A-562	M	D	P	P	P	P	D. U.
20—E M	A-564	M	D	P	P	Q	P	D. U.
21—F G	A-570	M	D	P	P	N	P	Op. Elsewhere; no report
22—L C M	A-571	M	D	P	N		P	D. U.
23—T J P	A-2419	M	D	P	P		P	D. U.
24—C A H	A-1833	M	D	P	P	P	P	D. U.
25—F L S	A-2461	F	D	P	P	Q	P	D. U.
26—H S	A-2465	M	D	P	P	N	P	D. U.
27—C B T	A-2483	M	D	P	P	P	P	D. U.
28—A O L	A-3378	M	D	P	P	P	P	D. U.
29—E I W	A-3429	M	D	P		P	P	D. U.
30—J D	A-1324	M	D	P	P	P	P	D. U.
31—A C S	A-6129	M	D	P	P		P	D. U. Chr. App.
32—J P H	A-6213	F	D	P	N	P	Q	D. U. and G. B.
33—J Y	A-2221	M	D	Q	P		P	Umb. Hernia

TABLE VII.—ANALYSIS OF TABLE VI.

29 cases agree with the roentgen report.
4 cases are not in entire agreement with the roentgen report.

No. 1—Corrected the location of the ulcer made by clinician.

No. 2—"Perigastric adhesions" reported is a surgical case anyway, and may have been due to perforation or ulcer inflammation.

No. 8—"Doubtful" should have put the clinician on guard.

No. 9—"Chronic appendicitis" was a clear miss, although surgical exploration was justified.

No. 15—"Periduodenal adhesions and chronic appendicitis." The duodenal adhesions may be explained in the same way.

No. 33—"Umbilical hernia" was a clear miss. Examination was incomplete, due to difficulties in handling the patient. Exploration justified.

Roentgen evidence "Positive" is of great value.
Roentgen evidence "Negative" is of definite value.

SUMMARY

Roentgen Findings..	Positive, 28 Negative, 3
Number Histories..	Positive, 29 Negative, 4
Number Physical Findings..	Positive, 28 Negative, 4
Number Clinical Laboratory Findings..	Positive, 9 Negative, 15


W. B. Cannon

Cannon and His Work

THE little town of Prairie du Chien, Wisconsin may be justly proud of being the birthplace of Cannon even as Boston is to be congratulated for being the place of his professional investigations and research. Walter Bradford Cannon was born in Prairie du Chien, Wisconsin, in 1871. After receiving the degrees of A. B. and A. M. at Harvard, he took up the study of medicine in 1897 at the same place.

He is Fellow of the American Medical Association and is licensed to practice medicine in Massachusettes, but is not in practice, preferring rather research work and the teaching profession.

He resides at 2 Divinity Ave., Cambridge. His office is at the Harvard Medical School where he is Professor of Physiology in the school and in the graduate school.

The different societies which he honors by his membership demonstrate the happy variety of his interests. He is a member of:

The Association of American Physicians.

The American Gastro-Enterological Association.

The American Roentgen Ray Society.

The National Academy and Sciences.

The American Philosophy Society.

The Society for Experimental Biology and Medicine.

The Massachusettes Medical Society.

The Boston Society of Medical Sciences.

Our immediate interest is in his work in roentgenology. When the rays were only a year old, Dr. Cannon was the first to demonstrate the possibility and practicality of studying the movements of the stomach and intestines by means of the x-rays. His paper on "The Movements of the Intestines Studied by Means of the Roentgen Rays" which was published in the American Journal of Physiology in Boston reads like a fairy tale even now to the uninitiated. At the present time, only about 25 years later, the wonders which it records are seen every day in any x-ray laboratory. But it is tremendously valuable as marking an epoch in the development of roentgenology and suggests what vast regions may be explored in the next 25 years. Following is an abstract of the paper cited.

Movements of the Intestines Studied by Means of the Roentgen Rays

W. B. Cannon, M. D.

Introduction

PATHOLOGICAL subjects or animals have been the only scources of our knowledge. The slowly-advancing peristaltic wave and the Pendelbewegung have been regarded as true physiological processes. There has been less agreement concerning anti-peristalsis and swiftly-running vermicular contraction. The best known is the normal peristaltic wave.

Pendulum movements are the gentle swaying motion of the coils and the rhythmical contractions of the intestinal wall. These continue even after paralysis of the local nervous mechanism by nicotine or cocaine.

The swift vermicular wave may pass the whole length of the intestine in about a minute. It is often seen just after death, as well as in pathological states. According to Starling this is an exaggeration of the rhythmic type. Mall puts it in a class by itself. Nothnagel says the movement is transitional between a physiological and a pathological activity.

The Method

Sub-nitrate of bismuth, one-tenth to one-third the weight of food was mixed with what was fed to the animal under observation. The animal was usually not allowed to eat anything during the day previous to examination, and was commonly given four to six teaspoonfuls of castor oil.

A tranquil mood on the part of the animal was found to be as necessary for seeing the movements of the intestine as for securing the normal activity of the stomach. On this account female cats were more favorable subjects than males.

Five hours and forty-five minutes after eating, the cat was placed on her back. The photo plate was placed over the front of the abdomen. By means of a leaden plate between the cat and the Crookes tube, the exposure was made during the pause recurrent at the end of each respiration when the shadows resume approximately their former position. Records were taken by means of radiographs and by means of tracings made with a soft pencil on tissue paper laid over the fluorescent surface of the screen.

Movement of the Small Intestine

When the food has been distributed through the intestine so as to present the appearance of long, narrow masses, a noticeable feature in most or all of the loops is a total absence of movement.

If the animal is quiet, in a few moments peculiar motions appear in one or another of the loops or in several and last for some time, suddenly dividing one of the long narrow masses into many little segments of nearly equal size. These segments are again suddenly divided and neighboring halves unite to make new segments, and so on. This process is called rhythmic segmentation of the intestinal contents. At the time of the third segmentation the segment which formed the end of the long narrow mass is not redivided. It varies in size with each division; is full size from the addition of a part of the nearest segment and a moment later is a small bit left after another division. The segment which is probably the rear of the mass shoots away when the end mass is divided and is swept back at each reunion to make the large end mass again. This movement is repeated with each recurrence of the constrictions. Segmentation continues commonly for more than half an hour without cessation. The food changes its position in the abdomen to only a slight extent, which may be a passing of the food along the loop or a movement of the loop itself.

Variations From the Typical Form of Rhythmic Segmentation

Sometimes, and especially if the mass of food is thick, constrictions do not make complete divisions and are so far apart that intermediate portions are relatively large and are also constricted not into halves but into thirds. If a little pointer is placed at the middle of a segment when the segments are completely divided into halves, in a few seconds the pointer will be in the middle of the clear space between two segments; in a few more seconds the first phase will return and the pointer will again indicate a segment. When portions are constricted into thirds, three operations intervene between similar phases as shown by the indicator.

The remarkable feature in segmentation of food is the rapidity with which it takes place. To estimate this, count not the number of times partition of food recurs in the same place, but the number of different sets of segments observed in a given period. In long thin chains of food the most common rate of division varies between 28 and 30 times a minute. In some cases the rate is as low as 23 times per minute. In larger masses of food, operations occurred from 18 to 21 times a minute. Segmentation frequently continues for more than half an hour and in one instance persisted for two hours and twenty-two minutes, with only three short periods of inactivity. At the rate of 30 segmentations per minute a slender mass of food may undergo division into small particles more than a thousand times while scarcely changing its position in the intestine.

In a cat lightly etherized the exterior of an intestine which was dividing the food as described above, was seen. An hour and a half after a salmon meal the anesthetic was given, the abdomen was opened and flaps raised to form walls. Warm salt solution was then poured into the abdominal cavity and the floating coils left covered with the transparent omentum. The gastric peristaltic waves were running regularly. On the intestine there were visible at various places regions of constrictions. The constrictions recurred irregularly and at much longer intervals than in the normal animal.

The process of rhythmic segmentation brings the food over and over again into closest contact with the intestinal walls, thereby mixing the undigested food with the digestive juices and exposing the digested food to the organs of absorption. Also by compression of veins and lacteals of the intestinal wall the constrictions serve to deport through the blood and the lymph channels the digested and absorbed material.

Peristalsis is observed normally in two forms, as a slow advancing of the food for a short distance in a coil, and as a rapid movement sweeping the food without pause through several turns of the gut.

When the segmenting activity has gone on for some time, the separate segments may suddenly begin to move slowly along the loop in which they lie. When the front segment stops or meets other food the succeeding pieces are swept one by one into the accumulating mass which shows no sign of commotion.

Another form of slow peristalsis is frequently observed when the food is pushed forward as a large lump. This combines peristalsis and a segmentation into two parts.

Rhythmic Segmentation and the Pendulum Movement

The segmentation described is due to an activity of the intestinal musculature similar to that causing so-called pendulum movement. This activity is rhythmic and involves the longitudinal and circular layers of muscles. Observations of the effect of the rhythmic contractions upon the food show that the action of the circular fibres is most prominent. The function of the longitudinal muscles would be to contract between new rings of constriction and thereby aid in relaxing the former ring between them.

Bayliss and Starling state that the swaying pendulum movements are essentially due to peristaltic waves recurring in the same place and running rapidly downward. I have seen this form only once. About 90 c. c. of soapy water had been injected. The effect was to exaggerate in every particular the movements of the small intestines. A broad constriction appeared about the middle of a long string of food and persisted there while it spread down the gut. As the contraction spread, the gut swayed slowly to and fro before it. Then there was a relaxation followed by recurrence of constriction in the same place and a spreading of the contraction. This phenomenon was repeated till finally the string of food was divided and the forward piece pushed on into the colon.

The Course of Food in the Small Intestine

Chyme is not forced from the stomach by every wave that passes over the antrum, but only at intervals. When the pylorus relaxes, the food, moved toward the pylorus under considerable pressure, is squirted along the duodenum for two centimeters or more. It lies in the curve of the duodenum until additions have been made to it from the stomach and a long thin string of food is formed. In this place it is exposed to the outpouring of the bile and pancreatic juices. Then segmentation begins and continues several minutes thoroughly mixing the intestinal digestive juices with the chyme. Finally the little segments unite in a single mass or in groups, move forward very rapidly for some distance when the food is collected in thicker and longer strings characteristic in other loops.

During the first stages of digestion in the cat's small intestine the food usually lies chiefly on the right side of the abdomen; during the last stages, on the left side. After remaining, sometimes for an hour or more, with no sign of movement, rhythmic segmentation begins, and by a process of kneading and peristaltic advance the food is brought to the ileocaecal valve to enter the large intestine. Records from ten different animals show that salmon does not appear in the small intestine until one or one and a half hours after the food is eaten; and not in the colon until five or six hours after eating. The chyme thus takes four or five hours to pass the length of the small intestine. The operations are shortened if the meal has consisted of bread and milk.

Competence of the Ileocaecal Valve

The competence of the valve for the food which enters the colon from the ileum is perfect. The activity of the colon proves this statement. The failure of every attempt to drive the food in the colon back through the valve into the ileum confirms the proof. Again and again I have tried, by manipulation through the abdominal wall, to press the normal contents of the colon downward with sufficient force to cause them to return to the small intestine, but without success.

Movements of the Large Intestine

In the descending colon the material which is usually hard and in incompressible lumps is very slowly advanced by rings of tonic constrictions; in the ascending and transverse colon and caecum the soft material is commonly subjected to an antiperistalsis movement.

Antiperistalsis in the Colon

The colon of cats which have been without food for a day usually contains enough gas to make the position of the gut distinguishable with the fluorescent screen. The contents of the colon, instead of being driven immediately toward the rectum by slow peristalsis are first repeatedly pushed toward the caecum by an antiperistaltic action.

These antiperistaltic waves begin either on the more advanced portion of the food in the colon (when only a small amount is present), or at the nearest tonic constriction which is usually at the turn between the transverse and descending colon; follow one another like the peristaltic waves of the stomach; and rarely run continuously for a long time. When the colon is full, it is usually quiet. The first sign of activity is an irregular undulation of the walls. Then faint constrictions pass along the gut toward the caecum. When the waves become more prominent they are seen to start near the end of the transverse colon and pass without interruption to the end of the caecum. After a few minutes the indentations grow gradually less marked and finally are hardly discernible.

The period of antiperistalsis lasts from two to eight minutes with an average duration of four to five minutes; recurs at varying lengths of time; and the waves have nearly the same rate of recurrence as those in the stomach, i. e., eleven waves in two minutes.

Usually the almost immediate result of a rectal injection of warm water is the appearance of deep antiperistaltic waves, which often continue running for a long period of time, an hour and 20 minutes in one case observed.

These constrictions passing backward over the colon do not force the normal contents back through the valve into the small intestine. In hundreds of such constrictions observed, only two exceptions to this rule were found. The importance of the competence of the ileocaecal valve is now apparent. Inasmuch as the valve is normally competent the constrictions repeatedly coursing toward it force the food before them into a blind sac. Since it cannot go onward in the blind sac and is subjected to increasing pressure as the constriction comes nearer, it is forced into the only way of escape, i. e. away from the caecum through the advancing constricted ring. The result is a thorough mixing of the contents and a bringing of these contents into close contact with the absorbing wall, a process variously repeated many times in the stomach and small intestine.

Two Other Movements Observed But Rarely in the Ascending Colon

One was a serial sectioning of the contents in an animal given castor oil with the food. A constriction separated a small segment in the caecum; another constriction then cut off a segment just above the first, and with the disappearance of the first constriction, the two separated segments united. The whole mass was sectioned from one end to the other and the process was immediately repeated several times. The second of the two movements consisted in a gentle kneading of the contents caused by broad constrictions appearing, relaxing, appearing, relaxing, over and over again in the same place. Once a constriction occurred and remained permanently in one place while the bulging parts on either side of it pulsated alternately at the rate of about 18 times in a minute, with the regularity of the heart-beat.

The Changes When Food Enters the Colon

The passage of food through the ileocaecal valves seems to stimulate the colon to activity. The moment it has entered the colon, a strong contraction takes place all along the caecum and the beginning of the ascending colon, pressing some of the food onward. A moment later deep antiperistaltic waves sweep down from the transverse colon and continue running until the caecum is again normally full, i. e. for two or three minutes.

The Appearance of Tonic Constrictions

As food accumulates in the ascending colon it is at first confined to this region by antiperistaltic waves. With further accessions the contents are pressed more and more into the transverse and descending colon. As the contents extend along the intestine a deep constriction appears near the advancing end and nearly separates a globular mass from the main body of the food. New tonic constrictions appear which separate the contents into a series of globular masses. The rings disappear from the transverse colon and then are present in the descending colon. In the transverse colon which is free from the slowly-moving rings the antiperistaltic waves have full sway. The persistent slowly-moving rings away from the caecum form the waste matter into globular masses at the end of the transverse colon and slowly push these masses onward.

Defecation

Food was observed in the colon of the animal observed at 3:11 p. m. About 3:25 the gut swung around with a slow sweeping movement; the ascending colon lying in the position of the last half of the transverse colon; the transverse colon taking the position of the descending part. The tonic constrictions disappeared. Strong broad contraction of the circular muscle tapered the contents off on either side in two cones. The region of strongest contraction was apparently drawn downward with the rest of the gut by a shortening of the descending colon. As the intestine swung round, more material was forced into the rectum, and when the swinging of the intestine stopped the constriction which divided the lumen passed slowly downward and with the aid of the muscles surrounding the abdominal cavity, pushed the separated mass out of the canal. After which the colon with the remainder of its contents returned to nearly its former position. Most of the contents of the caecum and the ascending colon may be passed onward even during starvation. The only activities manifested are the antiperistaltic waves, and the strong tonic contraction of the whole circular musculature.

Observations indicate that either a general contraction of the wall of the large intestine or a true peristalsis may be effective in pressing waste matter from the region where antiperistalsis is the usual activity into the region where the slowly advancing rings may carry it on to evacuation.

Enemata consisting of 100 c. c. of milk, one egg, 10 to 15 grams of bismuth subnitrate, and two grams of starch to hold the bismuth powder in suspension were used. To make a thick enema all were stirred together and boiled together and boiled to a soft mush; to make a thin enema, all ingredients were boiled together except the egg, which was added after the boiled substance was cooled. The small amount injected was 25 c. c.; the large almost 90 c. c. The animals were given first a cleansing injection and when this was effective the nutrient material was introduced. A control radiograph was first taken to show no bismuth food present, and other radiographs taken at varying intervals after the injection to record the course the food was following.

These experiments show that when small amounts of nutrient fluids are introduced they lie first in the descending colon. In every case antiperistaltic waves are set going by the injection and the material is thereby carried to the caecum. Large amounts injected stop for a moment in the region between the transverse and descending colon as if a constriction existed there. Then a considerable amount of the fluid passes the point and antiperistaltic waves carry it to the caecum. In any case the repeated passing of the waves seems to have the effect of promoting absorption, for in the region where these waves continue running, the shadows become gradually more dim and finally bismuth appears to be only on the intestinal walls; in other regions, e. g., in the descending colon, the shadows retain their original intensity. I have never seen small injections forced even in part into the small intestine. With the larger amount whether fluid or mushy, the radiographs show many coils of the small intestine containing the bismuth food.

The passage of the injected material beyond the ileocaecal valve is probably due entirely to antiperistalsis in the colon. The valve which is thoroughly competent for food coming normally from the small intestine into the large is curiously incompetent for even a thick creamy substance introduced in large amount by rectum.

I have never seen food material pass back from the colon so far as the stomach; but once, about ten minutes after an injection of 100 c. c. of warm water, the cat retched and vomited a clear fluid resembling mixed water and mucus. In the fluid were two intestinal worms still alive.

In the colon the nutrient material of the enemata is worked over by the antiperistaltic waves, mixed with digestive juices present and exposed to the organs of absorption in that region. If the enemata are large, the digestive and absorptive processes may also take place along extensive surfaces of the small intestine.

The Effect of Emotions and Sleep

Observations on the stomach of the cat showed that the peristalsis is inhibited whenever the animal manifests signs of anxiety, rage or distress. Many emotional states are a strong stimulus to peristalsis, but other emotional states inhibit peristalsis. In the cat the same conditions which stop the movements of the stomach, stop also the movements of the intestines.

When the segmentation process in the small intestine is stopped by excitement the segments unite and the series of parts returns to the form of a solid string. In a descending colon where the antiperistalsis were inhibited by excitement the tonic constrictions were apparently not affected.

As soon as a cat shows distress when its breathing is artificially stopped every form of intestinal movement stops.

The statement is sometimes made that gastric and intestinal mechanisms cease to act during sleep; and that night time is their normal time for repose. But though nearly all the animals curled up and slept during the time between observations, nevertheless the progress of the food through the intestines was continuous and I have seen both large and small intestines actively at work from half past nine until half past ten o'clock at night.

Summary

1. Bismuth subnitrate, 10 to 33 per cent, mixed with the food

renders the movement of the intestinal contents,—and thereby the movements of the intestinal walls,—visible on the fluorescent screen.

2. The activity most common in the small intestine is rhythmic segmentation which in the cat proceeds at the rate of 30 divisions per minute, mixing the food and the digestive juices, bringing the digested food into contact with the absorbing mechanisms, and emptying the venous and lymphatic radicles of their contents by compression of the intestinal wall.

3. Peristalsis is usually combined with segmentation, interfering constrictions often momentarily separating the rear end of an advancing mass of food from the main body.

4. The ileocaecal valve is thoroughly competent for food entering the colon from the ileum.

5. The usual movement of the transverse and ascending colon and the caecum is an antiperistalsis, recurring in periods of five minutes each about every 15 minutes and giving new significance to the ileocaecal valve; for the food, now in a closed sac is thoroughly acted upon without any interference with the processes in the small intestine.

6. When new food enters the large intestine a strong general contraction immediately takes place along the caecum and ascending colon, forcing some of the food onward; a moment later antiperistaltic waves begin to pass.

7. With the accumulation of material in the transverse colon, deep tonic constrictions appear one after another, carrying the material into the descending colon and leaving the transverse and ascending portions free for the antiperistaltic waves.

8. In emptying the large intestine the material in the lower descending colon is first carried out by combined peristalsis and pressure of abdominal muscles; the remainder of the material is then spread into the evacuated region, and this region is again cleared. In normal life the new food arriving in the colon must force forward the old contents of the ascending and transverse colon.

9. Observations have revealed no evidence of antiperistalsis in the small intestine, but, since the ileocaecal valve will allow nutrient material under pressure to pass backward, the antiperistalsis of the large intestine may force into the small intestine a considerable portion of a large nutrient enema. Segmentation in the small intestine affects such an enema precisely as it affects food passed normally through the stomach.

10. Signs of emotion, such as fear, distress, or rage, are accompanied by a total cessation of movements of both large and small intestines. The movements continue in the cat both during sleep and at night.

[American Journal Physiology, Boston, 1901-2, vi, 251.]

Ether as an Anesthetic

Dr. Morton at 24 years of age. Picture hangs in Ether Room of Massachusetts General Hospital, Boston.

THE use of ether as an anesthetic has become such a common and general daily occurrence that it scarcely seems possible that this use is but 75 years old the 16th of this coming October. Before that time ether was not unknown. The story is that at that time there was hardly a gathering of young people which did not end with an "Ether Frolic"; the girls and boys finishing the evening by inhaling ether,—some would laugh, some cry, some fight and some dance. On one occasion when they had exhausted their own possibilities they haled a negro boy who was peeping through the door and while he fought and struggled, they etherized him into insensibility. When he lay quiet and unconscious his tormentors became thoroughly panic stricken and sent for Dr. Long. But as we should now expect, the victim soon came to himself, none the worse for his mishandling.

It was not until 1846 that the drug graduated from being the plaything of fun-loving youth or even the means of deadening pain in such slight operations as teeth extractions and was recognized as the "greatest discovery ever made", "the most precious heroic agent against pain". While courts may wrangle over the question of who personally is to bear the laurels for first finding the ether anesthetic, Boston will always be definitely credited with being the geographic theater where its use as an anesthetic was first proved. The case was a man, a printer, tall and feeble, with a tubercular heredity, who was brought into the amphitheater of the Massachusetts General Hospital for operation on a "congenital but superficial vascular tumor" just below the jaw, on the left side of the neck. J. C. Warren was the surgeon and the ether was administered by Wm. T. G. Morton. At the hour appointed on the momentous 16th of October, the scene was all set for the ether drama, the surgeon and his patient were ready, the members of the Surgical Staff were present, the seats in the amphitheater were filled by the class from the Medical School. Fifteen minutes later Morton, who had been delayed by repairs upon his inhaler rushed into the room and proceeded with his novel duties. There being no time for confidences Warren did his expert work in ignorance of the agent at his command and completed it in five minutes. Then turning to his audience while his patient, rapidly recovering, still lay half-stupefied on the table he paid tribute to the drug by saying, "Gentlemen, this is no humbug".

Close upon the heels of this operation followed one for a large, fatty tumor of the shoulder and then the amputation of a limb. Such was the introduction to the world of ether as an anesthetic. "The degree to which this ether insensibility could be carried, the safety with which this could be done and the uses to which this state could be put" were problems yet to be laboriously worked out. But the introduction was complete. And while the world may never wholly satisfy itself as to whom to give the credit for finding the anesthetic it will always pay tribute to and rejoice with Boston as being the theater of its introduction to the world.

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Boston, The City

(Boston Chamber of Commerce)

PARTICULAR interest is attached at this time to Boston, both because of forthcoming conventions to be held, and because of the series of Plymouth and Provincetown Tercentenary Celebrations, scheduled for this spring and summer. More and more, New England, of which Boston is the very center, is coming to be regarded as the ideal playground of America. The mountains, lakes, woodlands, sea-shores, magnificent drives, gorgeous scenes and salubrious climate have always attracted thousands of tourists and pleasure and health seekers during the hot months of the year. Historical scenes, of which the New England states abound, have always commanded the intense interest of school children. The foundation stones of American independence and of national consciousness were laid there, and nearly all the great reforms and movements were mothered in or near Boston.

Main building of Harvard Medical School, Boston.

In recent years, attentive consideration has been given by hotels, railroads, touring companies and pleasure resorts to visitors from a distance so as to provide the fullest information and to enable them to make the most of their vacation spent in that section. Recently the Boston Chamber of Commerce created a Convention and Tourist Bureau, designed to provide such information as may be asked by tourists and visitors and to assist in arranging tours and in supplying information when called upon.

In no other city in America may there be found such a wealth of historic data and the actual scenes and symbols of the events that made up the early history of the country. These old landmarks have been sacredly preserved and clearly defined, and provision has been made by the railroads, trolley lines and automobile touring companies to take visitors to them comfortably and inexpensively. The chief historical attraction this coming year both by reason of the generous appropriation made by the Federal Government and by the State of Massachusetts, will be the series of events at Provincetown and Plymouth, both of which towns are erecting notable permanent memorials. A series of twelve pageants will be given during the summer at Plymouth, and among the visitors who have already accepted invitations are included President Harding and Vice-President Coolidge. President Harding will be conveyed to Plymouth by the presidential yacht, the Mayflower, the namesake of the old Pilgrim boat.

Main building of Peter Bent Brigham Hospital, Boston.

Boston, as the shipping and receiving center for New England, handles a wide variety of products. Among the leading exports are meats and dairy products boots, shoes and leather, breadstuffs, iron and steel products, tobacco, cotton and cotton manufactures. Chief among its imports are wool, cotton, sugar and molasses, hides and skins, fibers, silk and fruit.

As a center of industry, Boston has the reputation of sending forth a more diversified array of manufactured products than any other community in the United States. From a hairpin to a superdreadnought; from the famous "Boston Garter" to the finest woolen products in the world, the metropolitan manufacturing district of Boston produces nearly everything required for the needs of humankind.

For more than 150 years, New England skill and workmanship in the production of manufactured articles have been highly regarded in the markets of the world. With little more than 7 per cent of the population of the United States, it produces annually more than 13 per cent of the value of the country's manufactured goods. This section produces 48 per cent of all the cotton goods made in the United States; more than 55 per cent of the woolen and worsted goods; nearly 54 per cent of the boots and shoes; 40 per cent of the

Main building of Massachusetts General Hospital. Ether Room in dome.

jewelry; 50 per cent of the brass and brass fittings; and most stupendous of all 87.5 per cent of the machine tools. Truly an industrial empire!

Of the New England group, Massachusetts is the most intensively organized state in an industrial sense, producing much Hemisphere, and in some very important branches of manufacture she leads the world. It may be news to some that nearly one-half the boots and shoes manufactured in the United States are made in Massachusetts to the value of $361,090,261; that one-third of all cotton goods, worth $537,631,-

Ether Room—Massachusetts Hospital, Boston.

more than half of the goods manufactured in the six states. Small as Massachusetts is in physical comparison with some of the great states of the Union, it holds fourth rank among the states in the volume of goods manufactured, with a production value of nearly four billion dollars in 1918, the last year for which statistics are available.

In a score of industries Massachusetts is supreme in the Western 796, and one-third of the woolen and worsted goods, worth $464,-067,705, are produced in the little "Bay State."

She also produces an impressive volume of foundry and machine-shop products, leather preparations, exclusive of boots and shoes, cut stock and findings and other auxiliaries of the gigantic boot and shoe industry; electrical machinery and apparatus, paper and wood pulp, meat and other food products. The striking variety of her products is shown by the fact that 166 major industries received classification exclusive of a group of practically 100 other minor industries.

It is natural that Massachusetts should be the leading market for the raw materials which enter into the making of her great products. As showing how this holds true, Boston in 1918 imported wool to the value of $177,896,026, which means, in other words, that Boston is the greatest wool port in the world.

Metropolitan Boston, with a population of about 1,800,000 persons, has nearly 5,000 industrial establishments producing annually manufactures valued at nearly a billion and a half dollars, and employing on an average of 250,000 wage earners. In variety, its products are probably more extensive than those of any similar community in the United States. It has 103 major industry groupings and about 60 minor lines of industry.

Tuft's Medical School, Boston.

In higher educational institutions Boston again stands forth. Harvard, Tufts, and Boston universities, Massachusetts Institute of Technology, Radcliffe, Simmons, Wellesley and Boston colleges are examples of the great educational forces which draw the attention of the world to Boston. They are too well known to need encomium; their alumni and alumnae are to be found in every country on the globe. In the Boston Conservatory of Music this city presents the finest college of music in the United States; in the Harvard medical group are the finest buildings devoted to this science in the country.

The real Boston, better known as the metropolitan district, embraces 40 cities and towns within a radius of 15 miles from the State House at Boston. In this district live about 1,800,000 persons, who in every essential respect are Bostonians as much as if they lived on Beacon Hill. In this district there is one main street car system, one telephone system, one main water supply, a principal sewerage service administered by a single board, and one general park service. It is one district for fire prevention, one postal district, one banking district, one commercial and industrial center —all built around one great harbor.

Boston is the industrial and commercial center, the marketplace and the natural outlet of New England. To a large degree it is the civic, economic and intellectual dictator of an empire of 8,000,000 persons.

Its geographical advantage and the ease and rapidity with which vessels can get to open sea combine to make the ocean trip between Boston and the great European ports shorter by fully 24 hours than from any other large American port.

In respect to piers and docking facilities, Boston is probably unrivalled, and is certainly not surpassed, by any American port. Commonwealth pier No. 5, built by the state, is held by Bostonians to be the greatest passenger and freight pier in the world. It is 1,200 feet long, 400 feet wide and will accommodate five 600-foot ships at one time. It comprises three two-story buildings of steel and concrete construction containing 900,000 square feet of floor space. Its cost (when money was on its feet) was $4,500,000.

The new Boston fish pier, successor to the famous old T wharf, as the headquarters of Boston's fresh fish industry, is another Commonwealth enterprise. It is generally agreed that no fish pier in the world approaches Boston's in adaptability and service. It provides dock berths for at least 40 vessels, and 80 vessels can unload to the pier at one time. It is linked up by a trolley freight line with the traction system of Greater Boston, and spur tracks connect it with railroad lines which interchange with the great trunk systems of the country.

Boston possesses the finest fish pier in the world, and has become in the past two years the leading fish market of the world. Boston was selected as the site of the great army supply base at the outbreak of the war, and $40,000,000 were spent by the Government for facilities for the economic handling of freight at this terminal. At one time during the war, wool and army supplies valued at more than one billion dollars were stored in the new warehouse. The State of Massachusetts is now working upon a project whereby 600 acres of flat lands will be used for extensive commercial development.

ETHER STATUE, BOSTON PUBLIC GARDEN
Erected 1867, by Thomas Lee.

The following inscriptions appear on the sides of the statue:

"To commemorate the discovery that the inhaling of ether causes insensibility to pain. First proved to the world at The Massachusetts General Hospital in Boston.
October, MDCCCXLVI."

"Neither shall there be any more pain."

"In gratitude for the relief of human suffering by the inhalation of ether.
A citizen of Boston has erected this monument.
1867."

"This also cometh forth from the Lord of Hosts, which is wonderful in council, and excellent in working."

Walter James Dodd

(1869-1916)

Percy Brown

WALTER JAMES DODD, pioneer roentgenologist and a martyr to his specialty, was born in London, Eng., in the year 1869, and came to this country as an immigrant boy at the age of 15. He was early moved to follow the sea, but was induced by the college authorities, impressed by his ability, to continue life here as an assistant in the chemical laboratory of Harvard College in Cambridge, Massachusetts. He acquired a profound knowledge of chemistry and in 1892 was appointed to the Massachusetts General Hospital as assistant apothecary and four years later as apothecary. It was in this capacity that he undertook experimentation with x-rays under the usual unfortunate and restricted conditions which obtained in the early days. A severe dermatitis was therefore sustained in 1896 and he underwent his first operation for its results in 1898. Since that time he had been the subject of fifty operations for roentgen dermatitis and its sequelae.

Seeking to dignify further his work, which already through his sacrifices had attained high dignity, Dr. Dodd studied at the Harvard Medical School in 1900 and 1901, but completed his course and was graduated from the medical department of the University of Vermont in 1908. From that year until his death he held the position of roentgenologist to the Massachusetts General Hospital, an official recognition of what had been, in reality, his position for many years.

With the organization of a department of roentgenology in Harvard University, he was appointed instructor, a position which he held at the time of his death. He was an honored member of the St. Botolph Club of Boston, as well as of many medical societies, in addition to his membership in the American Roentgen Ray Society.

He married Margaret Lea of Moncton, Nova Scotia.

Dr. Dodd died December 18, 1916, following still another operation for infected glands.

Such, briefly, were the events in a life of singular beauty—the life of a gentle man, loving and beloved; cheerful beyond conception in the face of physical anguish. Glorified by a martyr's soul, his face turned toward the horizon of high purpose, with an obliteration of self that cheapened and made tawdry the usual motives of ordinary men. He journeyed steadily on toward that horizon, turning into the gold of loyal friendship all those who came within the Midas-touch of his personality.

A life such as his gives charity a new meaning. As a crown to its later years, his ear was alert to hear from the far land of his adoption, the call of the nation of his birth, in dire need of the peculiar service which he could give. Disdaining physical handicaps and added risks, he hastened forth to labor for England with a heroism that even she knew not of.

Thus again have fallen the burden and the staff and again has another been received into the glorious band of those that self-sacrifice, upon the altar of a noble cause, has immortalized.

[American Journal of Roentgenology, January, 1917.]

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State Medicine

MUCH discussion on the question of state medicine is being indulged by the profession. Perhaps it would be advisable to consider the entire subject under the fluoroscope of public interest. It is possible we could thereby contribute something to the sum total of effort if not of knowledge and reason, and ascertain by point of contact something of our own relation to the subject.

Being of that mind, we anticipate we shall have something to say on different phases of the question from time to time, as they occur or are suggested to us. We shall try, however, in any comment we may make to hold a strictly impartial attitude. We approach the question with open mind.

Jumping over the usual frumpery with which questions of this magnitude are vested, it seems to us there are at least three major divisions into which the motivating causes naturally fall. They may be stated:

1. Those naturally flowing from the trend of the profession toward specialism, with its consequent duplication of medical cost to the patient.

2. Those growing out of dilletantism on the part of some members of the profession who practice to live and do not live to practice.

3. Those arising from the failure of the profession to acquaint the public with true conditions and thereby keep it in full sympathy with the difficulties naturally inherent in this sort of humanitarian service, and likewise familiar with the struggles, hopes, and ideals which inspire those men who render such service in its true form.

Viewed as a medico-economic question, certain deductions are irresistible:

1. That the trend toward specialism should decrease rather than increase the cost of the particular service rendered and at the same time increase the earning power of the specialist.

2. That specialism requires per se more exact knowledge of some one classification of the profession in its relation to all others, so the buyer of service secures a positive and coördinated rather than a negative and general service.

3. That the medical adviser is in fact a quasi-public servant; for which reason, the more so because of the confidential nature of his employment, the public is entitled to know as much as he can possibly know about the whys and wherefores of diagnoses made and treatment prescribed, as well as the general research being conducted in the broad aspects of all branches of medical science. This is supported by all the laws of morals, legal procedure, and psychology.

The Boston Meeting

ARRANGEMENTS have now been completed for the summer meeting of the Radiological Society, which will be held in Boston, June 3rd and 4th, at the Copley Plaza Hotel. The program is practically complete and we can assure you that it will be well worth your attendance.

A banquet will be given in the evening, followed by a lantern slide exhibit. We feel that every one who contemplates attending the meeting of the American Medical Association should go a couple of days earlier and attend the meeting of the Radiological Society.

The Boston Program

1—"The Treatment of Epithelioma of the Lip" ....Dr. Douglas Quick, New York City
2—"Further Observation of X-Ray Examination of Mastoid Disease"..Dr. Isaac Gerber, Providence, R. I.
3—"Means of Measuring or Specifying X-Ray Dose Given"..N. E. Dorsey, Ph. D., Washington, D. C.
4—"Recent Developments in Deep Therapy Technique—Facts and Fancies" ....Dr. A. F. Tyler, Omaha, Nebr.
5—"The Possibilities of Pneumoperitoneum in Gastro-Intestinal Diagnosis"..................................Dr. L. R. Sante, St. Louis, Mo.
6—"Paget's Disease"........................Dr. I. S. Hirsch, New York City
7—"An X-Ray Study of the Healing of Benign Bone Cysts" (Lantern Slide Demonstration)........Dr. Joseph Colt Bloodgood, Baltimore, Md.
8—"High Voltage Problems"........Dr. W. D. Coolidge, Schenectady, N. Y.
9—"Further Consideration of Upper Right Quadrant" ....Dr. Arial George, Boston, Mass.
10—"Roentgenological Study of Eight Primary Lung Carcinomas"..Dr. Lloyd Bryan, San Francisco, Calif.
11—"Observations in the Use of Radiation in Leukemias"..Dr. Albert Soiland, Los Angeles, California
12—"The Determination of Dental Focal Infection by Means of the Radiogram"..........................Dr. Maximilian J. Hubeny, Chicago, Ill.
13—"The Advantages of a Uniform Angle of Twelve Degrees in Examining Accessory Sinuses and Mastoids"..................Dr. A. F. Holding
14—"Report of Five Cases of Hernia of the Diaphragm. Differential Diagnosis from Eventration"..............Dr. L. T. LeWald, New York City
15—"The Dead Tooth and X-Ray Indications for Extraction, and the Failure of Root Canal Treatment"......Dr. Byron C. Darling, New York City
16—"The Relationship of the Roentgenologist to Group Medicine"..Dr. Frank S. Bissell, Minneapolis, Minn.
17—"Duodenal Bulb Deformity in Relation to Symptoms and Chemistry of the Gastric Juice"..................Dr. A. W. Crane, Kalamazoo, Mich.
18—"A Retrospective Note Concerning Treatment of Tonsilitis by X-Ray" ....Dr. H. W. Van Allen, Springfield, Mass.
19—"Atrophy of Lymphatic and Tonsillar Tissue by Radium and X-Ray" ....Dr. C. Augustus Simpson, Washington, D. C.
20—Dr. Harry H. Bowing, Rochester, Minn....(Title, to be announced later)
21—"The Roentgenologic Aspect of Pulmonary Metastasis"..Dr. Russell Carman, Rochester, Minn.
22—"The Law and Medicine, with Special Reference to Radiology"..Dr. I. S. Trostler, Chicago, Ill.
23—"Consideration of Oesophageal Diseases"..Dr. P. F. Butler, Boston City Hospital
24—"Radio Therapy in Superficial Malignancy"..Dr. G. W. Grier, Pittsburgh, Pa.
25—"Effect of Cellular Reaction Induced by X-Rays on the Site of Cancer Crafts"....................Dr. James D. Murphy, Rockefeller Institute

26—Dr. James Ewing, Cornell Medical College, New York City.......... ....(Title, to be announced later)

27—"Further Consideration Concerning Direct, Indirect and Secondary Rays and the Ray of Selective Absorption"........................ ....Dr. Lewis Gregory Cole, New York City

28—"Dermoid Cysts in the Thoracic Cavity"........................... ....Dr. John T. Murphy, Toledo, Ohio

29—"Present Status of Roentgen and Radium Treatment of Cancer of the Breast"..........................Dr. Thos. A. Groover, Washington, D. C.

30—Dr. Arthur W. Erskine, Cedar Rapids, Ia....(Title, to be announced later)

31—"Post-Operative Mastoid Treatments with X-Ray"................. ....Dr. Charles Goosman, Cincinnati, Ohio

32—"Treatment of Naevi".................Dr. R. H. Stevens, Detroit, Mich.

The Canadian Radiological Society

THE Canadian Radiological Society will hold its annual meeting in conjunction with the meeting of the Ontario Radiological Society, at Niagara Falls, May 31st to June 4th, inclusive.

An invitation is extended to all members of the Radiological Society of North America to attend this meeting. The program is unexcelled and well worth the attention of any one interested in this subject.

We hope that a large number of men from the States will attend this meeting. The Canadians have been very faithful in lending their interest and co-operation to the advancement of Radiology in the States and it is only just and right that we return this courtesy at this time.

Omaha Roentgen Society Entertained at Lincoln

NO MORE enjoyable event has ever occurred in the history of the Omaha Roentgen Society than the entertainment given in its honor by Dr. E. W. Rowe and Dr. R. L. Smith of Lincoln, on the evening of March the 19th.

The Lincoln men acted as hosts for the entire membership of the Omaha society and a number of invited guests. We were entertained royally at a dinner beginning at seven o'clock, at which time plates were laid for seventy-five. Immediately after the dinner, the following program was given:

The Relation of Roentgenology to Internal Medicine—Dr. G. W. Covey.

The Relation of Roentgenology to Rhinology and Otology—Dr. J. J. Hompes.

The Relation of Roentgenology to Orthopedics—Dr. H. W. Orr.

The Relation of Roentgenology to Dentistry—Dr. F. W. Webster.

The Relation of Roentgenology to Surgery—Dr. J. S. Welch.

New Methods in Sinus Diagnosis—Dr. W. Walter Wasson.

Therapy—Dr. Edward H. Skinner.

The papers given at this meeting will appear in the Journal in the near future.

Excellent taste was shown in the artistic programs furnished, the cover being actual photographic paper, on the front and back of which had been printed reductions of actual x-ray plates. On the front of each cover was the guest's name so that the program served as a place card.

We are sure that this get-together meeting was conducive of good fellowship in a way which will be lasting and will cement the friendships closer than ever before.

Department of Technique

Examination of the Wrist

Fig I.—Anteroposterior view of wrist, showing Skinner's lines. Note distance between horizontal line and styloid process of ulna.

IN MAKING x-ray examination of injuries to the wrist, we should bear in mind the possibility not only of injury to the lower end of the radius, which of course is the most common fracture that we have, but we should also remember that frequently injuries to the wrist are complicated by fractures of one or more of the carpal bones. In order that we may not overlook fractures of the carpal bones, it is necessary not only to make plates in the lateral, as well as in the antero-posterior position, but we should also make stereoscopic plates in the antero-posterior position. Anyone who employs the steroscopic examination in addition to the lateral view, will be greatly interested in noticing the number of fractures of the carpal bones which have been previously overlooked by the flat plate antero-posterior view. It is probably the complication of fractures of the

Fig. II.—Lateral view of wrist, showing Skinner's lines. Note acute angle on palmar side. This is reversed in Colle's fracture, the acute angle being on the dorsal side.

carpal bones with injury of the lower end of the radius, which results in many of the cases of prolonged disability.

The carpal scaphoid is the most frequent site of fracture. Occasionally we have a fracture of the unciform process of the unciform, giving a flail-like wrist joint, due to the fact that the ligament on the ulnar side is attached to this process. When this is broken off, the wrist on the ulnar side becomes freely movable in relationship to the ulna.

A number of years ago, Dr. E. H. Skinner of Kansas City, devised the employment of lines which are very helpful in establishing the amount of reduction necessary in Colle's fracture of the radius. One of these lines is drawn on the antero-posterior plate parallel with the mid-axis of the shaft of the radius. A perpendicular line is drawn to this line just touching the styloid process of the radius. In every normal wrist this perpendicular line will be a considerable distance distal to the styloid process of the ulna. In fractures of the lower end of the radius with shortening, the amount of shortening is shown graphically by the distance between the styloid process of the ulna and this perpendicular line. Another line is drawn on the plate in the lateral view, the line being parallel with the central axis of the shaft of the radius. Another line is drawn crossing this and touching the articular surfaces of the radius. In the normal wrist, the acute angle will usually be found on the palmar side.

Oliver Wendell Holmes

E. W. Rowe, M. D.
Lincoln, Nebraska

OLIVER WENDELL HOLMES was born August 29, 1809, and died in 1894. He saw almost the beginning and the end of the unusual nineteenth century. From a Calvinistic clergyman father he inherited a sterling character and the taste for literature. From a mother of old New England blood, the daughter of a judge and descendant of two governors of Massachusetts, he inherited a sunny disposition, full of wit, vivacity and humor. Careful home training and a good early education, followed by a course at Andover College, prepared him for Harvard. After four years' study he graduated with the famous class of 1829. It was his 21st year when Congress ordered the frigate "Constitution" destroyed. His poem "Old Ironsides" gave him immediate fame in all parts of the country, and it induced the Navy Department to rescind its order. As an alumnus, from 1851 to 1889 he returned regularly for the anniversary and class dinner, each time giving a poem. "After the Curfew," a touching poem, was his last.

For one year after graduation he studied law. For reasons hardly known to himself he gave it up and undertook the serious study of medicine.. After attending two courses of lectures in the school of Dr. James Jackson he went abroad and studied, chiefly in Paris, then the medical center of Europe. Most of the time was spent with Louis, a famous French physician. The opportunities of travel, as well as his intensive medical training, gave him a polish and breadth of vision that fitted well his inherited strength of character and culture. In his own words, from Europe, we read: "I have more fully learned at least three principles since I have been in Paris—not to take authority when I can have facts; not to guess when I can know; not to think that a man must take physic because he is sick.". And again: "My aim has been to qualify myself * * * not for a mere scholar, for a follower after other men's opinions, for a dependent on their authority—but for the character of a man who has seen and therefore knows." This spirit animated his life, and as he matured he continued battling vigorously for these ideals.

On returning from Paris in 1836 he made an unsuccessful attempt to practice in Boston. He was small, humorous and witty. Staid Boston never took him seriously as a practitioner. Unfitted by taste or temperament to the life of the practice, gifted with extraordinary brilliancy, trained and cultured by the best medical education of the times, he easily became prominent as a teacher of medicine. He lectured on anatomy and physiology in Dartmouth from 1838 to 1840. In 1840 he married Amelia Lee Jackson, daughter of Hon. Charles Jackson, a well-known jurist. His eldest son was born in 1841, and after serving as a distinguished officer in the Civil War, rose to the position of an eminent jurist and author of legal books who has just rounded out his career in the United States Supreme Court.

In 1847 Harvard made Dr. Holmes Parkman Professor of Anatomy and Physiology. He delivered these lectures until 1882, long after he had retired from medical affairs. He was famous for his ability to interest his students and to take them at the end of a tiresome day and inspire them in their work. Few writings on medical subjects came from his pen in later years. In his medical papers and teachings he was of that type of mind that saw far into the future and stimulated other minds of slower thought to work out the details.

My task is to interpret Dr. Holmes as a physician, but a word must be said of him as a literary man. To the public he is first of all a writer of literary charm and merit. Brilliant poems and elegant prose are the product of his versatile pen. Among his earlier poems, "The Last Leaf" is said to be the most pathetic and humorous in literature. "The Chambered Nautilus" reveals the soul and faith of the man. In his later days he attempted longer and more pretentious poetry and prose. But he will always remain pre-eminent for his ability to picture and popularize New England life. His real literary standing was obtained and maintained when he joined James Russel Lowell in founding a new magazine, "The Atlantic Monthly." In this "The Autocrat of the Breakfast Table," each time beginning "I was just going to say—" was immensely popular and contributed much to the financial success of the magazine. In lyric poetry he was at his best. His deep-seated resentment for the old Calvinistic theory of retribution and condemnation so stirred him that many of his writings were on subjects so developed as to bring out his more liberal ideas. These writings stirred up a great amount of criticism, equalled only by the criticism from the medical profession. so that it was only in his later years that he left controversy and enjoyed peace.

Dr. Holmes was not a politician, but he lived in stirring times. Such causes as temperance, women's rights, and abolition were the liveliest topics, and of these he frequently wrote. His Fourth of July oration delivered in Boston in 1863 was a masterpiece and showed great statesmanship.

Dr. Holmes lived mostly in Boston, going in the summer to Pittsfield and Beverly Farms. In 1886, when 75 years of age, he made a four-months' trip abroad. In England he received signal honors. Cambridge University made him Doctor of Letters, Edinburgh University made him Doctor of Laws, and Oxford University made him Doctor of Civil Laws. Already, in 1880, Harvard had made him Doctor of Laws. He died on the 7th of October, 1894, and was buried from King's Chapel, Boston, in the cemetery of Mount Auburn.

The medical essays and addresses of Dr. Holmes are numerous. He was much sought after to write and lecture. His writings helped to raise the style and tone of medical literature. He was an active participator in medical societies, being one of the members prominent in the early days of the American Medical Association. He early recognized the self-limits to disease. He helped Morton publish his work on Anesthesia. To his students in 1847 he said on this subject: "Here, almost within the present year, the unborrowed discovery first saw the light, which has compassed the whole earth before the sun could complete his circle in the zodiac. There are thousands who never heard of the American Revolution, who know not whether an American citizen has the color of a Carib or a Caucasian, to whom the name of Boston is familiar through this medical discovery. In this very hour while I am speaking, how many human creatures are cheated of pangs which seem inevitable as the common doom of mortality, and lulled by the strange magic of the enchanted goblet, held for a moment to their lips, into a repose which has something of ecstasy in its dreamy slumbers. . . . The knife is searching for disease, the pulleys are dragging back dislocated limbs, Nature herself is working out the primal curse which doomed the tenderest of her creatures to the sharpest of her trials; but the fierce extremity of suffering has been steeped in the waters of forgetfulness, and the deepest furrow in the knotted brow of agony has been soothed forever."

We come now to his masterpiece, for which Holmes ranks among the great men of the medical profession. On February 13, 1843, Dr. Holmes read to the Boston Society for Medical Improvement his paper on "The Contagiousness of Puerperal Fever." This stirred up a storm of violent opposition from leading obstetricians such as Hodges and Meigs of Philadelphia. The medical mind was in a peculiar state at this time. The obvious was not accepted, and it was for Holmes to bring home finally the real cause of the prevalence of puerperal fever.

Dr. Holmes antedates the Vienna School several years. Yet it remained for them to work out the real prophylaxis for puerperal fever. They too carried on the contest so warmly begun and championed by Holmes in America.

Dr. Holmes' paper appeared in April, 1843, in "The New England Quarterly Journal of Medicine and Surgery," a short-lived journal of little reputation. In 1852 and 1853 his conclusions were attacked so vigorously that he added a reply to his critics in the form of an introduction, and again the paper was published. In this introduction he said: "I am too much in earnest for either humility or vanity, but I do entreat those who hold the keys of life or death to listen to me also for this once. I ask no personal favor, but I beg to be heard in behalf of the women whose lives are at stake, until some stronger voice shall plead for them.". Harvey, Jenner and Morton encountered the same difficulties. When this paper was first written he was not so well known. Later he held the position in Harvard, and the controversy became very bitter. Through it all he held a calm and consistent dignity. Of this he said, "When, by the permission of Providence, I held up to the professional public the damnable facts connected with the conveyance of poison from one young mother's chamber to another,—for doing which humble office I desire to be thankful that I have lived, though nothing else should ever come to my life—I had to bear the sneers of those whose positions I had assailed and as I believe have at last demolished, so that nothing but the ghosts of dead women stir up the ruins."

Let me briefly call attention to some of the interesting parts of Dr. Holmes' paper upon "The Contagiousness of Puerperal Fever." After three-quarters of a century it is still intensely interesting. Keep in mind how the controversy was raging at that time. In the opening paragraphs Dr. Holmes by skilful argument logically defines the special issues of his case. First in his argument he throws out all negative evidence and prepares to consider only that which is positive. To illustrate it he says it is the woman with the disease whose case should be studied. "This is like the hundredth tenant of the fold, though the ninety and nine may be escaping the wolf at its entrance." He had been told that his subject was threadbare. Yet standard authorities and teachers in places of prominence were not admitting the truth. This much he felt unnecessary. to. prove:. "The. disease known as puerperal fever is so far contagious as to be frequently carried from patient to patient by physicians and nurses."

Before proceeding to the main argument he grants the following statements as obvious and common sense requires them to be accepted:

"1. It is granted that all forms of what is called puerperal fever may not be, and probably are not, equally contagious.

"2. I shall not enter into a discussion of the mode of infection. * * *

"3. It is not pretended that the contagion of puerperal fever must always be followed by disease. * * *

"4. It is granted that the disease may be produced and variously modified by many causes besides contagion and more especially, by epidemic and endemic influences. * * *

"5. I take it for granted that, if it can be shown that great numbers of lives have been and are sacrificed to ignorance or blindness on this point, no other error of which physicians or nurses may be occasionally suspected will be alleged in palliation of this, but that whenever and wherever they can be shown to carry disease and death instead of health and safety, the common instincts of humanity will silence every attempt to explain away their responsibility."

These reservations brush aside a good deal of rubbish. Though most skilfully put in a naive manner, they allow the Doctor to get at once to his main argument, and this consists in bearing on the one point of proof—that is, the contagiousness of puerperal fever. Case follows case to show that it must be contagious. Eminent authorities in all parts of the world are summoned to testify. The literature for half a century is carefully searched. Nothing is found in the American literature prior to the year 1829. But abroad, Dr. Gordon of Aberdeen in 1795 said: "I arrived at that certainty in the matter that I could venture to foretell what women would be affected with the disease, upon hearing by what midwife they were to be delivered, or by what nurse they were to be attended, during their lying-in; and almost in every instance my prediction was true.

Mr. Robertson of Manchester testifies: "A midwife delivered a woman on the fourth of December, 1830, who died soon after with the symptoms of puerperal fever. In one month from this date the same midwife delivered thirty women, residing in different parts of an extensive suburb, of which number sixteen caught the disease and all died. These were the only cases which had occurred for a considerable time in Manchester. The other midwives connected with the same charitable institution as the woman already mentioned are twenty-five in number, and deliver, on an average, ninety women a week, or about three hundred and eighty a month. None of these women had a case of puerperal fever, yet all this time this woman was crossing the other midwives in every direction, scores of the patients of the charity being delivered by them in the very same quarters where her cases of fever were happening."

Modestly he sums up the proof in this manner: "The recurrence of long series of cases, like those I have just cited, reported by those most interested to disbelieve in contagion, scattered along through an interval of half a century, might have been thought sufficient to satisfy the minds of all the inquirers that there was here something more than a singular coincidence. But if, on more extended observation, it should be found that the same ominous groups of cases clustering about individual practitioners were observed in a remote country at different times and in widely separated regions, it would seem incredible that anyone should be found too prejudiced or indolent to accept the solemn truth knelled into their ears by the funeral bells from both sides of the ocean—the plain conclusion that the physician and the disease entered, hand in hand, into the chamber of the unsuspecting patient."

Next he calls attention to large cities and eminent physicians to whom the disease was almost a stranger. He says: "In view of these facts it does appear a singular coincidence that one man or woman should have ten, twenty, thirty or seventy cases of this rare disease following his or her footsteps, with the keenness of a beadle, through streets and lanes of a crowded city, while the scares that cross the same paths on the same errands know it only by name."

There is one case I have selected by which he illustrates the process of direct inoculation. "Dr. Campbell of Edinburgh states that in October, 1821, he assisted at the post-mortem examination of a patient who died with puerperal fever. He carried the pelvic viscera in his pocket to the class room. The same evening he attended a woman in labor without previously changing his clothes; this patient died. The next morning he delivered a woman with the forceps; she died also. And of many others who were seized with the disease within a few weeks, three shared the same fate in succession."

That Holmes held some of the fallacies of the day, long since disproved, appears in his argument; but when one remembers that bacteriology and modern pathology were then unknown, it detracts very little from the force of his argument. "Now add to all this the undisputed fact that within the walls of lying-in hospitals there is often generated a miasm, palpable as the chlorin used to destroy it, tenacious so as in some cases almost to defy extirpation, deadly in some institutions as the plague; which has killed women in a private hospital of London so fast that they were buried in one coffin to conceal its horrors * * *"

The occurrence of erysipelas and puerperal fever together, alternating or interchanging, led him to write: "I will only say that the evidence appears to me altogether satisfactory that some most fatal series of puerperal fever have been produced by an infection originating in like manner, or effluvia of erysipelas." A long list of references of those who held the same view follows.

Let me quote his closing argument just before the summary: "I have no wish to express any harsh feeling with regard to the painful subject which has come before us. If there are any so far excited by the story of these dreadful events that they ask for some words of indignant remonstrance to show that science does not turn the hearts of its followers into ice or stone, let me remind them that such words have been uttered by those who speak with authority I could not claim. It is a lesson rather than a reproach that I call up the memory of these irreparable errors and wrongs. No tongue can tell the heart-breaking calamity they have caused. They have closed the eyes just opened upon a new world of love and happiness; they have bowed the strength of manhood into dust; they have cast the helplessness of infancy into the stranger's arms, or bequeathed it, with less cruelty, the death of its dying parent. There is no tone deep enough for regret, and no voice loud enough for warning. The woman about to become a mother, or with her new-born infant upon her bosom, should be the object of trembling care and sympathy wherever she bears her tender burden or stretches her aching limbs. * * * God forbid that any member of the profession to which she trusts her life, doubly precious at that eventful period, should hazard it negligently, inadvisedly, or selfishly!"

In closing he gives the same practical advice that today is taught medical students when taking their courses in obstetrics.

"What course are we to follow in relation to this matter? * * * If any should care to know my own conclusions, they are the following:

"1. A physician holding himself in readiness to attend cases of midwifery should never take any active part in the post-mortem examination of cases of puerperal fever.

"2. If a physician is present at such autopsies, he should use thorough absolution, change every article of dress, and allow twenty-four hours or more to elapse before attending to any case of midwifery. * * *

"3. Similar precautions should be taken after the autopsy or surgical treatment of cases of erysipelas. * * *

"4. On the occurrence of a single case of puerperal fever in his practice, the physician is bound to consider the next female he attends in labor, unless some weeks at least have elapsed, as in danger of being infected by him. * * *

"5. If within a short period two cases of puerperal fever happen close to each other, in the practice of the same physician, the disease not existing or prevailing in the neighborhood, he would do wisely to relinquish his obstetrical practice for at least one month. * * *

"6. The occurrence of three cases * * * in the practice of one individual is prima facie evidence that he is the vehicle of contagion.

"7. It is the duty of the physician to take every precaution that the disease shall not be introduced by nurses or other assistants. * * *

"8. Whatever indulgence may be granted to those who have heretofore been the ignorant causes of so much misery, the time has come when the existence of a private pestilence in the sphere of a single physician should be looked upon, not as a misfortune, but a crime; and in the knowledge of such occurrence the duties of the practitioner to his profession should give way to his paramount obligation to society."

Dr. Holmes as a physician was preeminently a teacher and a writer. He will be known as a scientist who, seeing far in the future, almost glimpsed the modern views founded on pathology and bacteriology. He is not great in medicine because he was great in literature. But he stands out among the great men in both lines of endeavor. His brilliant mind sensed the big things on the horizon and left the details to more plodding types of mind. Dr. Holmes belongs to medical history as truly as the literary world.

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Abstracts and Reviews

The purpose of this department is to furnish its readers a succinct epitome of current interesting articles and books. We will be glad to review articles which have been presented for publication or any manuscript or book sent us.

Abstract from Letter appearing in the following Philadelphia papers: The Ledger; North American; Bulletin, Dr. George E. Pfahler.

THERE has been so much notoriety given to new discoveries in the treatment of x-rays, by more powerful rays and new technique, that a word of caution is appropriate. No new discovery has been made. The real cause of all this discussion has arisen in some one's imagination and the newspaper agitation.

Careful tests in research laboratories made by men who have recently visited Germany show that we have been using practically the same quality of rays which were used as routine in Germany, and that even the exceptional were only from ten to twenty per cent more penetrating.

In this country one experimenter has produced even more penetrating rays than have the Germans. There are no new principles, and it is not proven that more penetrating rays are more useful in the treatment of cancer. By analogy it is assumed that they will be more useful, because gamma rays of radium have a greater effect.

"The careful scientific physician takes up these advances which are made in the hope of accomplishing more for the cancerous patient, and I believe that much progress will be made; but such wild flights of the imagination in newspaper print can only arouse false hopes on the part of patients and their friends. This leads them away from known valuable methods of treatment, and makes them a prey to advertising quacks."

Service—Suggestions, Victor X-Ray Corporation, April, 1921.

THE subject of deep therapy, higher voltage, and apparatus of greater capacity is receiving considerable attention at this time. Many reports are coming from Germany, and conditions in America are being studied. It has been found that German and American engineers estimated voltage, and hence penetration, differently. In fact, the workers in the two countries are doing almost the same. Some of the German machines are capable of deliverying 20-inch spark gaps. Yet in actual practice it is doubtful if they run over ten inches according to certain American-made machines.

In Germany, when speaking, the peak voltage is always used. In this country we speak of root, mean, square voltage, or in other words, "for a ten-inch gap between points we have considered the voltage to be the equivalent of 100,000 volts r. m. s. To translate this to terms of peak voltage it is necessary to multiply by 1.4 which is the ratio between peak and root mean square voltage."

The Germans also test the spark gap between a point and a plate. A spark will jump ten per cent farther if taken this way. This also gives the impression that the Germans are using more penetration than they are.

The Germans are using larger ports of entry, greater focal distance. There is certainly a large quantity of x-ray delivered to the tissue, and if a greater quantity of rays and secondaries is desirable, it is certainly possible.

Much heavier filtration—at least one half millimeter of copper or its equivalent—is used. Treatments are given in one sitting. By means of heavier filtration the proportion of depth to skin dose is increased, since only those rays get through which affect the skin the least.

A test of one of the German induction coil types shows that when operated as per instructions the x-ray output is quite small compared with the output of a tube operating from a .. .. .. machine at five milliamperes and a voltage of ten inches between points, which correspond to 140,000 volts peak value. These, as one can readily see, represent the approximate figures at which the Coolidge tube and the .. .. .. machine are used in deep therapy.

As a result, engineers advised considerable research and experimentation before the use of machines and tubes with higher voltages should be used for deep therapy. In order to keep the practice of roentgenology in America on the high plane where it stands today, it is necessary for all interested to make a calm and careful survey of the subject.

Study of Influenzal Pneumonia by Serial Roentgen Ray Examination. Dr. L. R. Sante, St. Louis. Jr. Missouri State Medical Ass'n, February, 1921, Vol. xviii, p. 43.

THIS paper was written on observations made in a 3,000-bed debarkation hospital during the epidemic of influenza of 1918-1920. In the study, serial roentgenograms at intervals of one to three days were taken, which aided materially in the prognosis. Several hundred cases with clinical, laboratory, and roentgen examinations were studied. A careful analysis of the cases showed six modes of invasion manifested by pneumonic processes:

1. By peribronchial invasion with small areas of consolidation which enlarge and become confluent to form solidification and are not confined to any one lobe, but affect all the lobes alike—true broncho-pneumonia.
2. Those which involve a single lobe only, but invade by the same peri-bronchial route—likewise true broncho-pneumonia.
3. Those which commence radiographically as a general haze over a part of the lung area, and progress uniformly over the entire involved area, in a measure very similar to the radiographic appearance in the invasion of a lobar pneumonia, suggestive of a lymphatic or hematogenous origin. These prove at necropsy to be an atypical broncho-pneumonia, probably the diffuse pneumonitis so often described.
4. Those which involve the hilus region only, the so-called 'critical pneumonias' of Ewing of Cornell.
5. Those which start below in the most dependent portion of the lung and spread upwards seemingly by continuity of tissue, atypical pneumonias unassociated with fluid and usually fatal.
6. Very rarely a true lobar pneumonia."

These six classes are illustrated by carefully selected roentgenograms. His conclusions are as follows:

1. That there are six general modes of invasion in the influenza-pneumonias, as revealed by serial radiographs of a large number of patients.
2. That these types of invasion suggest the medium of conveyance of the infection by blood or lymphatics or by bronchii in each case.
3. No particular type of organism is responsible for any particular type of invasion. Any type may be associated with any of the organisms commonly found—pneumococcus 1, 2, 3, 4; streptococcus, or streptococcus hemolyticus.
4. That while prognosis could not be accurately determined in all cases, in a great number a fairly accurate prognosis could be determined by careful study of serial roentgen ray plates.

Organ Stimulation by the Roentgen Ray. Dr. William F. Petersen and Dr. Clarence C. Saelhof, Chicago. Jr. A. M. A., March 12, 1921.

DIAGNOSTIC technique in roentgenology as in all other fields is outrunning the therapeutic. Knowledge of new methods in diagnosis travels fast. Roentgenologists also believe that the therapeutic effect of the roentgen ray is due to cell destruction. But the authors feel that the future development lies more in the field o fcell stimulation.

The authors recite experiments on the roentgenization of liver and kidneys, collecting bile and urine and analyzing their chief constituents. From preliminary clinical observations they believe that roentgen ray stimulation is a method of decided usefulness offered in the treatment of diabetes. Fraenkel calls attention to the effects of irradiation of ovaries in certain forms of dysmenorrhoea, the thymus and hypophysis in osteomalacia, perisoteum in non-united fractures, epiphyses of bones in children to promote growth, spleen and bone marrow in pernicious anemia, and the spleen in tuberculosis.

Secondary effects may be important. Enzymes, ani-bodies and thromboplastic substances may come out of an organ stimulated by treatment.

The roentgen ray in proper doses stimulates cellular metabolism. When organs are selectively stimulated by roentgen rays, therapeutic results can be achieved either by direct stimulation of an external secretion (kidney) or an internal secretion (the pancreas in diabetes). A second method consists in the mobilization of anti-bodies, enzymes and thromboplastic substances following selective organ stimulation. The future of roentgenology holds much in store if study and development take place among these lines.

Radium Treatment of Uterine Fibromyomas, Journal de Radiologie et d' Electrologie. Paris, December, 1920, vol. iv, No. 12, p. 537, T. Nogier.

RADIUM is often the only means that is safe in patients too anemic, or with heart or kidney disease too far advanced to permit operative intervention. Metrorrhagia and menorrhagia are promptly arrested, even in the young. In a short time retrogression of the fibroid is usually accomplished.

The Dandy Method of Localizing Brain Tumors by the Roentgen Ray. Dr. Karl A. Menninger, Topeka, Kansas. Archives of Neurology and Psychiatry, April, 1921, p. 438.

FEW physicians realize the value of roentgen rays in the diagnosis of skull and spine pathology. The discussion and case report illustrate the importance of photographing the ventricles of the brain filled with air. The case was a boy of six years giving a history of intra-cranial pressure. Roentgenograms were made showing the separation of sutures, signs of pressure in the bony structures, an absence of sella tursica. The skull was trephined and 50 c. cfl of fluid removed from the ventricle. Air was injected. Then immediately the skull was examined by roentgen rays, showing roentgenograms in the lateral and posterior-anterior positions. The lateral ventricles were found enormously dilated to three times their normal size. This showed clearly hydrocephalus. The roentgenograms showed also that both ventricles were dilated symmetrically and equally. Fluid removed from the left ventricle must drain through the third ventricle into the right, into which the needle was inserted, and this illustration shows that the drainage was apparently incomplete. This gave a slight haziness in one, probably due to fluid. But the approximate equality of both, neither displaced beyond the midline, shows that the obstruction is cerebral. Dr. Dandy says: "Except in rare instances, only tumors in the brain stem or cerebellum can produce a symmetrical bilaterial internal hydrocephalus." The obstruction must be a neoplasm in the cerebrum, between the aqueduct (or foramen) and the foramen of Magendie.

Recently some question has been raised by Dr. Samuel T. Orton, doubting that all cases are due to cerebellar tumor. A local pressure directly on the aqueduct of Sylvius behind the anterior end would cause the same result. Tumors springing from the corpora quadrigemina, or from almost any point in the floor of the fourth ventricle, could and probably would produce the same picture. An inflammatory process might block the acqueduct. These factors should be ruled out by the clinical and special neurological tests.

The surgical treatment consisted in opening the cerebellar cavity. No tumor was found, but the search was discontinued on account of surgical limitations and the poor condition of the patient. This does not disprove the diagnosis nor lessen the value of the roentgen method. Diagnosis ran ahead of surgical limitations.

Roentgen Ray Therapy of Uterine Fibroids. T. W. Eden and F. L. Provis. Lancet, London, February 12, 1921, p. 309.

AFTER thirty years of age the method of choice in the treatment of chronic metritis with hemmorhage and no other complications should be roentgen therapy. The treatment is more easily consummated than that of fibroids. It is important to avoid treatment if the ovaries or tubes are involved by inflammation.

Fibroids not above the umbilicus, in patients over thirty-eight, may be treated by roentgen ray if the hemorrhage is of the regular monthly type, the tubes and ovaries uninvolved, and no signs of degenerative changes in the tumor are present. Intercurrent troubles may increase the operative risk; then roentgen ray is the course of choice. Often the patient should be allowed to choose after she has considered all sides of the question. All cases should first have a careful gynecological examination to exclude malignancy, inflammatory complications and degenerative changes.

The failure of roentgen treatment is so small, in properly selected cases, that it can be neglected. Symptoms of menopause come on a little more rapidly, but there are no untoward symptoms or changes in physical condition.

An Aid in the Diagnosis of Tumor of the Urinary Bladder. D. R. Mellen, Rochester. Jr. A. M. A., March 19, 1921.

THE roentgen ray is a recent introduction in the study of the tumors of the bladder. It helps visualize the form, size and location of the tumor. It is indicated where cystoscopy is impossible on account of stricture of a prostate. Also it is applicable in cases of uncontrollable bleeding during cystoscopy, cases of intolerant bladder, and cases of contracted bladder.

A case is described in detail and roentgenograms demonstrated showing a malignant papilloma of the bladder. Sodium bromide, 15 per cent, was used for the cystogram. The tumor decreased in size by the use of radium.

The technique suggested consists in an air cystogram first, as this may show a neoplasm, then to fill the bladder with opaque solution and take a picture, and lastly to take an immediate picture of emptying the bladder.

Conclusions.

1. It is possible to demonstrate a tumor of the bladder by means of the roentgen ray.
2. The older methods, such as injecting air or an opaque media, sometimes fail.
3. It is suggested that an air cystogram should be taken first, then the bladder filled with sodium bromide solution, either 15 or 25 per cent; then take a second picture, and lastly, one immediately after emptying the bladder.

Traumatic Ossifying Myositis. Dr. Thomas G. Orr, Kansas City, Mo. The Medical Herald.

THE etiology has never been satisfactorily explained.. The predisposing factor constantly present is trauma, acute or long-sustained. Aberrant embryonic cells, true tumor formation, transformation of blood into bone, aberrant sesamoid bones, action of synovial fluid in tissues, trapho-neurotic changes, periosteal origin, inflammatory or a true metaplasm of tissue—all these are the various theories of pathologic change. The last three suit the author best. Most of the discussion concerns the explanation by periosteal development and metaplasia. True bone occurs and ossification often extends along a great length of the muscle.

The roentgen examination early reveals the presence of bone. Stages of growth and increased density may be traced. Symptoms may disappear. The difficulty of diagnosis is not great. Sarcoma must be eliminated.

The prognosis is good. It is left alone if it does not interfere with function; absorption may take place. Operation should not be performed early on account of danger in recurrence. Removal, if attempted, should be thorough.

Childhood Tuberculous Lymphadenitis: Its X-Ray Findings and Diagnostic Significance. Dr. Maximilian John Hubeny, Chicago. International Clinics, Vol. I, 31 series, p. 110.

MEDICAL propaganda through the profession and the laity have made tuberculosis secondary to heart lesions as a cause of death.

The roentgen ray has established itself as a diagnostic and therapeutic agent with limitation and usefulness. All clinical, pathological and bacterial data should enter into consideration of cases.

Pulmonary and pleural tuberculosis, with or without glandular involvement of the mediastinum, bronchial, tracheal, and broncho-pulmonary areas, offer the most tangible findings. The roentgen therapeutic aspects of tuberculous adenitis is mentioned with enthusiasm. Its use is not new. Its application has proven its value. The advantages are many, such as these: There is no mutilation, no tendency toward metastasis, no permanent derangement. There is a high percentage of cures. On account of the widespread infection, complete radical removal by surgery may be impossible. Roentgen rays favorably affect the blands that are diseased as well as those in the surrounding territory. Some glands cannot be reached surgically, such as those in the chest and abdomen. Roentgen rays offer some relief in tuberculous affections of the tracheal and bronchial lymph nodes. Dysphagia and dyspnoea are much relieved. Results are uniformly good.

The lymphatic system is readily and easily affected by the roentgen ray. The selective action in other words is marked. The effect is destructive, The growth of connective tissue is stimulated and cicatrization follows. Pirie believes another important factor is the destruction of giant cells. This destroys the protection of the tubercle bacilli and allows the leucocytes to destroy them in turn. There is no demonstrable effect on the bacilli themselves. Serological changes in the organism may be obtained, accounting for the changes in disease areas in distant parts of the body undergoing treatment.

If treatment is not too severe, the opsonic index will steadily rise.

The roentgen rays bring about actual destruction of the tuberculous granulation tissue. In the surrounding tissue active hyperaemia occurs, crowding the vessels with leucocytes which promote absorption, and in time wall off the diseased area by connective tissue.

From the standpoint of roentgen therapy three types are mentioned:

1. Simple tuberculous, non-suppurating lymphoma.
2. Closed suppurating or partly caseating lymphoma.
3. Open suppurating and caseating lymphoma with fistula.

Group one occurs most often in children and requires six to eight weeks as a rule to treat successfully. The second group is favorable to treatment if no inflammatory signs are present.

If inflammation is present, incision and drainage is usually necessary to secure good results.

The third group yields slowly, the tract first dries up and then the more distant parts subside. The older the fistulae, the longer time necessary.

Technique.

Adults: 10 Holzknecht units every three or four weeks; 4 mm. filtration; 9½ inch spark gap, 5 milliamperes, cross-fire if possible. In children, 6 Holzknecht units will suffice.

Areas containing any of the ductless glands, or those susceptible, should be carefully protected. The response may even be a test for the accuracy of diagnosis. Tuberculous glands yield slowly, but those of leukemia and pseudoleukemia literally melt away, often in a few days.

E. W. ROWE.

X-Ray Pictures of the Bones in the Diagnosis of Syphilis in the Fetus and Young Infants. P. G. Shipley, J. W. Pearson, A. A. Weech and C. H. Green. Bulletin of The Johns Hopkins Hospital, March, 1921, pp. 75-77.

A NEGATIVE Wassermann in the new-born is of little value in the diagnosis of syphilis. The tendency is to extend this "capricious" action until the end of the fourth month. The diagnosis of syphilis is so difficult and yet so important in the new-born that any assistance from the x-ray is of great importance. All syphilitic infants do not show bone changes or clinical and serological changes, but the bones which do show syphilitic changes are so easy of recognition as to be pathognomonic.

Three hundred white fetuses ranging in age from the sixth month of intrauterine life to nearly term, normal and pathological, were studied with roentgenograms. Syphilis easily stood out as the great factor in their death. In the first hundred plates studied, 15 showed advanced luetic changes, 10 had signs of less marked syphilitic involvement, and 21 showed one or more bones which presented slight variations. "In other words, 25 had marked signs of lues, and 46 out of 100 bodies examined had well-marked or suspicious lesions."

The lesions were of two types (1) those seen in the new-born, and (2) those seen in the bones of older children. The normal bone pictures are carefully described. We are more concerned with the syphilitic.

Syphilitic bones are characteristic on roentgenograms. All bones are not affected to the same extent. The order of frequency is as follows: The lower end of the femur, the distal and proximal ends of the tibia, the distal ends of the radius and ulna, the extremities of the metacarpals, the proximal ends of the phalanges, and the proximal ends of the ulna and radius. No bones are exempt.

The syphilitic changes in the bones of the fetus, unless of severe or long standing, do not involve the periosteum to any extent, but are confined to the epiphyseodiaphyseal region. At birth periosteal changes begin to occur, and in young infants this may be the most marked skeletal lesion.

The first change shown on the roentgenogram is an intensification of the bone at the epiphyseal line. This broadens, becomes homogenous, and seems to form a cap on the ends of the trabeculae of the spongiosa. Ab-normally heavy calcification of the provisional calcified zone goes progressively forward. This width may be exaggerated to .5 mm. and to 1.5 mm. Bones may be seen in which this calcification is irregular, due to rarefaction in small areas. At other times the bones end in double heavy lines, corresponding to the zone shown by histological examination to contain granulations. This increases in intensity as the process goes on. Irregularity becomes marked until finally the bone becomes jagged in appearance. The epiphyseal border appears jaw-toothed or serrated.

Periostitis, when it occurs near term in severe cases, may be present throughout the length of the bone or only at the extremities. It shows in longitudinal striations separated from the external surface of the cortex by a narrow clear area which bounds the bone. In the roentgenogram the trabeculae of the syphilitic bone appear to be finer than in normal bone.

Scurvy and rickets must be differentiated. In earlier weeks neither need be considered. Fetal rickets never occurs. Scorbutus is rare before the sixth month.

Lues of the fetus and newly born child interferes little if at all with skeletal growth.

E. W. ROWE.

The Effect of Phosphorus in Rickets. Dr. D. B. Phemister, Dr. E. M. Miller, Dr. B. E. Bonar, Chicago. Jour. A. M. A., March 26th, 1921, p. 850.

"IN PREVIOUS studies Phemister showed in roentgen ray studies the influence of phosphorus on the growth of normal bones and the bones in the growth disturbance of osteogenisis imperfecta and dyschondroplasia. A dense shadow formed at the growing ends of the shafts, which gradually increased in thickness as long as the phosphorus was given, but gradually faded after the discontinuance of the drug. Further doses demonstrated that it influenced the longitudinal growth of the bones, but not the transverse in the normal bones. But in osteogenesis imperfecta the transverse increase was as noticeable in the transverse as in the longitudinal."

Dr. Phemister has also repeated the Wegner experiments showing that the "shadows are found to be due to a layer of densely packed, longitudinally arranged, bony trabeculae that form excessive activity in the zone of ossification at the end of the shaft."

Illustrations are given showing the effect of phosphorus administered for various periods of time. Some show the effects of phosphorus alone, and some with cod liver oil. The end results of phosphorus and cod liver oil were the same as with phosphorus alone. Rarefied areas in rachitic bones acquired an approximately normal density in both instances. The method of action is little understood. Clearly phosphorus and cod liver oil restored the power of normal ossification, which in rickets is temporarily lost.

E. W. ROWE.

Postural Rest for Pulmonary Tuberculosis. Dr. G. B. Webb, Dr. A. M. Forster, Dr. G. B. Gilbert, all of Colorado Springs. Jour. A. M. A., March 26, 1921.

THIS article has been selected because it illustrates how dependent the clinicians are upon roentgen study; also, how helpful the roentgen laboratory may be where the co-operation is close.

Rest is the most approved aid in the treatment of tuberculosis. It has been neglected or inadequately carried out in pulmonary tuberculosis. It is best carried out in patients without two badly affected sides. When the affected side is down in the recumbent position, it gradually becomes quieter and less expanded. Hyperaemia develops, which is also of benefit. Patients submit readily to the treatment, expectoration becomes less, fever subsides, and cough ceases. A pillow may be used to compress the recumbent side. It seems to have all the advantages of artificial pneumothorax.

Case histories and roentgenograms are included, showing the effect of position in normal individuals and those affected with tuberculosis. These are confirmed by other similar data secured at the U. S. General Hospital No. 1.

E. W. ROWE.

Errors in Diagnosis in Treatment of Duodenal Ulcer. J. D. Dunham, American Journal of the Medical Sciences, November, 1920.

THE writer quotes Moynihan, disapprovingly: "It is therefore not necessary to the attaining of a diagnosis that any examination of the patient be made: the anamnesis is everything, the physical examination is relatively nothing." The writer insists on the fullest examination, namely chemical tests of stomach contents, stools, urine, blood count, a Wassermann, and insists on a fluoroscopic examination of the chest and abdomen. Fluoroscopy of the chest will sometimes show an enlarged aorta suggesting an aortitis, which condition in turn points to syphilitic duodenal ulcer or visceral lues, either of which condition is usually confused with a simple chronic duodenal ulcer. He emphasizes the diagnostic importance of an early hyperperistalsis followed by a later hypoperistalsis and duodenal distortion. In his experience duodenal ulcer has rarely been associated with visceroptosis. A distortion of the duodenal cap accompanied by local tenderness is strong evidence of duodenal ulcer.

J. H. DEMPSTER, M. D.

Roentgenological Aspects of Lower Right Quadrant Lesions. F. H. Baetjer, M. D., and Julius Friendenwald, M. D., Baltimore, Md. The American Journal of Medical Sciences, November, 1920.

THE writers mention the following among the affections of the lower right quadrant of the abdomen: 1, Appendicitis, 2 Incompetent ileocecal valve and ileal stasis, 3 Dilatation of the cecum with retention, 4 Adhesions and angulations, 5 Ulcerations due to tuberculosis, 6 Ulcerations due to carcinoma. In studies of the lower right quadrant lesions, the authors use both the opaque meal and the opaque enema. The opaque meal ordinarily reaches the cecum in five to eight hours. Delay in the passage of the opaque residue may be due to dilatation of the cecum, to ptosis, to adhesions or to ileal stasis and angulations. In determining lesions of the lower right quadrant the authors place the patient in the knee chest position and use a low enema, allowing it to run in slowly by gravity.

Chronic appendicitis: In very chronic forms of appendicitis the lumen of the appendix may be completely closed as a result of the obliterative inflammatory process, in which case the appendix may not be seen. The appendix should fill in 6 hours, especially under fluoroscopic palpation. When the appendix remains visible more than 24 hours after the examination, or if the cecum has emptied itself, it is potentially dangerous in proportion to its poor drainage. The majority of retrocecal appendices show tenderness upon fluoroscopic palpation. In those cases in which there is no tenderness on direct palpation, the authors say appendicitis may be excluded. According to Pfahler, a localized tenderness over a fixed cecum even if the appendix is not visualized, means a pathologic appendix. The writers claim that not every visualized appendix is of necessity diseased. This is particularly so if the appendix can be found well filled with bismuth, lying practically free, no signs of adhesions and emptying with the emptying of the cecum. When, however, the appendix is found filled with barium curled up and fixed, this points to a pathologic process. The kinking of the appendix, which remains constantly pointing towards the gallbladder, must be viewed with suspicion. Adhesions associated with the appendix must extend to adjacent structures and thus produce varying degrees of cecal and ileal stasis even to partial obstruction of the colon.

Chronic appendicitis may at times give rise to symptoms which point to duodenal ulcer, that is, reflexly we get a gastric and duodenal hypermotility with a definite deformity of the duodenal cap. These cases call for repeated examination and close study of the plates together with clinical history.

Incompetent Ileocecal Valve and Ileal Stasis: As a diagnostic sign of this condition, we have the ileum entirely empty 24 hours after partaking of the barium meal and at the end of 36 hours to 48 hours the terminal ileum may be filled, which points to a regurgitation from the cecum to the ileum due to incompetent ileocecal valve. The ileocecal valve is normally competent, hence the reflux of the opaque meal from the colon into the ileum is looked upon as a sign of incompetency.

Dilatation of the cecum with retention: Cecal stasis may be associated in some cases with chronic appendicitis or it may be due to a high degree to interoptosis. The roentgen ray examination of the dilated cecum has thrown more light upon this type of constipation in which the patient may not complain of constipation maintaining that the bowels move regularly every day. The barium mass will be found adherent to the side of the cecum allowing a small channel in the center. This condition points to a low grade inflammation of the cecum, which frequently involves the appendix also. This undoubtedly accounts for cases in which the removal of the appendix is not followed by any marked benefit to the patient.

Adhesions and Angulations: The terminal portion of the ileum is a common seat for adhesions, which may produce angulation and kinks in the bowel at this location.

Tuberculous Ulcerations: The writers draw attention to the importance of the x-rays in the diagnosis of intestinal tuberculosis. The radiogram shows hypermotility of the bowel often with complete evacuation in from twenty to twenty-four hours. The most important sign is the spastic condition of the bowel involving the usual cecum and cecocolon. There is also an irregular appearance presenting definite filling defects at the seat of the lesion. The presence of intestinal hypermotility, spasm and filling defect give in a patient with pulmonary tuberculosis almost definite evidence of a chronic tuberculosis.

Ulcerations due to carcinoma: In this condition, we have a definite filling defect persistent in all the plates. There is likewise localized tenderness on fixation. The writers caution against a diagnosis of carcinoma from filling defects observed at a single examination. The examination should be repeated after the bowels have been thoroughly cleaned by means of cathartics and enemata. The barium enema is the method of choice for the examination of colonic growths. In conclusion, the writers strongly impress the necessity of correlating the roentgen findings with the clinical findings. No one method of diagnosis must be looked upon as absolute.

J. H. DEMPSTER, M. D.

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The Relation of Ossification to Physiological Development

C. R. Bardeen,
Madison, Wisconsin.

DURING the growth of an individual we may distinguish increase in size, structural metamorphosis, and the rate of development either in size or structure. During early infancy growth in size is relatively more rapid than structural differentiation. The proportions of the body change comparatively little. During childhood growth in size and structural differentiation to a considerable degree keep pace with one another. As the child grows in height and weight the proportions of the body change, owing largely to relatively slow growth of the head, and rapid growth of the lower extremities. As puberty is approached and during adolescence structural differentiation is more rapid than growth in size although there is usually marked acceleration of growth in size preceding and following puberty. After adolescence slow structural change continues. During early maturity the body becomes stronger, in old age weaker. During the former it usually becomes thicker and heavier, during the latter thinner and shorter.

The changes in size and structure which characterize infancy, childhood, adolescence, maturity and old age demarcate periods of what C. Ward Crampton has designated physiological age in contrast to chronological age.

In dealing with a group of individuals we may determine the average or the mean chronological age at which a given characteristic of physiological age appears and take this chronological age as the "normal" or type age for the appearance of that particular characteristic. Thus, we may find that the first incisor teeth "normally" appear at seven months of age, that the first menstrual period "normally" appears at fourteen years of age. Individuals in whom the first incisor teeth appear earlier than at seven months of age then have an accelerated, those in whom the first teeth appear later a retarded physiological age with respect to that particular phenomenon. Puberty appearing before fourteen years of age would be accelerated, after fourteen retarded, with respect to fourteen taken as the normal or typical chronological age.

The phenomenon of dentition is relatively definite and simple to observe and record, although teeth apparently otherwise equally developed may break through the gums at different periods and thus interfere with the exactitude in comparing different individuals It has been found, however, that there is a wide variability in dention. The normal or typical age for the appearance of the teeth as determined by one observer is apt to differ considerably from that determined by another observer. Full physical and mental maturity may be reached without the wisdom teeth appearing at all. Dentition is an uncertain indication of general physiological development.

The phenomena which characterize pubescence have received special study by Prof. Crampton from the standpoint of physiological age. These phenomena may enable an expert to form a fairly accurate opinion as to general physiological as contrasted with chronological age but many of them are of such nature that only an expert could make successful use of them. The most definite phenomenon characterizing puberty is the beginning of menstruation. It is well known that the chronological period at which this occurs is subject to wide variation. A retarded beginning of menstruation is not necessarily associated with a general physiological retardation, an accelerated puberty with a general physiological acceleration. Prof. Crampton's investigation indicates, however, that this is most frequently the case. Wensenberg (1911) states that menstruating girls thirteen years of age usually have the stature normal for fifteen-year-old girls, while fifteen-year-old girls who have not menstruated are usually of sub-normal stature. His studies were carried out on South Russian Jewesses.

The phenomena of growth marked by increase of stature and of weight are those most frequently used in the study of acceleration and retardation in physiological development. A considerable number of investigators have studied the correlation between school grade and acceleration and retardation in growth in stature and weight. In most cases the correlation has been found to be positive. As a rule children advanced for their age in school are on the average relatively large in stature and weight, backward children are on the average relatively small. There are, however, many individual exceptions and some investigators have failed to find a positive correlation.

Crampton's observations support the view that there is a closer correlation between such phenomena as dentition and pubescence and growth in height and weight than there is between them and chronological age. If we could measure stature during childhood in terms of percentage of the adult stature which heredity has in store, rather than by comparing the stature reached by an individual of a given age with the average absolute stature for that age, we should probably find stature a still better index of general physiological development. Thus, if we should assume that a child of two years of age normally has half the stature of the adult, and we knew what the normal adult stature of a given child as determined by heredity would be, we could say that a child of two with less than half this adult stature was retarded, with more than half this adult stature was accelerated in development. Unfortunately, we have at present no means of determining what the normal adult stature for a given child may be. We may get some help from a consideration of his parentage and race but this help is quite limited in value.

Another method of determining physiological development is based on a study of relative sitting height. From infancy to puberty the lower extremities grow relatively fast. The rapid growth of the lower extremities causes the relative sitting height, (sitting compared with stature) to decrease. Of two children of the same stature but differing in sitting height the child with the shorter legs and greater sitting height is in this respect relatively less developed, more infantile, than the child with the longer legs. As a rule of two children of the same stature but differing in age, the younger child before puberty has the greater sitting height and shorter legs. There are, however, many exceptions and relative sitting height offers an uncertain method of estimating general physiological development.

The use of relative sitting height in the determination of physiological age is but an indirect method of studying skeletal differentiation as an index of physiological development. The use of the x-rays offers a much more simple and direct method of determining relative skeletal development. By means of the x-rays one may study the extent of ossification of as many of the bones of the body as may seem desirable in any given case. Thomas M. Rotch (1910) advanced the view that the extent of ossification of the bones is the best means we have of determining the relative development of the body. If this were true the admission of children to school and of adolescents to industry might better be based on a radiograph than on a birth certificate. The study, the results of which I desire to place before you today, is an effort to determine to what extent Rotch's theory can be accepted.

This study carried out under

my direction by one of my pupils, Mr. Ernest Donald, represents an attempt to correlate the ossification of the carpal bones with age, height and weight in a group of 167 school children, 96 boys, 71 girls, ranging in age from 3.5 up to 13.5 years. A full report of the study is given by Mr. Donald in a thesis deposited in the University library. Dr. Howard Curl, instructor in roentgenology at the University of Wisconsin kindly took the radiographs on which the work is based.

The ossification of the corpus has been carefully studied by Pryor. Pryor found that, as a rule, centers of ossification appear in the carpal bones in the following order; capitate, hamate, triquetral, lunate, navicular, lesser multangular, greater multangular, pisiform. In the old nomenclature with which many of the present are more familiar the order is as follows: os magnum, unciform, cuneiform, semilunar, scaphoid, trapezoid, trapezium, pisiform According to Pryor in boys centers of ossification for the capitate (os magnum) and hamate (unciform) always appear before five years of age, the center for the triquetral (cuneiform) usually appears at five, that of the lunate (semilunar, at 5.5, for the navicular (scaphoid) at 6, for the lesser multangular (trapezoid) at 7, for the greater multangular (trapezium) at 8 and for the pisiform at 12.

In girls, according to Pryor, the centers appear in the same order, but about two years earlier than in boys.

The present studies show an order of appearance of centers of ossification similar to that described by Pryor, but, do not disclose so early an average appearance of these centers nor so great a difference between the sexes.

In order to make finer subdivisions in stages of ossification of the carpus than one marked by the mere presence or absence of a center of ossification, the ossification of each center was classified according to extent of ossification into one of four groups A. B. C. and D. Those in group A show on the radiograph large dense centers of ossification, those in group D centers of ossification barely visible. Groups B and C are intermediate. With this grouping as a basis the ossification of the corpus was divided into the following stages:

Stage 1. Capitate (os magnum)and hamate (unciform) in class C. All others unossified.

Stage 2. Capitate (os magnum), hamate (unciform) and triquetral (cuneiform) in class C. All others unossified.

Stage 3. Capitate (os magnum), hamate (unciform) triquetral (cuneiform) and lunate (semilunar) in class C. All others unossified.

Stage 4. The pisiform and two of the three following bones unossified multangulum majus (trapezium) multangulum minus (trapezoid) and navicular (scaphoid).

Stage 5. All carpal bones in classes B or C except pisiform which is always unossified and the multangulum majus (trapezium) which may be in class D or unossified.

Stage 6. All carpal bones in class B except multangulum majus (trapezium) and multangulum minus (trapezoid) which are in class C and the pisiform which is unossified.

Stage 7. All the carpals in class B except the pisiform which is in class D or is unossified.

Stage 8. Capitate (os magnum) and hamate (unciform) in class A. Others in class B except pisiform which is in class D or unossified.

Stage 9. All carpals in class A except pisiform which is in class D.

Stage 10. All carpals in class A except pisiform which is in class B.

Stage 11. All carpals in class A.

Individuals in which there is a distinct difference in stage of ossification in the two wrists are relatively infrequent. Four such cases occurred in 96 boys examined. One boy, age 12.5, had the left carpus in stage 10, the right in stage 9. One boy, age 8, had the right carpus in stage 5, the left in stage 4, while in another boy of the same age the left carpus was in stage 5, the right in stage 4. In one boy, age 6, the left carpus was in stage 5, the right in stage 4. Of 71 girls studied, in two there was a difference of ossification in the carpus. In one, age 12, the right carpus was in stage 10, the left in stage 11. In one girl, age 6, the right carpus was at stage 5, the left at stage 4.

TABLE I.
Extent of Ossification of

Stage	Number M.	Number F.	Capitate (os magnum)	Hamate (unciform)	Triquetral (cuneiform)	Lunate (semi-lunar)	Navicular (scaphoid)	Mult. minus (trapezoid)	Mult. majus (trapezium)	Pisiform	Ave. Age Years M.	Ave. Age Years F.
I	2	..	C	C	O	O	O	O	O	O	5.3	..
II	3	..	C	C	C or D	O	O	O	O	O	5.5	..
III	5	..	C	C	C	C or D	O	O	O	O	6.3	..
IV	7	3	B	C	C	C or D	O	O	D	O	6.6	5.7
V	7	9	B	B	B	B or C	B or C	C or D	D or O	O	7.4	6.6
VI	12	19	B	B	B	B	B	C	C	O	8	7.5
VII	15	2	B	B	B	B	B	B	B	O or D	8.7	8.8*
VIII	20	11	A	A	B	B	B	B	B	D or O	10	10
IX	12	2	A	A	A	A	A	A or B	A or B	D	10.8	11.3*
X	6	6	A	A	A	A	A	A	A	B	12.3	10.8
XI	7	19	A	A	A	A	A	A	A	A	12.7	12.5

*—Only two cases for each.

In case of the boys this grouping by stages corresponds well with the grouping by stature, by weight and by age (See Table II). The average stature, average weight and average age for each ossification group is successively greater from stage 1 to stage 11.

In case of the girls those at stage 9 are taller, heavier and older than those at stage 10, those at stage 7 are shorter and lighter though older than those at stage 6. There are, however, only two girls with ossification at stage 7 and only two girls with ossification at stage 9. These small numbers probably account for the serial discrepancy.

While averages thus show a fair correspondence between growth in stature and weight and in age on the one hand and stages of ossification on the other hand, individual variations are wide. See Table II.) Thus of 20 boys at stage 8 with an average age of 10 years the youngest was 8 years, the oldest 11 years, 5 months, with an average stature of 53.6 inches, the tallest was 60 inches, the shortest 47 inches; with an average weight of 65.2 pounds, the lightest weighed 52 pounds, the heaviest 80 pounds. Of 19 girls at stage 6, with an average age of 7 years, 6 months, the youngest was 6 years of age, the oldest 10 years, 5 months; the shortest was 45 inches tall, the tallest 52 inches tall; the lightest weighed 41 pounds, the heaviest 68 pounds.

If we compare the stature of the individuals of a group of a given age in years with the average stature of that group, we may divide the individuals into three groups, those of average stature to within an inch for age in the group studied, those of greater

TABLE II.

Relation of Stages of Ossification to Stature, Weight and Age.

Stage	No. of Cases		STATURE—INCHES						WEIGHT—POUNDS						AGE—YEARS AND MONTHS					
			MALE			FEMALE			MALE			FEMALE			MALE			FEMALE		
	M.	F.	Ave.	Tallest	Shortest	Ave.	Tallest	Shortest	Ave.	Heaviest	Lightest	Ave.	Heaviest	Lightest	Ave.	Oldest	Youngest	Ave.	Oldest	Youngest
I	2	..	40.8	44	37	..	..	..	39.5	45	33	..	..	..	5–3	6–8	3–6	..	..	..
II	3	..	42	44	39	..	..	..	39	43	32	..	..	..	5–6	6	4	..	..	..
III	5	..	45	45.5	44.5	..	..	..	45.2	56	40	..	..	..	6–4	7	6	..	..	..
IV	7	3	46	49	41	41.4	43	39	45.3	52	34	36	43	32	6–7	8	5–5	5–8	8	3–5
V	7	9	47	49	41	45.1	47	42	47.7	54	42	45.4	53	42	7–5	8	6	6–7	8	6
VI	12	19	49.75	52	44	49.4	52	45	55	63	45	53.6	68	41	8	9–5	6	7–6	10–5	6
VII	15	2	50.75	52	46	47	48.5	45.5	59	65	47	48	48.5	47.5	8–8	12–5	6–5	8–10	9–2	8–7
VIII	20	11	53.6	60	47	53	56	49	65.2	80	52	63.25	73	60	10	11–5	8	10	11–5	7
IX	12	2	56	61	52	56.25	56.5	56	80.75	105	60	75	75	75	10–9	12–5	9–5	11–3	11–4	11–3
X	6	6	57.5	59	56	53.3	57	50	83.85	93	78	69.6	85	55	12–3	13	8–6	10–10	12	10
XI	7	19	61.75	66	57	57	67	53	96.75	112	73	92	122	66	12–8	13–5	10	12–6	13–5	11
Total	96	71																		

and those of lesser stature. (See Table III.) On this basis we find 30 per cent of the boys studied accelerated in stature, 56 per cent of normal stature and 14 per cent retarded in stature. Of those accelerated in stature 82 per cent showed an acceleration of weight of one or more pounds; 61 per cent an acceleration of ossification; 18 per cent showed average weight for age, 36 per cent average ossification; none retarded weight, 3 per cent a retarded ossification. Of those of average stature, 17 per cent showed accelerated weight, 23.5 per cent an accelerated ossification; 59.5 per cent average weight, 63 per cent average ossification; 23.5 per cent retarded weight, 13.5 per cent a retarded ossification. Of those retarded in stature none showed accelerated weight or ossification, 15 per cent showed average weight, 60 per cent average ossification, 85 per cent retarded weight, 40 per cent a retarded ossification. Of the girls 18.5 per cent were accelerated in stature, 64.5 per cent of average stature, 17 per cent retarded in stature. Of those accelerated in stature, 92 per cent were accelerated in weight, 31 per cent accelerated in ossification; 8 per cent were average in weight, 52 per cent of average ossification; none were retarded in weight, 17 per cent in ossification. Of those of normal stature, 22 per cent showed acceleration in weight, 9 per cent in ossification; 69 per cent, average weight; 76 per cent average ossification; 9 per cent retarded weight, 15 per cent retarded ossification. Of those retarded in stature, 8 per cent were accelerated in weight, none in ossification; 58 per cent were average in weight, 42 per cent in ossification, 34 per cent were retarded in weight, 58 per cent in ossification. Generally speaking, therefore, correlation between retardation and acceleration in stature and that in ossification of the wrist is comparatively low, and is in contrast to the correlation between retardation and acceleration in stature and that in weight, which is generally high in the same group. In some instances, however, the correlation between stature and ossification is closer than that between stature and weight.

TABLE III.

Relation of acceleration in stature to acceleration in weight and in ossification.

NINETY-TWO MALES

STATURE		WEIGHT	OSSIFICATION
Acceleration—30 per cent	Acceleration	82 per cent	61 per cent
	Average	18 per cent	36 per cent
	Retardation	0 per cent	3 per cent
Average—56 per cent	Acceleration	17 per cent	23.5 per cent
	Average	59.5 per cent	63 per cent
	Retardation	23.5 per cent	13.5 per cent
Retardation—14 per cent	Acceleration	0 per cent	0 per cent
	Average	15 per cent	60 per cent
	Retardation	85 per cent	40 per cent

OSSIFICATION—BARDEEN

SEVENTY FEMALES

STATURE		WEIGHT	OSSIFICATION
Acceleration—18.5 per cent	Acceleration	92 per cent	31 per cent
	Average	8 per cent	52 per cent
	Retardation	0 per cent	17 per cent
Average—64.5 per cent	Acceleration	22 per cent	9 per cent
	Average	69 per cent	76 per cent
	Retardation	9 per cent	15 per cent
Retardation—17 per cent	Acceleration	8 per cent	0 per cent
	Average	58 per cent	42 per cent
	Retardation	34 per cent	58 per cent

If we subdivide the children studied into groups based on acceleration or retardation in stature compared with averages for a given age such as those of the Boas Burk table, the closer correlation between stature and weight than that between stature and ossification becomes much more marked than in the procedure cited above.

We may therefore, conclude that ossification does not afford a practical method of judging general relative physiological development. Within comparatively wide limits, variation in the age at which centers of ossification appear is independent of those factors which produce acceleration or retardation of growth in stature and weight. One has no right on the basis of present knowledge to judge a child generally backward because centers of ossification in the carpus appear relatively late.

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Conclusions Drawn From The Consideration of Eighty Cases of Pneumoperitoneum

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THE radiographic examination of the intra-abdominal organs by the aid of pneumoperitoneum, or gas inserted into the peritoneal cavity, is a procedure so recently advocated that it seems advisable for anyone having utilized this method to relate his findings. Since this method was first brought into prominence in this country by Drs. Stewart and Stein of New York, in the early part of 1919, it has been taken up by many roentgenologists and surgeons with a great deal of enthusiasm. The wide range of possibilities which this method affords in the differential diagnosis of obscure intra-abdominal conditions has been welcomed by the roentgenologists who realize only too well the limitations of radiological examination of this part of the body. With the same over-enthusiasm which characterizes nearly every new method of examination, this method has been seized upon by many as the method of choice in investigation of all intra-abdominal conditions. This is by no means the case, and its indescriminate use can only lead to failure and disappointment. Wherever, therefore, this method is used, it should be used, not to supplant other established methods of examination, but only as an additional aid after these fail to give the desired information, or where their use would obviously be of no avail.

In the first place, it is not possible to secure the same information obtainable by the other established methods of examination, by this means, for, it cannot be used in lieu of a barium meal examination for lesions of the gastro-intestinal tract, nor will it render tumor masses of the pyloric end of the stomach visible. It should not be used to secure a plate of the kidneys unless the kidney outline cannot be made out and there is a definite undetermined shadow suspicious of a urinary stone or other kidney disease present. It may be necessary for the differentiation of shadows, suspicious of urinary stones, where the ureters, for some reason or other, cannot be catheterized. I do not feel that the inflation of the abdominal cavity with air is attendant with more danger than ureteral catheterization and injection. Surely this method would seldom. if ever, be justified for a lateral plate of the spine, unless under some exceptional condition for the fifth lumbar vertebra. This method should not be used for the demonstration of gall stones until definite effort has been made to demonstrate the stones in the usual manner. Where a pathological gallbladder is still suspected, and ordinary examination has revealed nothing, or if the regular method of examination has disclosed a suspicious shadow, then pneumoperitoneum is justified in an effort to localize the shadow to the gallbladder area.

Secondly: While no untoward result has so far occurred, still there is always a certain amount of risk connected with inserting a needle into the peritoneal cavity, especially where the intra-abdominal condition prevailing is unknown, and the indiscriminate use of this method will undoubtedly culminate in some accident.

Thirdly: There is a certain amount of discomfort associated with the procedure—not much, to be sure. but still sufficient to warrant its not being used unless indicated.

Fourthly: The promiscuous use of this method in an attempt to diagnose all intra-abdominal lesions will only lead to failure and disappointment, and a discrediting of this method of examination.

I do not wish this to be interpreted as a discredit to pneumoperitoneum, but I mean it merely as a warning that this method, like all others, has its definite indications, and likewise, its definite limitations.

As a basis for determining the conditions in which we have found the method most useful, I have divided our cases into six groups.

The first group is rather large. and embraces those cases in which information is desired concerning the presence, position, size, form and mobility of the intra-abdominal organs.

The second is composed of cases in which there are masses of undetermined origin (other than those arising from the stomach or large bowel). This group is one in which the method is probably most useful in determining the point of origin of definite palpable masses. It is probably the only means at our disposal by which the retroperitoneal character of a mass can be definitely established.

The third includes cases of kidney or ureter involvement after other methods have not yielded the desired information. For instance. where there is a constant shadow suspicious of stone over the supposed kidney area, and the ureter and kidney pelvis cannot be injected. this method serves to localize the shadow to the kidney area.

The advisability of placing in the fourth group the conditions in which pneumoperitoneum will be an aid, can only be determined after a long time has elapsed and many examinations made. I refer to the examination of the gallbladder. I feel that this method will ultimately prove of great aid in the detection of infected, or pathological gallbladders, and in gall stones. It should, of course, be used only after the ordinary methods fail, and may be of use in doubtful cases, in localizing suspicious shadows to the gallbladder.

In the fifth group I have placed those cases in which adhesions are present—postoperative or otherwise—to the abdominal wall or other viscera. In this group pneumoperitoneum is of all methods the most satisfactory.

In the sixth and last group, it might be well to place cases of subdiaphragmatic conditions, where it is desired to ascertain whether the lesion is above or below the diaphragm, or whether this region is involved at all.

Having considered the indications and contraindications of this method, I will pass to a brief description of our procedure and a few cases in which this method has been useful.

The preparation of the patient is the first thing to be considered. All patients who are to be examined by pneumoperitoneum should be given a cathartic the night before, and an enema the next morning. They should be allowed a light breakfast, and just prior to examination should be catheterized or caused to void. The patient is then prepared for inflation. The skin is prepared in the ordinary manner as for a thorocentesis, soap and water, alcohol and iodine; and a sterile lumbar puncture needle is inserted into the abdominal cavity in the lower left quadrant, directed slightly upward. The lower left quadrant is chosen because of the lessened likelihood of damaging any of the solid intra-abdominal organs, and the needle is directed upward so as not to put the omentum or any organ with mesenteric attachment on a strain, if the needle should accidently come in contact with them. The air rising to the top, displaces or envelopes the abdominal organs, and causes them to be thrown out in relief by reason of the varying radiographic densities thus established. We have discontinued the use of manometers and all other measuring devices for determining the amount of pressure of gas inserted, having found them unnecessary and useless; and find that such a simple apparatus as that shown in Figure I, is perfectly satisfactory. An ordinary lumbar puncture needle is attached by suitable connectors to the pump of a Potain Aspirator, or oxygen tank, depending on the type of gas to be used, with some sort of a trap interposed, such as a Murphy drip with the small vent hole plugged. The purpose of interposing a trap is to avoid the possibility of introducing foreign material from the pump or tank of gas. We use as a criterion of proper distention, the slight rounding of the abdomen and development of a tympanitic note over the solid organs. If a mass be present, inflation must be continued until there is a tympanitic note over the mass if its adherence to the abdominal wall is to be determined. A very satisfactory method of gauging proper distention for the individual case, and one which we have adopted as a routine, is to inflate under the fluoroscope.

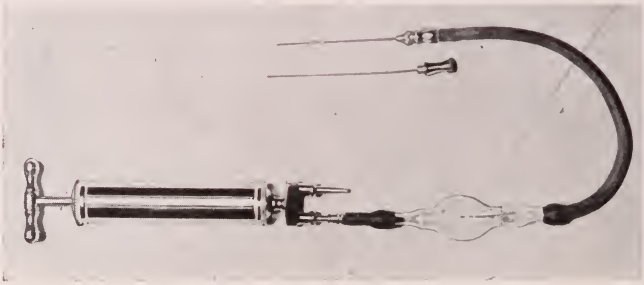

Fig. 1.—Apparatus used for production of pneumoperitoneum. An ordinary lumbar puncture needle fitted to the pump of a Potain aspirator by suitable rubber tubing and connectors, with a Murphy drip interposed as a trap.

The injecting materials which we employ are air and oxygen. We do not use carbondioxide since it is absorbed too rapidly for a satisfactory examination. It seems possible that we may be able to secure a proper dilution of carbondioxide with air which will retard absorption long enough to permit a proper examination, and yet retain enough absorbtive quality to be ideal as an injecting agent. As a result of the injection of these two mediums—air and oxygen—we have been impressed with the fact that although air takes longer to absorb than oxygen, it causes less pain and discomfort to the patient. When the desired amount of inflation is obtained the needle is withdrawn and the examination proceeded with. Details of the technique utilized have been so ably presented in previous publications (Drs. Stewart and Stein) that I will pass over this phase and consider rather the conditions in which we have found it useful. be placed in six groups.

The first group having to do with the presence, position, size, form and mobility of the abdominal organs, is obviously a very large one, and in view of the limited number of examinations made so far, presents certain difficulties; for instance, as to the range of normal mobility or variation in size or form of different or- These, as previously stated, may gans in individuals of different age or habits. Only after a large number of observations can these points be established with any degree of accuracy.

Figure 2 represents the relation of the abdominal organs in a normal individual. The liver, spleen, wise normal individuals the liver has been encountered much smaller than shown here, and often confined entirely to the right side. Disproportionate variation in the size of normal kidneys has not been noted. The outline of the normal liver is smooth and any variation from the normal can be readily detected. Figure 3 shows

Fig 2.—Normal relations of the intra-abdominal organs in the antero-posterior view.

kidneys, psoas muscles, descending colon are partially filled with barium, and both diaphragms are well shown. The liver and spleen are seen displaced somewhat from the diaphragm, but this varies with the degree of inflation. The spleen is about normal in size, and yet very much larger spleens have been observed in otherwise apparently normal individuals. In other- numerous secondary carcinomatous nodules too small to produce definite palpable masses, studding the surface of the liver.

Figure 4 shows the relation of the female pelvic organs with a retroversion of the uterus. In the male the bladder can be inflated as well, and the prostate demonstrated in a number of instances. Observations on the condition of the bladder wall are thus also possible.

The second group is well illustrated by the next three plates. Figure 5 shows a large, smooth, rounded mass without attachment to the anterior abdominal wall. Such a plate, however, does not serve to show the connections of the mass, nor will it determine its possible retroperitoneal origin. In order to show whether or not the mass springs from the retroperitoneal structure it is necessary to examine the patient in the retroperitoneal position. This position can be briefly described as follows: the patient is placed in the prone position and supported upon two blocks, one under the thighs and the other beneath the chest. This serves to take all pressure off the abdomen, and allows the abdominal wall to sag freely between the two supports. This position causes the intestines and all intra-abdominal organs with mesenteric attachment to fall forward, leaving the spine and retroperitoneal tissues clearly visible, and producing a prevertebral clear space, which, when encroached upon, shows up any retroperitoneal mass extending into it.

Figure 6 shows this same patient in the retroperitoneal position. It will be seen that the mass drops well forward, leaving the retroperitoneal tissues and prevertebral space uninvolved.

Figure 7 shows a retroperitoneal carcinoma secondary to a carcinoma of the bladder. In this case it will be seen that the retroperitoneal character of the mass can be easily established. The mass is seen to spring from the retroperitoneal tissues and to extend well into the prevertebral space.

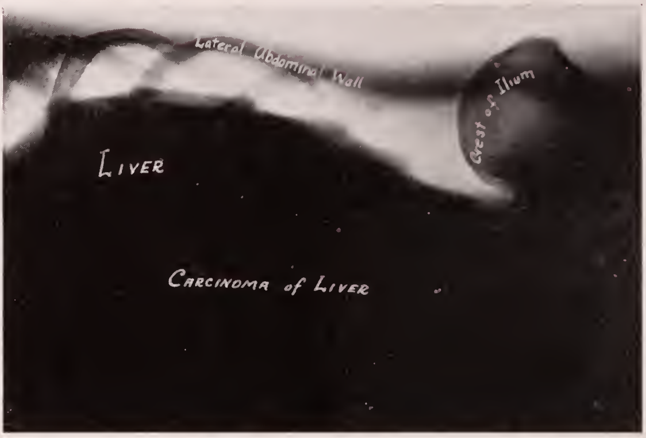

Fig. 3.—Small nodules studding the liver margin, too small to produce definite palpable masses, but none the less definite evidence of carcinomatous involvement.

Examination of the kidneys under the conditions indicated in the third group is most satisfactory. Occasionally both kidneys can be shown in the antero-posterior position, but often, especially for the right kidney, a lateral view such as that shown in Figure 8 is

Fig. 4.—Female pelvic organs as seen with retrodisplacement of the uterus.

necessary. The patient is rolled well upon his side, causing the liver to tilt almost beyond the midline. This uncovers the right kidney and brings it well into view. In this position the ureter can be injected and the injected material readily followed under the fluoroscope, showing any kink or obstruction in the ureter. Any shadow suspicious of kidney stone can be readily localized to the kidney in question. The method is also of great value in the detection of other kidney diseases.

In the fourth group the examination of the gallbladder for pathological conditions I feel that this method will ultimately prove a great aid. Its greatest usefulness does not lie in the detection of gall stones, but rather in rendering a pathological gallbladder visible, and thereby localizing shadows suspicious of gall stones to the gallbladder area. Figure 9 shows such a gallbladder filled with stones.

The fifth group where pneumoperitoneum is of advantage is in the detection of abdominal adhesions, postoperative or otherwise. In this connection it is well to remember the regional anatomy on the plate examined so as not to mistake normal structures for abnormal adhesions. The falciform ligament shows well in Figure 10, and might easily be mistaken for an adhesion. Adhesions to an old abdominal scar are seen in the lower abdomen. This method will not aid in determining whether the adhesions present are causing obstruction.

The sixth and last group, that of subdiaphragmatic conditions, such as subdiaphragmatic abscess, is one in which the method is undoubtedly a great aid. Although it has been performed in some cases without injury to the patient, it seems that more extended experience will be necessary before its use in such conditions can be unqualifiedly recommended. Figure 11 shows an extensive adhesion of the spleen to the diaphragm.

This method of grouping is undoubtedly very artificial. The dif-

Fig. 5.—Fibroid of uterus in dorsal position, showing the large tumor mass and distended abdominal wall.

Fig. 6.—Uterine fibroid as seen in the retroperitoneal position, clearly showing the intra-abdominal character of the tumor.

ferent groups may overlap. For instance, a mass of undetermined nature may turn out to be a displaced kidney, or an infected gallbladder; or a tubercular spleen may be adherant to the abdominal wall. Still it serves as a guide to a clearer understanding of its usefulness.

A brief consideration of the conditions under which pneumoperitoneum was induced in some occurred, appearing first on the axilla and side of the neck. Neither patient suffered any ill-effect. Since we have used the apparatus shown, and determined by means of a stethescope when the needle was in the abdominal cavity we have had no further trouble.

We have found that while air takes longer to absorb (5 to 7 days) than oxygen (3 to 4 days),

Fig. 7.—Retroperitoneal carcinoma secondary to carcinoma of the bladder shown in the retroperitoneal position.

of our cases, and the presence of other co-existing pathological conditions or diseases, might be of interest. Early in our experience we had difficulty on two occasions on inserting the needle. In both cases the abdominal wall was very thick and the needle was inserted beneath the fascia and the air introduced. In both instances marked subcutaneous emphysema still it certainly causes less pain In one case of general carcinomatosis the air showed no evidence of absorption and was finally removed on the 12th day. No explanation of the action in this case could be found. One patient on whom no subcutaneous emphysema was induced, complained of obstruction to his breathing from stopping up of his nose. Examination showed a swollen nasal mucus membrane, evidently due to congestion rather than emphysema.

We have used it in advanced diabetes without ill-effect; mild cardiac lesions, but never when signs of decompensation were present. In general carcinomatosis or tuberculous peritonitis it seems to do no harm and where adhesions are present either post-operative or malignant, no damage has been noted. The lowest blood pressure existing prior to injection in any case in which it was performed was 80 systolic, associated with carcinoma of the head of the pancreas and obstruction of the common duct. The highest blood pressure was 180 systolic, associated with nephritis and slight odema. One patient suffering from chronic pulmonary tuberculosis had a slight pulmonary hemorrhage four days after an oxygen injection. The patient stated, however, that she had had many previous hemorrhages. In one instance pneumoperitoneum was induced in search of a gall-bladder condition, when on operation, a sub-acute appendicial abscess was found. The patient showed no evidence of damage from the procedure. Other than these we have had no ill-effect from pneumoperitoneum.

Fig. 8.—The lateral position necessary to show the right kidney. The patient is rolled upon the side, tilting the liver well over to the midline, thus disclosing the right kidney.

Evidently, therefore, the conditions in which pneumoperitoneum should not be induced can be briefly tabulated:

First. Cardiac lesions with marked decompensation and irregularity.

Second. Advanced cases of nephritis with odema and very high blood pressure.

Fig. 9.—Gallbladder filled with stones.

Third. Acute intra-abdominal lesions.

Fourth. Acute pulmonary lesions, such as pnemonia.

We must remember that the adoption of this method is comparatively recent, and that further improvements in conditions or methods of technique may be found later, which will render this method much more useful. Even, however, if no improvements were made, the method has proven of sufficient usefulness to be firmly established as an addition to the armamentorium of radiological methods. The institution of this method opens up many possibilities for investigation among radiologists, and some of these will be dealt with in a future communication.

Fig. 10. Post-operative adhesions

Fig. 11.—Spleen adherent to the left diaphragm. Subdiaphragmatic lesions should be easily detected.

*Read at annual meeting of the Radiological Society, Chicago, December, 1920.

Some Points in Radiotherapy in Deep-Seated Cancer

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Detroit, Mich.

DURING the past five or six years. radiotherapy has compelled respectful recognition from the surgeon. Previous to that time the radiotherapist, in the mind of the surgeon, existed only as a specialist of convenience on whom the hopeless cancer case might be shifted. Today, there is an *entente cordiale* between surgeon and radiotherapist, and they are actually working together, hoping, by their combined efforts. to cure their early and some of their advanced cases of cancer; so that at the present time radiotherapy is being used much more extensively than ever before.

Apparatus

In the past, the manufacturer has devoted practically all his resources to the assistance of the x-ray diagnostician, because the therapists were too few in number to be profitable to him. The result has been but little advance in x-ray therapy apparatus. Consequently, the therapist has been obliged to put up with factory-conceived, and illy-suited apparatus, or construct his own. The time is now here when the manufacturer must listen to the x-ray therapist and build apparatus suited to his needs.

The X-Ray Tube

The Coolidge tube has been, perhaps, the greatest contribution to the development of deep x-ray therapy. When we read, however, of the wonderful work being done by the Germans, most of whom are still working with gas tubes, we wonder why we have not made greater progress in therapy in this country than we have. However, the Coolidge tube, elastic and controllable as it is, must be built for higher voltages than the present tubes carry, if we would go on, for there is much evidence that some malignancies may only succumb to large quantities of rays of shorter wave length than any we are yet familiar with in this country.

In the past, we have talked glibly about the cancer cell being sensitive to the x-ray. Our experience with the x-ray and radium rays we are now able to use, teaches us that now we must talk about the cancer cell of this or that type and of this or that stage of development, as being sensitive to a ray of this or that wave length. We shall, no doubt, use filters and apparatus that will enable us to produce any wave length, from the softest x-ray to the gamma rays of radium, and our problem will then be to get into cancer tissue the proper quantity of rays of the various qualities, which will be suited to the types and stages of development of cellular activity with which we have to deal.

The Transformer

At present, we have transformers which are noisy and cumbersome, but so far as suitable current is concerned, are quite satisfactory. If the Coolidge tube be built, however, to safely carry twice the voltage it does now, transformers, of course, must be built to produce this voltage.

The Overhead Wiring

The overhead system has been greatly improved in the last three or four years, but there is still room for much improvement. The prevention of corona along the main wires overhead, no doubt does away with much of the unpleasant gas that we formerly had, but the trolley reels with small wires and ordinary old-time connections to the tube make a lot of gas, which no doubt helps to make our patients sick. It would seem to be a simple matter to devise practical coronaless reels with ball connections to the tubes, which would effectually do away with corona altogether. The wires leading to the tube should be effectually insulated by hard rubber or micanite for a distance of about 18 inches, so that the patients could not easily come in contact with the high tension current.

Tube Holder and Shield

The tube-stand and holder should be built of wood. The shield should be of some non-conducting x-ray proof material. Heavy lead glass would answer the purpose fairly well, but in therapy there is so much generated for such long periods of time that the glass is likely to crack. The shield should at least extend around the sides and ends of the tube. Many burns have occurred during deep therapy because the ends, particularly the cathode end, were directed toward the patient.

If the whole apparatus is of wood, there will be no chance of grounding a high tension wire with disastrous results. In our laboratory, we have a wooden tube holder which is a diamond-shaped box. It hangs from a wooden arm seven feet long, which runs up and down a two-inch iron standard by means of a counter-weight. The standard is fastened to the floor and ceiling at one end of the treatment room and the arm extends lengthwise over the couch. The box containing the tube is so arranged that it can be tilted in any position. The sides and bottom of the wooden box are lined with heavy lead-rubber and asbestos board, the latter on the inside next to the tube to prevent the heat injuring the rubber. On the other side of the opening in the floor of the box for the passage of the rays are slots for insertion of a glass cone and filters. The glass cones are made of heavy lead glass of different diameters and of such length as, when placed in contact with the patient, to make the distance between the anode and the skin about eight and one-half inches.

If glass is used as a shield, it should be of deep dark red, green or black, in order to most effectively shut out the glare from the white hot anode of the tube.

These lead glass cones are very convenient in many ways:

1. They enable the operator to work with a constant distance if they are touching the skin.

2. There is no static from them to annoy or burn the patient.

3. One can always see the field of operation.

4. They make the use of lead on the skin, to block out the part to be treated, unnecessary.

The cones we are using are round, having been made by cutting down to proper size the long glass cones put on the market for radiography years ago by the old Scheidel-Western Company. These cones, however, should be square, and of about three sizes, namely 15 cm. by 15 cm.; 10 cm. by 10 cm.; 6 cm. by 6 cm. A small round one, 3 cm. in diameter, would be handy for small superficial lesions.

Filters

We are using both aluminum and glass filters and leather filters. We have not yet tried copper or zinc. In using a ten-inch spark gap with aluminum filters, we were unfortunate enough to puncture several Coolidge tubes, so we changed to glass three or four years ago and have continued using it. In our deep therapy, we use 6 mm. of glass and a piece of sole leather between that and the patient. The glass we use is ordinary 5x7 cleaned Seed x-ray plates. Much of this glass is just 2 mm. in thickness and we use one of these in superficial nodules in and below the skin,—three of them for deep therapy.

Timer With Automatic Switch

A practical timer with automatic switch for x-ray therapy is much to be desired, but there appears to be none on the market. I have had a home-made one constructed which has served the purpose very well for several years. It was described in the American Journal of Roentgenology, Vol. III, 1916, p. 58. It consists of a magnet and armature in circuit with a good wall clock. Its front is a dial similar to a clock, divided into quarter minutes, up to 60 minutes. The clock interrupts the current in the magnet every 15 seconds and the armature connected with a wheel with 240 teeth in its circumference, one for each quarter minute in sixty, is also connected with the hand on the dial, and moves the hand backward a space corresponding to a quarter minute on the dial. There is an ordinary door-bell ringing coil under the switchboard electrically connected by means of the alternating current from the machine, with a stop at O on the dial. When the hand reaches O, the connection is made with the door-bell ringing coil, which releases a spring, which opens the x-ray switch on the switchboard. Thus we have our treatment safeguarded to a certain extent. Of course, it should be someone's business to watch the treatment just the same, and turn off the current quickly in an emergency. But the human element is not so reliable as many mechanical devices and the two should check one another in such dangerous work as x-ray therapy.

Measurement of Dose

The radiotherapeutic dose at the present time, in this country at least, is only measured by the crudest of methods, which gives but little information. What the future of radiotherapy is, no one can predict because we know so little about dosage. The old pastille and photographic slip methods are wholly unreliable. Most of us using Coolidge tubes are depending upon M. A., K. V., Distance and Time, as the factors concerned. The filter of course, is another important factor. Our individual experiences have settled what the amounts of these factors are. The dose must be considered from three main standpoints:

1. The local effect upon the skin and other normal structures.

2. The effect upon the local pathology.

3. The constitutional effect through the direct action upon the elements of the blood, and through the indirect effect by the formation of toxins from breaking up proteins, etc.

The determination of the numerous physical, chemical and biological factors entering into these actions of the rays will provide an abundance of research work for a long time to come, so that the last word in radiotherapy would appear to be a long way off. Possibly our attention has been too much centered upon the local effect of rays. We have talked about "erythema dose" and "lethal dose" of cancer cells, without giving sufficient consideration to the relationship between these local and the constitutional reactions. The latter, no doubt, has some influence upon the local pathology.

A decade or more has passed since the publications of Barkla and Sadler, concerning the three kinds of secondary rays which are observed when the rays strike substances of the atomic weight of aluminum and higher.

First, there are the "characteristic rays" which have a selective absorption characteristic of the elements from which they arise.

Second, a scattering of the primary beam.

Third, the displacement of electrons from the substance rayed, thus forming cathode rays. These cathode rays lack penetration and are otherwise similar to the less penetrating beta rays of radium.

The characteristic ray is said to be homogeneous though some metals give off two types of characteristic rays which have different absorption coefficients, but still each of a homogeneous type. Copper and zinc appear to give off, under certain hard rays, a most homogeneous type of softer ray, the use of which would seem quite desirable in roentgenotherapy. Consequently, these agents have been used as filters, particularly by the late Prof. Koenig of Freiburg and his associates, half a mm. of copper being used and a current backing up a spark of 40 cm. to 50 cm. Friedrich and Wintz maintain that this characteristic homogeneous radiation was increased by the scattered rays going in the same direction, and this action was increased the wider the port of entry. By means of their Iontoquantiometer — an ionizing chamber, placed on or under a patient or within a cavity—they measure accurately the amount of the dosage at any depth. Startlingly enormous doses thus measured are given through one or two ports until the tumor has received a lethal dose, which latter is carefully determined for different types of growth. Some time later the patient is often given a transfusion to counteract the radiation toxaemia, and the dose is not repeated. Cures of cancer of the pelvis are freely claimed.

The Hamburg School, on the other hand, headed by Albers Schonberg, opposes so radical a method, and uses a more moderate therapy more like that used in this country.

Several investigators, especially Colwell and Russ, have demonstrated that every cell has its own "selective absorption" for rays. This is different, not only for each type of cell, but also for the same types with different functions and the same in different life cycles. The epithelial cell of the hair follicle is more sensitive than that of the epidermis, for instance.

All this clearly indicates that we must experiment with different substances for filters, with different qualities of primary rays from both x-ray and radium, on the various growths with which we have to deal. Radium and x-ray will no doubt both be called into action many times in the same case so as to secure the action of different types of rays on the local pathology.

But we must not focus our attention on the local pathology to the exclusion of the patient himself. The sickness following large doses of x-ray and radium must be a warning to us to watch more closely the patient's general condition as a result of radiation, and let that, as well as the local condition, be a guide to the dose. We require more studies of the blood, both morphologically and chemically, as well as of the various secretions and excretions before and after x-ray therapy, in order to determine just what our dosage should be in a given case.

As I look back upon 17 years of x-ray therapy, and almost as many years since I began radium therapy, and go over the patients with deep-seated cancer, I find only a few who have survived the three-year period and a very few who have gone over the five-year period. To be sure, the greater part of my work has been with operated cases, mostly with recurrences, or inoperable hopelessly advanced cases. Our best results have been with those patients who have had suitable preoperative treatment as well as postoperative, but even in these cases there have been many recurrences. For years I have urged adequate pre-operative treatment, advising two or three series of treatments in cancer of the breast, three weeks apart, before operation. We now have a number of cases so treated but the time is a little too short from which to draw conclusions. It was formerly our practice to give the entire treatment of 12 to 18 ports in two or three days. I am now satisfied that this was wrong and what little chance some of those patients had were lost by lowered resistance as a result of x-ray toxaema. Now we rarely treat more than one or two ports a day, but even these produce a marked nausea and ill-feeling in many patients. The higher voltage, with also higher filtration and consequently longer radiation seems to be responsible. When we were using an eight-inch spark gap with one or two millimeters of aluminum filter, we did not so often have x-ray sickness. We see the same radiation sickness although not so marked, when heavy doses of radium with high filtration are given.

We use radium in combination with x-ray in treatment of cancer of the uterus, but seldom use radium in cases of cancer of the breast. It has a very favorable action on superficial nodules, but we believe these cases will do as well or better under the properly selected x-ray. For a long time we have treated cancer of the breast and recurrent cancer of the chest after breast amputation, by the following formula,—using a large amount of fairly high atomic weight filtration in the form of glass:

8½-inch Focal Distance.

6 mm. of glass and 1 sole leather filter.

5 M. A.

10-inch Spark Gap.

18-20 minutes to each of about 15 ports.

Recently we have had four lung involvements. These were beginning before we began treatment. They were all recurrences after operation for cancer of the breast. The x-ray did not seem to accomplish anything inside the chest, though nodules in the chest wall, axillæ and supraclavicular regions, and, in one case, destructive processes in the fourth and fifth lumbar vertebræ and in two or three ribs (one with fracture), all cleared up. But the lung condition remained and the patient succumbed.

In the fourth case, after trying the above technique and finding my patient was growing worse, I changed my formula to the following:

8½-inch Distance.

2mm. glass, a 1 sole leather filter.

5 M. A.

10-inch Spark Gap.

12 to 14 minutes to about 15 ports.

Stereoscopic plates were made of the chest both before her first treatment and before changing the formula. Both sets of plates show involvement, but in the last plates there was very marked increase in the pathology. She was having increased difficulty in breathing, pain in the chest, was developing much cachexia and was losing in weight, etc. Almost at once, after the change of formula by cutting out four millimeters of glass filtration, her subjective symptomatology began to improve. Her cachexia improved and she appeared better in every way. It is only three weeks since changing our technique so we have not yet made the third set of plates of the lungs. This subjective improvement, however, under the changed formula, suggests that in lung conditions the high filtration may not be desirable.

The longest standing case of deep seated malignancy we have treated with x-ray is one of recurrent post-operative fibrosarcoma of the knee, in a man 21 years of age, referred by Dr. Geo. Augustin, formerly of Detroit. Three prominent pathologists had confirmed the diagnosis, sarcoma of the knee, by microscopical examination. Several prominent surgeons advised amputation at the hip, but he refused. After the second removal and return of growth, we gave him x-ray treatment, beginning treatment in March, 1906. We used a Gundelach gas tube, operated a Scheidel-Western 12-inch coil and mercury interrupter. The spark was about eight inches and there was about one-half to one milliampere of current. He was treated two or three times a week at intervals, from the knee to the liver, for about a year. Six or seven years later, he was allowed to carry life insurance and was alive and well when I heard from him indirectly a few months ago, which is nearly fifteen years since treatment.

About the same time, we treated a man of 70 with a post-operative (for the second time) recurrent fibro-sarcoma of the thigh, in much the same way. He lived four years without further recurrence and died of some other trouble. This case was also proven by microscopical examination.

In March, 1916, a woman, aged 45, was referred by Dr. C. Kennedy for recurrent postoperative nodule in the left axillary line. The patient had been operated on 11 months previously by Dr. Kennedy, for tumor of the breast. The pathologist's report was round-celled sarcoma. She was given postoperative x-ray treatment as follows:

8-inch Distance.
1 mm. Aluminum filter.
8-inch Spark Gap.
7½ M. A.
7 Minutes.

(Coolidge tube and Wappler transformer) through 15 ports in the chest, all in one sitting. About 18 of these series were given in two years (later in two or three sittings). She refused operation after the first two or three series. The growth disappeared and she is still alive and well, four years after beginning treatment.

A patient, aged 39 years, referred by Dr. Oscar Le Seure, had cancer in the left breast operated upon. Recurrences came rapidly and four operations, including one for removal of the right breast, were done. There were recurrences in three weeks after the last operation. In two months the left hip was involved. Several nodules were present in the skin of the chest and lower part of the back. There were several ribs involved. Stereoscopic radiographs showed no evidence of lung involvement. The patient was terribly emaciated and she was brought to the office in a wheel chair from the car. We began x-ray as follows:

4 Minutes.
8-inch Distance.
7 M. A.
9-inch Spark Gap.

Three mm. Aluminum and sole leather filter, given through several ports of entry to the chest and right hip. She had about 17 such series in 1915 and 1916. She gained rapidly and is alive and well, earning a good living since 1916—four years ago.

A woman, aged 64 years, referred by Dr. H. Hewitt, had the right breast removed for cancer (laboratory confirmation) in 1911; another operation for recurrence in supraclavicular region in October, 1913, and another in October, 1917. She came to me with two nodules in the right supraclavicular region, the size of a walnut, and one in the right axilla. She was given x-ray as follows:

8½-inch Distance.
4 Mm. Glass filter.
5 M. A.
8-inch Spark Gap.

8½ Minutes to 18 ports in three sittings. These series were repeated every three weeks. The nodules quickly disappeared and she has been well for nearly three years.

A woman, aged 73 years, referred by Dr. G. G. Caron, came to me March 7, 1916, with large ulcerated carcinoma of the left breast, adherent to the chest wall and enlarged axillary glands. She had no operation and she was given the following formula:

8½-inch Distance.

1½ Mm. of aluminum filter.

8-inch Spark Gap.

7½ M. A.

9 Minutes through about 12 to 18 ports every three weeks.

Healing was prompt. The last treatment was July 6, 1916, and she has been well ever since—four and a half years.

A woman, aged 50 years, referred by Dr. Shafor, diagnosis: Adeno carcinoma of left breast. Hard irregular nodular tumor in the left breast, firmly adherent to the skin. Several large nodules in the left axilla. She had three series of preoperative treatment, then three postoperative treatments. Her formula was:

8½-inch Distance.

1½ Mm. aluminum filter.

7 M. A.

7½ Spark Gap.

7 Minutes, 22 ports in two sittings, ever three weeks. Her last treatment was in September, 1916. She is alive and well over four years later.

These are a few of the successful cases which would ordinarily be considered hopeless. There have been many deaths. I feel sure that faulty technique is to blame for not saving some of them. They have been treated by different techniques and have not been improved materially. This impresses me with the great importance of making more careful study of the physics and biology concerned for a clearer understanding of radiotherapy. In spite of the long series of 10 to 13, or more, ports treated at one sitting, there was less radiation sickness in cases treated with lower voltages and moderate filtration than with the higher technique, and I am not sure but my results in breast cases treated with less filtration, will compare more favorably than those treated exclusively with much filtration. Now we try to make a combination treatment of moderate and large amount of filtration in chest cases.

In conclusion, let us add that there should be a research committee at work on therapy in this society. It should be composed of physicists, x-ray and radium therapists. First of all, we require better standardized apparatus. The committee should take this up with manufacturers at once, stating the need and securing co-operation. Provision should be made for more research work on the blood and metabolism of cancer patients being treated with x-ray or radium, or both.

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Work To Do

WRITING in eulogium of William Ironside Bruce, late physician to the roentgen ray and electrical departments of the Charing Cross Hospital, and who died from a severe attack of aplastic anemia due to his intense devotion to his work, the London correspondent of The Journal of the American Medical Association says:

> "In view of the dangers to which roentgenologists are exposed, it has been decided to appoint a committee consisting of physicists, physiologists and roentgenologists to investigate—
>
> 1. The changes induced in tissues by the roentgen ray, particularly blood changes.
> 2. The properties of the roentgen ray and the best means of controlling their action.
> 3. To report on the equipment of roentgen ray and electrical departments with a special view to the protective measures employed, and
> 4. Recommendation for the guidance of assistants in those departments, particularly dealing with hours of work and the need for fresh air and change."

After making these comments, he adds the further observation:

> "The progress of roentgenology in this country has been impeded by the want of coördinated research work. It is hoped that money will be subscribed for an institute endowed for research on the physical, technical and biologic sides."

Undoubtedly, every member of The Radiological Society of North America is in thorough accord with this undertaking on the part of our fellow practitioners across the pond. There can be but little, if any room for argument over the need for those things set up for investigation. As there can be but little, if any room for argument that the progress of roentgenologic science has been very greatly retarded because there has been no coördinated attempt to understand and develop all its phases.

That is the primary purpose of societies such as ours. They can have no reasonable excuse for their existence otherwise. Is it asking too much, therefore, when we suggest that this society at its Boston meeting this month take some positive, definite action toward establishing contact and coöperating with the members of the profession in England doing this research work?

And, so that this undertaking, like many other good things, may not dissipate in the shadows of "Everybody's business," we suggest also that this society set aside a sufficient sum of money each year that the committee or bureau to be created shall assume proportions of permanence and be able to function.

State Medicine

THE fact that, in practically every state in which legislative assemblies convened during the past winter, bills fostering the creation of some sort of state medicine were presented for legislative enactment, indicates pretty clearly that this proposition has behind it some well organized agencies, and that the question is of sufficient interest to the medical profession to warrant an intelligent and exhaustive investigation.

It is our own opinion that our present economic flux is the underlying cause for this organized attempt to foist upon the people a scheme of medical paternalism. But it is somewhat suspicious, to say the least, that a program of this kind has not been brought before the public and profession generally and all the facts definitely stated.

Waiving all of these disturbing thoughts, however, let us try to analyze the situation. During the war our own physical unfitness was forced upon our notice commercially, industrially and militarily. The figures compiled by the military authorities alone make us wonder whether our pretensions of physical manhood are not a trifle askew. And when we add to these figures, the unknown quantity of our commercial and industrial physical debility, we have something to conjure with.

But that is not all. We are now passing through the aftermath of the greatest economic struggle history records. Thousands of men and women who represent the dregs of European manhood and womanhood are coming to us as immigrants with their heritage of broken constitutions and filthy, diseased bodies. Encephalitis, typhus, tuberculosis, and the whole catagory of loathsome diseases growing out of the sexual and physical miasma of all great wars, constitute the frankincense and myrrh men and women who can no longer tolerate their own misfortune hold out to us in justification of their pleas for mercy.

With an eye on our own future welfare, the situation is one indeed calling for serious thought and positive action. Whether state medicine will provide the answer to this problem, query? In order that we may not be accused of ignoring the benefits its adherents claim, let us examine carefully a summarization of the seemingly cogent arguments they advance.

1. That the public welfare demands every physician and surgeon have at his disposal a full complement of working tools and sources of knowledge.

2. That the average physician or surgeon does not have sufficient need for all these things to enable or to justify him in their purchase for his own individual use.

3. That the public concern is so real the public can well afford to, and should, provide all these things in order that all physicians, collectively, may have access to them.

4. That by providing a system of guaranteed compensation to all licensed physicians and surgeons from public funds, the profession will be relieved of all questions of a mercenary character and be wholly free to function in accordance with the high ideals to which they all aspire.

5. That the public health is

something which should be safeguarded by community or collective preventive measures and knowledge rather than curative practices.

6. That certain portions of the public will always be unable to provide or indifferent to proper medical care and knowledge for either themselves or their dependents; so that it becomes a question of public policy whether certain recognized public agencies should not be established in order to accomplish publicly and painlessly the things people cannot, or at least do not do for themselves privately. This on the theory that:

(a) Much of our contagious epidemics are incipient with those people who neglect their health in one form or another; and

(b) By providing a common or open sesame for medical treatment and knowledge for rich and poor, young and old, the maimed, the halt, the blind, the desire to be pure in mind and body will fall on the just and the unjust alike —and the "charity" bugaboo exterminated forever so that the profession and the public shall henceforward "lie down together."

7. That since the majority of hospitals are not now successful in a financial way and must depend on public or private contributions in one form or another, all hospitals should be coördinated into one great public organization, administered on a budget basis, and financed by taxation so that the burden of their support will be equitably distributed.

8. That as a member of a particular political or social unit, and having purchased his or her bill of health under compulsion, the average person will be much more apt to seek the personal benefits of that purchase, and thereby provide the impetus to preventive medical science which is so much needed at the present time.

..We have enumerated what seem to us the outstanding arguments indulged openly and insidiously in behalf of state medicine. We have done this for two purposes, the reasons behind which we believe are obvious, that is,

1. To demonstrate that at bottom this agitation is grounded in our economic structure, and can only be solved as an economic problem.

2. To focus our own thoughts on the underlying causes so that we may all proceed in this discussion with a definite picture of the job which confronts us as it is constituted by all the economic, professional and social factors in the order of their importance.

It should be understood in the beginning, we think, that if the medical profession hopes to arrest or eventually obviate the present trend toward state medicine, the medical profession will have to offer some other arrangement which is more practical and socially beneficial. More than that, the medical profession must realize, also, that the mere offering of such an arrangement in theory for public adoption will not be sufficient. The public will have to be "sold" on any plan suggested; and the medical profession will have to do the selling by arduous work, sustained thought, and unbounded patience. Any plan advanced will have to be reduced to terms of public expression and demonstrated in actuality with sufficient frequency to convince even the most stubborn adherent of the socialistic idea of state medicine.

We appreciate that it is futile to hope for any majority concert of professional opinion on such an important question without full discussion. Perhaps there may be an overwhelming majority of medical men who would not be averse to becoming attached to a government payroll. Probably there will be numerous others who will feel that the scheme of state medicine is worth a trial—the public health considered.

Frankly, we do not incline to either view. And, while we do not question the right of the people, through the police powers of the state or other political subdivision of government, to adopt and enforce such regulations as will best safeguard the public health, still we do contend that the public pensioning or subsidizing of the medical profession in any form will not provide the relief sought. The fallacy of that principle, it seems to us, has been pretty thoroughly demonstrated during the past few years in business undertakings of one kind and another—a demonstration which has added a good many millions of dollars to the public debt without commensurate, or, in fact, any real benefits.

The Patients' Interests

BECAUSE of the importance of our immigration problem from a physico-medical standpoint, especially at the present time, we want to call the attention of the medical profession to the other half of the profound truth uttered by Dr. James B. Herrick of Chicago before the annual conference on Medical Education and Hospitals, Licensure and Public Health at Chicago on March 7th. when he said:

> "I wish at the outset to advance the yroposition that in any discussion of the relation between specialist and general practitioner there is a third party to be considered, namely, the patient. Furthermore, his rights take precedence over those of the other two parties."

Dr. Herrick's subject was "Relation Between the Specialist and the Practitioner," and his address is printed at length in The Journal of the American Medical Association of April 9th, 1921.

Speaking as he was before a body of medical men, and himself a member of that group, it was perhaps but the natural thing for Dr. Herrick to presume that his auditors were fully versed in the rights of the patient as between him and the general practitioner, and to talk to his hearers more particularly about the new aspect injected into this situation by the entrance of the third party, the specialist. All well and good. We have no quarrel with Dr. Herrick.

But the question which to us seems to need further discussion and definition, at least in the minds of a great majority of us who plod along day after day as best we can, is, what consideration is to be given the patient, speaking generally, and just what are his rights, speaking specifically?

It occurs to us that it is somewhat difficult to keep within the bounds of patient interest or patient rights in our personal conduct unless we know pretty thoroughly just what the patient's interests and rights are, and as exactly as possible what one engaged in the practice of medicine or surgery or any specialty must do in order to merge his activities and his knowledge with patient interest and patient rights.

Perhaps we may be accused of being bumptious. Indeed, it is too obvious for discussion that every medical man knows what the patient's interests are and if he runs afoul of patient's rights he can employ a lawyer.

However, that is not in accord with either the spirit or letter of the law of the medical profession. There is a nice distinction between legal rights, by which most men measure their conduct, and the moral and professional obligation which abides with medical men to the end that patient interest shall be fully subserved in all cases as far as humanly possible. Patient interest and patient rights are two very distinct things.

Personally, we think this matter of such importance as to merit the earnest study of the profession. This study to be effective involves frank discussion pro and con in order that certain fundamental principles shall be carefully set up for the guidance of men who find themselves too pre-occupied with daily duties to think the proposition through, and who as a consequence dispose of each patient in the easiest way as mater of self-preservation.

There is no thought of professional malfeasance in this statement. But there is a very keen appreciation for the fact that medical men are human, and that in the actual application of their knowledge and energies they suffer the usual human limitations.

Under the pronounced motility with which human affairs proceed nowadays, the interests of the individual patient may reasonably be expected to change with equal rapidity. Certainly, it cannot be assumed that the patient's interests are static, and that a rule of conduct prescribed a few hundred years ago meets the requirements of the situation today, or that the rule of today will be the absolute rule of tomorrow. As a matter of fact, it is doubtful whether any hard and fast methods can be concocted which will guarantee to either patient or profession the absolutism of a sine qua non. To sacrifice dignity of expression for perfect understanding, we feel that discussion of this problem should be constant and searching, to the end that the individual practitioner may, like the good old house cat, always light on his feet.

Quite naturally, such an effort presupposes a broad and comprehensive plan of procedure. In order to succeed that plan would necessarily have to embrace many points of contact with and knowledge of practically every human activity. But why not? Is such a thing impossible?

We think not. There is no more honored body of men anywhere than the medical profession. There is no more studious or thoughtful class of men. None other comes into more intimate relation with all the people. Therefore, their opportunity for constructive leadership in social and in economic affairs as they touch private and public wellbeing is professedly obvious and real.

We believe we speak the desires of Radiologists everywhere when we say that it is their high purpose to pull a laboring oar in any movement that will be of benefit to medical science and medical men. They are perhaps peculiarly qualified to discuss the quesions pointed out because in a very large way they act as specialist consultant.

It may be too, that Radiologists have just a little bit of an edge on most other branches of the profession in what may be termed business experience, a very vital thing in the successful disposition of questions pertaining to public relations. Radiologists as a class must mainain very large plant investments as compared with either the general practitioner or other specialists, and must necessarily give considerable thought to hour cost of operation, scientific management, etc., questions too often considered "of business—too busy."

In view of all which the suggestion seems pertinent that here is an important section of the general professional plan where the Radiologists may serve faithfully and valuably in conjunction with the exposition of the scientific side of their relationship to the profession and the public.

Dividing Mass Dosage

UNDER the stress of producing results, in deep therapy especially, where the opportunity and the need are so great, and knowledge and specific technique are so small in comparison, the Radiologist is too apt to err on the side of over-dosage rather than under-dosage. This is particularly true in malignant growths where the dosage must be heavy if first reactions produce those tissue changes which make later treatments effective.

The Radiologist very often finds himself between the two horns of a dilemma—whether to get results ad nauseum or to run the risk of failing to function in order to avoid acute discomfort on the part of the patient.

Talking with Dr. E. C. Ernst of St. Louis not long ago, he told us he was dividing mass dosage into two smaller doses, the second but a few days removed from the first in point of time, in an effort to find a happy medium on this proposition if possible. While his experiments have not yet been extensive enough to justify a sweeping assertion as to their ultimate value, Dr. Ernst is very much gratified over the results thus far obtained.

There are, of course, certain cases where a division of dosage is neither advisable nor possible, but these may be set aside as emergency cases.

It is not our purpose here to discuss technique. That will come in due time when adequate knowledge, supported by case histories, has been acquired. Then we shall have something of scientific value for the profession.

In the meantime, however, we should be concerned with this opportunity to give the public tangible manifestation of our high professional conception of patient interest. And as we proceed in future, we should keep this problem graven on our minds in letters of fire, because when we shall have devised a method of dividing mass dosage without sacrificing results we shall have gone a long ways indeed toward the popularization of high voltage massive x-ray therapy.

Perhaps a good many of the better thinkers among the Radiologists have been working along this line for some time without saying anything about it. In other words, they have probably been proceeding on the theory that "silence is golden" until they could say something definitely good about their efforts.

But this is hardly the correct view. We feel there should be no hesitation in speaking openly about a theory of this kind which is certainly correct in principle, and which, if we understand the progressive scientific spirit of the Radiological profession will eventually be proven right in practice.

There can be no serious dispute over the proposition that the line between over and under-disage is a very delicate and inconstant thing. Each patient presents for consideration a differently gradated power of resistance, and each malignancy also sets up a varying factor depending on kind, age of patient, stage of development, etc. We must be fully conscious of all these elements which are not subject to exact precision.

But there are certain guiding principles in this matter which should be discovered and evaluated. With these things known, every Radiologist worthy his profession will be able to give that greater individual care and study which will relieve his ministrations of needless inhumanities.

Correspondence

Dear Editor:—

I note in the "Department of Technique" of the Journal of Radiology, that the expressions "Antero-posterior" and "Lateral positions" are repeatedly used in reference to the wrist.

At the St. Louis meeting of The Western Roentgen Society in 1916, I called attention to the lack of anatomic accuracy of these expressions when applied to the hand and wrist, and want to again object to the use of the inaccurate and vague, when we have amply terse and definite terms which fit better and cannot be mistaken in their meaning.

In discussing this subject with surgeons, some have held that the radio-ulnar direction through the wrist joint was the antero-posterior direction, while others consider that the dorso-palmar direction is the antero-posterior. This inaccurate way of description has always to be qualified, whereas if we used only the strictly anatomic method of describing our technique, etc., apologies and amplification would be unnecessary.

We should always refer to the radio-ulnar and dorso-palmar directions in the hand and wrist and the tibio-fibular and antero-posterior directions in the knee or leg. This is particularly necessary nowadays when so many of us are using duplitized films, which may be interpreted as either right or left (aside from markings to prove otherwise.)

Those of the readers of this who know me, know that precision has long been my watchword. I am a crank on it, and I am proud of it.

Sincerely,

I. S. TROSTLER.

A Modification of Technic For Radiographing Upper Molars

By C. A. LeMASTER, D. D. S.,
St. Louis, Mo.

JUST two factors enter into the production of a dental radiogram: Proper technic, including exposure and development, and correct angle. While the first will be subject to the personal views and preferences of the individual roentgenologist, and may vary within considerable limits without in any manner impairing the diagnostic value of the radiogram, the latter, that is the angle of incident of the Roentgen rays in relation to the film and tooth, may not vary in the least without seriously detracting from the value of the radiogram.

The well-known law which governs this may be concisely stated: The

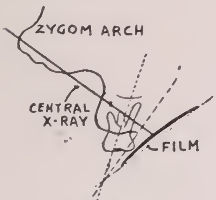


Fig. 1

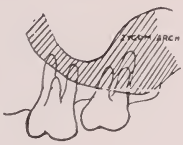


Fig. 2

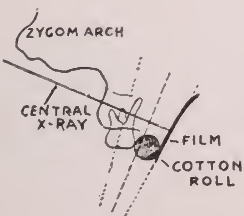


Fig. 3

Fig. 4

angle of incident of the normal ray shall strike at right angle the plane which exactly bisects the angle formed between tooth and film—a law to which there is no exception.

In considering this rule, we readily learn the reason which renders the making of a radiogram of the upper molar area exceedingly difficult at times; namely, the shadow of the zygomatic arch and the lower margin of the maxillary sinus are often projected over the molar roots, a situation which occurs with annoying perversity precisely in those cases where a clear image of those roots is very important. Figures 1 and 2 illustrate this.

Various measures have been suggested to overcome this difficulty, all of which may be classified under one group—the deliberate producing of distortion, in such a manner as to throw the suspected area clear from these shadows. This, to be sure, will often furnish a radiogram of sufficient diagnostic value, but unfortunately the relation of the various structures of the tooth appear at times distorted to a confusing extent. Rather than do this a radiogram is very frequently taken in normal position, and just as frequently some important diagnostic features are entirely overlooked.

Bacterial Fog

IN a recent visit to a neighboring radiologist, we were shown some plates which had many small black spots scattered over them. This called to our attention the fact that very little publicity had been given to this kind of fog.

These black spots are characterized by being small and round blackened spots, occurring in various locations through the plate, the center of each spot being very dense and gradually fading out at the circumference. Upon closer observation, especially if a magnifying lens is used, it will be seen that these spots are made up of many small radiating lines, being more closely assembled toward the center from which the lines radiate outward like the spokes of a wheel.

This kind of fog on the plate is due to the fact that in the process of manufacture the gelatin used for making the emulsion was not cooked sufficiently to kill all of the spores contained in the gelatin. After the emulsion had been coated on the plate, these spores slowly developed into living bacteria. These bacteria are of the aerobic type and slowly oxidize the silver of the emulsion found in their vicinity. Of course, this oxidization has the same effect on the silver as though it were exposed to light, so after the plate is developed these intense black spots show distinctly, interfering with the image cast upon the plate at the time of the examination.

A New Method Of Illumination for Plates and Films

J. DéVOINE GUYOT, M. D.
Bucklin, Mo.

I WISH to present to the profession a new method that I have found extremely useful in soft tissue work, and with plates and films that are flat and lacking in detail.. It is also very useful in all classes of dental work.

Load an unexposed plate in a cachet or other holder, carry it into the sunlight and expose it to the direct rays of the sun for several minutes.. Do not. use. the. sunlight. that. passes through the window glass or wire screen, and be careful to expose the whole plate at once, otherwise it will be mottled.

After the plate has been exposed to the direct sunlight, put it away in an even subdued light, being careful that there are no shadows cast on it by objects close to it.

Allow it to remain several days in this light; this is the seasoning process, and the emulsion should present a sea green color.

The plate is now used exactly as the ground or opalescent glass of the ordinary illuminating boxes, but you will be surprised how much more detail it will put in your plate or film.

When using, put the emulsion side of the plate or film next to the emulsion side of the screen plate, and for dental films a useful procedure is to use a plain glass to cover over the films after they have been placed in position. They can then be examined before any ordinary electric light.

Plates that, under ordinary form of illumination, are so thin and flat as to be useless, frequently become good working plates when examined by this method.

In a recent case, which was the basis of a legal procedure, the radiograph which was obtained at the time of the accident was so flat as to be useless.. By the use of this method, it showed detail enough to be easily read.. As this was the only plate that could be obtained it was very important.. No doubt such occasions will often arise, or the patient may live at a distance and another exposure obviated.

I related the method to Dr. H. J. Ravold of St. Joseph, Mo., at a recent meeting and he has since written me that he is enthusiastic regarding its use, in the type of plate and film suggested.

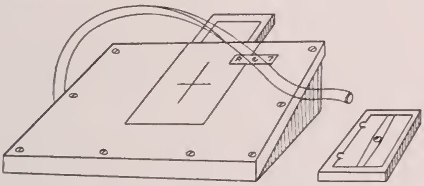
Of course, the perfect plate or film does not require this method of illumination, nor is it desirable in a very dense plate but in its field, I believe it superior to anything now in use. It is at least worth trying, and the expense of making is but a trifle.

I commend it to your consideration.

A Simple Device of Mastoid Radiography

J. H. Dempster, M. D., F. A. C. P.
Detroit, Mich.

THIS consists of a block of wood 16x10x1¼-inch supported at each end by cross pieces, which give the proper angle for mastoid work, chiseled out so as to admit a cassette namely twenty-three degrees from the horizontal. The face of the block is 6x8 inches, which size is sufficient to permit of easy insertion of a cassette capable of taking a 5x7-inch duplitized film. The block is faced with sheet aluminum one millimeter in thickness and on it are drawn lines indicating the position of the film within the cassette.



In the upper right hand corner there is a rotating marker with the letters L and R. The patient's head is placed in position with the mastoid being radiographed centered over the cassette with the penna of the ear drawn forward.

The head is immobilized by means of a piece of gauze or cotton bandage attached as indicated in the device. When the right mastoid is being taken the marker is rotated so as to bring the letter R over the upper right hand corner of the plate and the patient's head is turned to the opposite side with the ear drawn forward and immobilized by roller bandage fastened over the upper mastoid region. In making a radiograph of the left mastoid, the head is reversed and the markers rotated so that the letter L replaces the R. The position of the letters R and L facilitates the orientation of the film for reading.

A pair of double screen cassettes capable of handling 5x7 duplitized films are used. The exposure is much shortened as compared with doing the work without screens. The following technic works well with average adults: five seconds exposure; four-inch spark gap; twenty-five milliampere current; twenty-four inch distance, or a compression cone may be used.

The radiographs are made with a vertical central ray centered over the central portion of the plate as indicated by the cross in the drawing. This device lends itself admirably to stereoscopic work. There is a further advantage that the radiographer is able to furnish the aurist along with his typewritten report a pair of films showing the mastoid under examination, likewise the opposite mastoid for comparison. It is possible to obtain a screen with a grain so fine as to be practically a negligible factor.

Abstracts and Reviews

The purpose of this department is to furnish its readers a succinct epitome of current interesting articles and books. We will be glad to review articles which have been presented for publication or any manuscript or book sent us.

Roentgen Ray Studies of Bronchial Function, by J. G. M. Bullowa, M. D., and Charles Gottlieb, M. D., New York. Am. Jr. Med. Sci., July, 1920, p. 98.

CREDIT for the early use of bismuth in injecting bronchi and lung cavities for clinical study must be given by this admirable work done upon dogs. The following observations were recorded by the authors:

1. If the left diaphragmatic bronchus and its branches are injected, it is seen to move laterally with each pulsation of the heart.
2. A peristaltic action of the bronchial muscles, which seems adequate to empty them without invoking ciliary movement.
3. The action of adrenalin, benzyl, benzoate, ether and muscarin have been observed by this roentgen ray method.

Attention is called to an abstract of an article in the April issue of this Journal. Drs. Lynch and Stewart of New York City published some excellent studies on the human living being covering these same points and going farther at least in the clinical adaptation of this method of study. By priority of publication Dr. Bullowa's work antedates this one, and historical accuracy at least justifies us in giving him credit for this one observation before Drs. Lynch and Stewart.

—E. W. ROWE.

The Use of Agar-Agar in Gastro- Intestinal Roentgen Ray Work. John Tucker, M. D., Cleveland. Jour, A. M. A., April 16, 1921.

ROENTGEN RAY clinics have universally adopted buttermilk as a vehicle for bismuth or barium salts in gastro-intestinal work. The difficulties are (1) expense, (2) inaccessibility, and (3) need of refrigeration. From a physical standpoint other vehicles are better. Certain colloids are far preferable. Agar-Agar is the most convenient. It has been tried out in the Department of Health of the B. F. Goodrich Co., of Akron. A 0.4 per cent solution of the powdered, flake or shredded laboratory agar-agar in filtered water made a colloidal vehicle of almost satisfactory consistency.

The method of preparation is simple. To a 2-liter flash containing 1,000 c.c. of filtered water (plus 10 c.c. to allow for evaporation) are added 4 gm. of agar- agar. A cotton plug is used as a stopper, and the water is boiled until all agar-agar is dissolved. This takes five to ten minutes. The flask is then put in a cool or cold place, and within six hours is ready for use. For stock, several flasks of the solution should be prepared at the same time.

The amount used varies with the thickness of the patient. From 350 to 400 c.c. of the agar-agar and 180 to 250 gm. of chemically pure barium sulphate is average.

ADVANTAGES—

1. Ease in preparation.
2. Stable qualities (the solution is sterile.)
3. Uniformity of suspension.
4. Lack of gastric symptoms after ingestion.
5. Lack of expense.
6. Clarity of shadow of fluoroscope or roentgen ray plates.

—E. W. ROWE.

Roentgen Ray Treatment of Cutaneous Cancer. H. H. Hazen, M. D., Washington, D. C. Journal A. M. A., April 30, 1921.

THIS is an attempt to show what has been done. The value of this therapeutic agent has been overstated by its friends. However, some do not properly estimate its value. This report is founded on observations on private cases. About half have been followed with the microscope.

The most important are the prickle-cell and basal-cell growths. The former tend to form metastases and the latter do not. Pathologically the prickle-cell cancer consists of large cells that take acid stain with avidity, and there are always epithelial whorls present. In basal cell growths the infiltration is less deep, the alveoli are smaller, the cancer cells are smaller and take a basic dye; in addition, no epithelial whorls are present.

Sarcoma, malignant moles, and xeroderma pigmentosum have been successfully treated. The majority of the cases, however, are either basal-cell or prickle-cell cancer.

Of the basal cell cancers, 147 were treated. Sixty-one were men and forty-three women. In seventy-seven the cancer sprang from keratoses, in eleven from congenital warts or fibro-epitheliomas, in three from pigmented moles, in six from constant slight trauma.

TABLE I.—Results of Treatment.

	Number Cases
Well 3 years	16
Well 2 years	17
Well 1 year	39
	72
Relapses cured	4
Relapses healed	2
Healed	41
Not cured	16

A study of the cases shows that neither the age nor the sex had any bearing on the result.

TABLE II.—Results of Treatment on Various Types of Lesion.

Type	Total	Well	Healed	Recurrence Healed	Failed
Superficial plaque	5	5	..	..	..
Rolled edge	80	44	22	2	7
Deep ulcer	9	1	..	1	4
Superficial nodule	28	12	12	1	..
Deep plaque or nodule	22	9	5	2	5
Morphia-like	1	1	..	..	..
Cicatrizing	2	..	2	..	..

Basal cell cancers on the eyelids and the ears, where cartilage is involved, have notably resisted treatment.

TABLE III.—Location of Growths and Effect of Treatment.

Location	No.	Recurrences Cured	Recurrences Healed	Cases Healed	Failures	Total
Scalp	1	..	..	0	0	1
Forehead	4	..	..	1	1	6
Left Temple	6	..	..	2	0	9
Right Temple	1	..	..	4	2	7
Right outer canthus	1	..	..	1	0	2
Left outer canthus	1	..	..	2	0	5
Right inner canthus	3	1	..	3	1	8
Left inner canthus	0	..	..	1	0	1
Nose	14	1	..	10	1	27
Right nasal fold (facial)	2	..	..	1	1	4
Left nasal fold (facial)	2	..	1	0	1	4
Right nasal labial fold	0	..	..	1	1	1
Left nasal labial fold	0	..	1	1	1	4
Upper lip	2	..	..	0	1	3
Lower lip	0	..	..	0	1	1
Right cheek	5	..	..	7	1	16
Left cheek	12	..	..	3	1	18
Chin	4	..	..	0	0	4
Right neck	4	..	..	1	0	5
Left neck	4	1	..	0	0	7
Back	2	..	..	0	0	3
Chest	1	..	..	0	0	1
Hand	3	..	..	0	0	3
Elbow	1	..	..	0	0	1
Left ear	0	..	..	12	1	4
Right ear	0	..	..	1	2	3
	72	3	2	41	16	147

TABLE IV.—Results with no treatment, and with various types of treatment.

No. of Cases —	Cures	Healed	Relapses Healed	Failures
No treatment	52	34	3	7
Excised	5	1	..	0
Cautery	3	2	..	1
Roentgen ray	3	1	2	6
Radium	4	3	1	2
	67	41	6	16

Table V.—Number of Treatments Required to Heal Lesions.

Type of Lesion— Treatments—	1	2	3	4	5	6	Many
Superficial plague	2	3	..	..	..	..	..
Rolled edge	3	37	17	4	2	..	2
Deep ulcer	..	..	1	1	..	..	..
Superficial nodule	2	3	15	4	..	..	..
Deep nodule	1	4	2	1	4	3	..
Morphia-like	..	1	0	..	..	..	..
Cicatrizing	..	..	2	..	..	..	..
	8	48	37	10	6	3	2

Fifteen patients with prickle-cell cancer were treated. Three originated from keratoses, two from scars and two from undiagnosed dermatoses. Four were permanently cured; three healed under treatment, although it is too early to say the patients are well; and eight were not in the slightest degree influenced.

The Question of Dosage

In practice, if the first dose has no beneficial effect, the second dose is always made considerable heavier.

The Question of Filtration

No filters is best.

Outlook for the Future

Heavier apparatus not of benefit to superficial cancers.

Cosmetic Effects

Excellent. Fifteen cases with slight telangiectosia.

Comparison of Methods

The treatment of basal-cell cancer with carbon-dioxide snow, the electric needle, spuerficial curettage and burning with superficial caustics, is mentioned only to be condemned. A skilled surgeon can operate and give excellent results, but a less skilled surgeon cannot equal the roentgenologists. Surgery clears it up rapidly, but often does not remove enough.

There is every reason to believe that the action of radium is the same as the roentgen ray. The five treated that refused to heal also refused to yield when radium was used.

—E. W. ROWE.

A New Intestinal Tube, with Remarks On Its Use In a Case of Ulcerative Colitis. Max Einhorn, New York. American Jour. of Med. Sci., p. 546.

DR. EMHORN has been using a long-jointed tube that passes entirely through the intestinal tract. It is fifteen to twenty feet long and 8 mm. in circumference. The end of it is the usual duodenal tube with a metal fitting and thread. Aspiration is possible only at 1 and 2 meter lengths. The tube is entered a section at a time, and additional lengths are screwed on. It can be fed in by the touch or the roentgen ray to guide it. It is well borne. It permitted the lavage and necessary treatment in a case of ulcerative colitis and eliminated an operation. Perforation of the intestine is not likely.

—E. W. ROWE.

Keen's Surgery. W. B. Saunders Co., Pubr. Vol. VIII.

THIS supplementary volume to Keen's "Surgery" has recently been received. In general it may be said that it gathers up the loose ends of an advanced field in science. Surgery has many new chapters developing. This book in a remarkable way has surveyed the recent contributions to the specialty, and has collected a series of monograms on the latest subjects and new problems. It will be eagerly read by those interested in that which is fast becoming standard.

There are two chapters which will interest the roentgenologist. (1) Chapter LIV, "Radium in the Treatment of Malignant and Other Diseases," by William Duane, A. M., M. D., and Robert B. Greenough, A. B., M. D., Boston. (2) "The Technical and Clinical Use of the X-Ray," by Lewis Gregory Cole, M. D., and Joseph M. Steiner, M. D., New York.

The first chapter is an able review of the laws and principles of radioactivity, methods of treatment, methods of estimating doses, etc., to gether with a second part aiming to cover the field of radiotherapy. The following general summary by the author will give insight into the value of the article.

1. In the treatment of carcinoma the destructive action of radium rays on cancer tissue is beyond dispute. If the cancer tissue is superficial and not of too great extent it can be locally destroyed.

2. If the disease has already extended by infiltration or by metastasis to the deeper tissues, the effects of deep radiation are rarely if ever curative.

3. A differential action of radium on cancer tissue, such that the carcinoma cells are destroyed without any destruction of the stroma or of the surrounding healthy tissues, is still a matter of discussion.

4. The radical cure of cancer demands the removal or destruction of the local point of origin of the disease, together with the tissues known to be first involved by infiltration or metastasis.

5. Radium can in some instances produce the local destruction of the primary tumor, but must be supplemented by operation upon the regional area of metastasis if a radical cure is to be obtained in any case where metastasis has taken place.

6. Since radium treatment is not painful and does not confine the patient to a hospital, it can be applied promptly for suspicious but doubtful lesions, where operation would not be justified.

7. In cancer in certain locations, where radical operation has yielded unsatisfactory results, as in cancer of the cervix of the uterus and cancer of the tongue and mouth, the destruction of the local lesion by radium, supplemented in certain cases by the surgical removal of the regional lymphatics, offers advantages which may yet prove superior to purely operative treatment.

8. Tumors other than carcinoma show varying susceptibility to radiotherapy. Certain types of sarcoma, lymphosarcoma, the teratomata, ovarian and testicular tumors, and the mixed tumors of the salivary glands, all appear to be affected favorably by radium when direct application can be made. When deeply placed these effects are not so evident.

9. The non-malignant hypertrophic diseases of the skin and mucous membranes—the keratoses, papillomas, leukoplakia, keloid and nevi—are favorably influenced by radiotherapy. In many cases a brief and mild treatment definitely destroys the lesion. In some inflammatory conditions also (eczema, lupus) favorable results are obtained. In many other skin diseases radiotherapy has been attempted without conclusive results.

10. In gynecologic practice radium has proved of the greatest value in the treatment of uterine fibroids, certain types of uterine hemorrhages, rysmenorrhea, endometritis, kraurosis vulvae, and urethral caruncle.

11. The value of radiotherapy in leukemia and other blood diseases and in malignant lymphoma or Hodgkin's disease is beyond question. Although the benefits are often temporary, the improvement is apparently more marked than with other methods of treatment.

12. The medicinal use of radium and radio-active substances, as in drinking water, is not yet established on reliable grounds. The amount of radio-activity thus obtained would appear to be of infinitesimal value.

The chapter dealing with x-ray covers very well the gastro-intestinal tract. The briefest mention is made of other important systems of the body. Practically nothing is said of x-ray therapy.

One point is of interest. Writers of surgery are calling more and more on authorities in roentgenology for expert knowledge in the specialty. No longer does a careful surgeon try to make his own summary and deductions of all that is worth while in a branch that has grown beyond his knowledge or experience.

—E. W. ROWE.

Physiological Action of and Therapeutic Indication for the X-Rays. Dr. J. H. Dempster, M. D., F. A. C. P., Detroit, Michigan. J. Michigan State Medical Society, April, 1921.

A BRIEF HISTORY of the development of modern deep therapy is considered after which the author takes up a discussion of the effect of the x-rays on the tissues, mentioning not only the histological changes occurring, but also the important part played by ionization of the tissues.

He makes the statement that the effect of x-rays upon the living cell is first, stimulation; second, inhibition, and third, destruction. The destructive action is the one depended upon in the treatment of malignant new growths.

Brief mention is made of the recent technique brought out by the German radiologists, but in describing this the author has neglected to state the difference in the method of measuring the voltages in Gerany as compared with the method employed in America. This leads one to think that the German technique is much more advanced over the American technique than the actual facts prove.

A brief discussion is given of the effect of the x-rays and radium upon different conditions which are amenable to treatment, including radiation treatment of enlarged tonsils.

1. The x-rays may be used with stimulating, inhibiting or destructive effect at will of the x-ray therapist.

2. Their physiological action depends upon their ionizing properties.

3. Malignant cells resemble embryonic cells so far as being effected by the x-rays and radium is concerned. The destructive effect of these agents depends largely upon the power to produce an olbiterative endarteritis.

4. The x-rays have a large field of usefulness in pre-operative and post-operative treatment of malignancy.

5. Among the pathological conditions, which respond favorably to x-ray therapy, may be mentioned; Uterine fibroids, especially the subserous and submucous type, uterine hemorrhages, leukemias, hyperthyroidism, tuberculous adenitis, epitheliomias and various dermatoses.

6. X-ray dosage has been recommended as pre-operative measure in increasing the coagulability of the blood and in reducing the metabolic rate in thyroid cases, thereby rendering them good operative risks.

7. The x-rays have been employed with success in reducing hypertrophied tonsils.

—A. F. TYLER, M. D.

Diagnostic Experience with Artificial Pneumoperitoneum. Faschingbauer, H. and Eisler, F. Wiener Klinische Wochenschrift, 1920, xxxiii, 853.

GAS INFLATION of the abdomen as a diagnostic aid was first carried out by Weber, Lorey, Meyer-Betz, and Rautenberg. Rautenberg's work was confined to cases of ascites in which he supplanted the extracted fluid with oxygen. Goetze, who has done much to perfect the technique of the method, was the first to subject his technic to surgical tests.

Although the Viennese hospitals were rather conservative in taking up gas inflation, they now, as a result of considerable experience, have adopted a definite technique.

For several days prior to the examination the intestines are kept well evacuated; no food is given on the day of examination and immediately before the examination the patient is directed to empty his bladder. A subcutaneous injection of morphine is given and the patient is placed on an x-ray table which can be tipped to any angle. He is then screened in the dorsal position to ascertain the amount of gas in the gastrointestinal tract. Unless contraindicated by adhesions the site of election for inflation is about 3cm. below the navel and through the center of the right or left rectus muscle. The solidity of the muscle at this site insures a good closure after withdrawal of the needle. Under local anesthesia a fine, sharp-pointed, injection needle 8 cm. long is passed through the muscle. On reaching the posterior sheath, which is determined by the increased resistance, the needle is connected with a Franck's pneumothorax apparatus which injects the gas under a pressure of 300 cm. of water. The rectus sheath and peritoneum are pierced and the gas is allowed to enter the peritoneal cavity under observation with the fluoroscope.

From 1.5 to 3.1 liters are insufflated according to the size of the cavity, the tenseness of the abdominal walls, and the sensitiveness of the patient. The needle is then removed. After the screen examination a slightly large needle is introduced under screen control and the greater part of the oxygen is allowed to escape. Leaving the gas in the cavity causes the patient considerable discomfort. Spontaneous resorption does not take place under four to six days, and in some cases not before several weeks.

Occasionally a slight increase in temperature was noticed and in two cases a cutaneous emphysema resulted from the puncture. There is practically no danger of gas embolism or infection if the author's technique is followed. Injury to the intestines at the site of adhesions is hardly possible if the insertion is made under screen control.

Insufflation is contraindicated in patients with acute inflammatory conditions of the peritoneum and in diseases where an increase of the intra-abdominal pressure is undesirable.

The patient should be screened in various positions. First, with the head high and low; second and third, the left and right lateral positions with the same variations. The transition from one position to the other must be made slowly with continuous roentgenocopy; special attention is paid to the various changes in form and position of the organ. Fourth, knee chest position, right-left and left-right. Fifth, standing position.

By way of contrast the stomach is often distended with effervescent powder and the colon by insufflation. Various difficulties arise in the interpretation of the x-ray picture. The organs following the law of gravity and their own elasticity often manifest changes in shape and position which make it difficult to distinguish between the normal and pathologic.

Gas dilatation of the stomach and colon gives an unusual view of the liver, especially of the diaphragmatic surface. Its size and form are best judged with the patient upright. The right lobe is made out most clearly in the dorsal, left diagonal, upright position. If there are no adhesions, the organ is separated from the abdominal wall and diaphragm. The smooth surface of the normal liver is shown by very distinct shadow boundaries. The liver is very pliable and often as a result of increased intra-abdominal pressure may give appearances suggesting pathologic conditions. An increase in size is readily made out and if there is an increase in the consistency of the organ this is expressed by a loss of the normal changes in shape; the upper surfaces retain their convexity.

Insufflation is of more advantage from the diagnostic point of view in conditions difficult to recognize clinically, such as atrophic diseases of the liver. In atrophic cirrhosis the finely uneven surface of the liver causes the normally distinct margin of the liver shadow to become blurred. If a diseased focus is near the surface of the liver, a definite aid to diagnosis is obtained. This is of unusual importance in the search for metastatic growths. Abdominal inflation offers no special advantage in diagnosing diseased condition of the gallbladder.

The spleen can readily be made out; the notch, the smooth posterior margin, and the hilus are not infrequently seen quite clearly. This organ has not the pliability of the liver and changes in size are readily discernable.

No distinct advantage has been gained by insufflation in diagnosing pathologic conditions of the gastrointestinal tract. The lower portion of the stomach may at times be clear, but the fundus and cardia are generally not seen. If the stomach is dilated, its posterior wall may be seen above the liver shadow and peristaltic movements easily followed. Peristalsis at the antrum may be recognized by a gradually decreasing wave running toward the pylorus and disappearing at that point. If the pylorus is open it also appears in the form of a small ring.

The combined method of gas distension and insufflation often gives valuable data in the diagnosis of gastroectane and gastroptosis. The small intestines are generally forced into the lower abdomen by the gas and are not easily distinguished. The first part of the colon may be readily made out in the left lateral position, especially after contrast insufflation. The transverse colon is seen in the right lateral position. The descending colon is difficult to make out as is also the sigmoid, which is covered by the bony pelvis in all positions.

In the knee chest position the mesentery of the small intestine spreads out like a fan. Normally it manifests several strand-like thickenings. Shrinkage of the mesentery from disease produces an irregularity in its outline; a link of intestine may be drawn up and sharply kinked.

The pelvic organs may be demonstrated with the patient in the lateral position. The full bladder or enlarged uterus is easily recognized, as are also the adnexa or tumors of the rectum.

Adhesions are very easily seen, especially if they connect the abdominal wall and one of the intraperitoneal organs. Adhesive perihepatitis and perisplenitis are usually readily diagnosed, but perigastritis and perisigmoiditis are diagnosed with certainty only when there are adhesions to the anterior abdominal wall. In carcinomatosis of the peritoneum the areas of malignancy are often made out as small dense spots.

Fluid in the abdominal cavity may be recognized in quantities which are not demonstrable by physical examination.

The kidneys may be distinguished at times by appropriate lateral positions. Anomalies in position and diffuse or focal enlargements were noted in a number of cases. Valuable information may be obtained with regard to diseases of the abdominal wall or diaphragm, and in recognizing various types of hernia.

In the dorsal, lateral, or upright positions the diaphragm usually appears as a single or as a double line several centimeters apart. At times it is seen in the form of many intersecting curves, which probably signifies certain independence in contraction of the various diaphragmatic parts. Small pleural effusions are easily recognied in the phrenocostal angle. Pleural adhesions, as well as the contour and action of the heart are also demonstrable.

The method is easily carried out and if care is used in the selection of cases, it is not a dangerous procedure. The inconvenience to the patient is slight and valuable diagnostic data are often obtained, at times of such a nature as to obviate the necessity for an abdominal exploration. If properly indicated this method deserves to be employed as a diagnostic aid.

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The Fundamental Physical Action Underlying the Physiological Action of Radium Rays, X-Rays and Ultra-Violet Light

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ALTHOUGH nearly 20 years have elapsed since the first applications of radium or x-rays to the treatment of disease, and although much clinical data has been gathered, little is known of their physiological chemical action. The study of these radiations from the physical side has fortunately yielded us very precise notions as to the mechanism of the action of these radiations on the atoms of matter. It will then be of some interest to consider briefly the common action produced by all the different radiations on the atoms of matter and to draw from them some conclusions which may be of use to the practitioner.

The one and only effect which these radiations produce on atoms of matter which can concern us is *ionization.* It will be my task this evening to try to prove to you that it is only through the ionization produced by these radiations in human tissues that the chemical and physiological changes are produced. This notion once established, it follows that the effects produced by the radiations must depend on the total number of ions formed per unit volume in the regions treated. Now from our physical knowledge of the radiations we can estimate quite easily what the number of ions formed per unit volume of tissue by a given type of radiation will be, once we define the conditions. This it is obvious will at once lead to a much more accurate and intelligent use of the radiations in the treatment of disease as well as giving us a new *general fundamental* unit for all radiological treatment, viz: the number of ions formed in unit volume of the tissues treated.

Before going further it might be well to point out that in considering the question of a unit of dosage based on physical activity one must overlook the complications introduced by susceptibility.

It is well known to all of you that precisely the same treatment of radiation in the case of different individuals and different tissues produces widely different effects. This phenomenon is encountered wherever drugs are administered. It is eliminated in fixing the dosage by taking the average of the effects produced on a large number of individuals. Thus eliminated it in no way invalidates unit of dosage in the case of drugs. There is, accordingly, no reason why such effects should invalidate the fundamental unit of physical activity of these rays as a unit to be used in the radiological treatment.

In proceeding to the discussion of ionization it will be well first to define what we mean by the term ionization as applied to the action of the rays. We now know that the atoms consist of a massive but minute kernel or nucleus carrying a positive charge, the value of this charge determining the atoms chemical nature. Around the nucleus, possibly much like the planets in our solar system, revolve the small negative electrons, each carrying unit negative charge. As the atom is usually electrically neutral, these electrons must equal in number the value of the positive charge on the nucleus. The molecules which are formed from such atoms consist of the atomic nuclei separated by distances of the order of the diameters of the atoms, and bound together by the electrons which they share in common. A picture of what is possibly much like our nitrogen molecule may be seen in

Fig 1.

Nitrogen Molecule

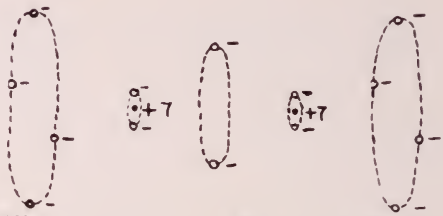


Fig. 1, the only difficulty with it being that the points representing the nucleii and the electrons are much too large relative to the distances which separate the electrons from them. The ratios of these distances are actually something like that of a nucleus the size of a marble in an atom five city blocks in diameter. Such an atom or molecule may, as a result of some sort of a cataclysm, have one of these electrons knocked off. Thus it would have a resultant positive charge and would become a positive ion. The electron would move off through space, eventually attaching to some other neutral molecule, thus making it a negative ion. The positively charged remnant of the molecule, the positive ion, will then remain such until it can pick up an electron lost by some other ionized molecule, or from a negative ion. The union of a positive and a negative ion, particularly if they are from molecules of a different kind, may bring the molecules into contact under such conditions that besides neutralizing their opposite charges they will unite chemically to form new compounds. Thus the act of ionization may result in chemical combination.

Now it is legitimate to ask how it is that the radiations such as alpha rays, beta rays, x-rays, or gamma rays can ionize. We know that the alpha particle is a doubly positively charged Helium atom traveling thru space with a velocity of about 200,000 kilometers per second, while the beta ray is an electron moving with a velocity of 200,000 to 3,000,000 kilometers per second. Since these electrons are negatively charged they must, if they approach closely enough to the electron of a molecule, repel it and therefore send it shooting out of the molecule, thus ionizing it. Alpha particles similarly, when passing near an electron of a molecule will attract it for an instant, giving it a velocity which will send it shooting out of its parent atom. X-rays and ultra violet light act slightly differently. As you see in Fig. 1, there are at the center of the atoms two electrons more closely bound to the nucleus than the majority. Being very rapidly bound, due to the enormous forces close to the positive nucleus, they, when disturbed, vibrate very rapidly, so rapidly in fact that they have frequencies of the order of magnitude of those x-rays. Thus it is these inner electrons in atoms like iron and tungsten that give rise to the x-rays when they are set into vibration. If now these electrons are at rest and x-rays strike them they start to absorb energy from the x-ray pulses. Eventually one of these electrons absorbs so much energy that the forces of the atom can no longer hold it in place.—it then goes shooting out of the atom as a fast *secondary* beta ray. These secondary beta rays act to ionize other molecules as described above. In fact probably 99 per cent or more of the ionization caused by x-rays is caused by the secondary beta particles produced by them. In the case of ultra-violet light, ionization is caused in a manner analogus to that produced by the x-rays except that in this case the electronic groups set into vibration by the light lie on the outside of the atom. That the biological action of ultra-violet light is similar to that of beta rays is shown in the work of Redfield who found that the temperature coefficient of the action produced by beta rays on certain tissues is that characteristic of so-called photochemical reactions. It is likely that the velocity of the electrons emitted by the light is too low to cause as much ionization as do the secondary beta rays liberated by x-rays. Gamma rays from radium act precisely as do the x-rays except that their *secondary* beta rays have velocities comparable with some of the primary beta rays from radium, and also in that having such high frequencies they less frequently find atoms in a condition to absorb their energy. They are therefore much more penetrating.

It may well be asked whether this ionizing action caused by the radiations discussed above is the *only* type of action produced which may account for the chemical changes occurring. It is true that these radiations in some cases produce the emission of light or of secondary x-rays. It is also true that in the case of the absorption of the rays from radium in matter considerable heat is involved. From the physical point of view the light emitted is emitted as a result of the ionization of the molecules. For some few of the molecules, on regaining their electrons, emit light. This light is, however, only capable of producing possible further ionization and its energy in general is so small compared with the total energy expended in ionization, that it can hardly be a factor in producing the effects observed. It might be thought that the local heat produced, i. e., that the high velocity imparted to a molecule due to the impact of a swift alpha particle, might enable the molecules to crash into other molecules with sufficient energy to cause a chemical change. This is a very rare occurrence. For in order to give a molecule an appreciable energy the alpha particle would have to collide with the minute nucleus of one of the atoms or at least pass very close to it. It is obvious that this event must happen very rarely, and in fact observations show it to happen, but once in nearly 100,000 ionizing impacts with molecules. The greater portion of the heat actually liberated by the rays probably comes from the recombination of the ionized molecules. Other than these effects, the radiations in passing through matter produce no effect at all. We are then safe in concluding that the rays act chiefly through the production of ions.

The next question which one may ask is whether the ionization produced is capable of causing the marked chemical changes that underlie the physiological effects of the rays on tissues. The ionization produced in mixtures of hydrogen and oxygen, and hydrogen and nitrogen by alpha particles causes the union of these gases to form water and ammonia. S. C. Lind, Duane, and Wendt, and others claim to have shown that the chemical action produced by the alpha particles in these gases is proportional to the ionization produced by them. We are further aware that the ionization produced in the various electrical gaseous discharges produce ozone in oxygen, and, as Wendt has shown, produced H_3 in hydrogen.

Stieglitz has shown that all chemical reactions of oxidations or reduction in chemistry are *equivalent* to the transfer of one or more electrons from the oxidized to the oxidizing atoms. It is also well known that the action of x-rays on water result in the formation of H_2O_2, Ozone, H_2, and O_2, and as water is a common constituent of the body, these products alone would cause some action on the tissues. Redfield has shown that the effect of beta and gamma rays on the fertilization membranes of the eggs of a marine worm, Nerius, are in approximate proportion to their relative ionizing efficiency.

How such reactions take place we do not know. The type of ionization which we are considering may conceivably cause such reaction by bringing the oppositely charged ions together, thus giving the atoms chance to rearrange themselves in different or new configurations. It is further possible that the act of ionization may make some delicately balanced molecules unstable so that they lose atoms. These latter, e. g. atomic oxygen, hydrogen or nitrogen, being very reactive, may react in such a fashion as to give new compounds. Recent work of Dempster has indicated that the mere ionization of the hydrogen molecule does not cause it to dissociate into the active atoms. It may well be that in the much more delicately balanced organic compounds such as the proteins and aminoacids, the ionization of one of the atoms of a molecule could cause a complete rearrangement of the molecule. This is a point where a possible study of the chemical changes produced in certain of the delicate organic substances by x-rays might be profitable. We may, however, from the foregoing, conclude that the type of ionization produced by the radiations is perfectly capable of producing the marked chemical changes observed.

We can then safely assume that the amount of chemical change produced in the tissues by the action of these radiations per cubic centimeter of tissue is directly proportional to the total number of ions produced in that cubic centimeter. And we may therefore at once proceed to compare the relative activities of the various types of agents on the basis of their ability to produce ions in a given number at a given place. In doing this I will first show how this number varies with the different factors entering into the exposure.

1. The total number "N" of ions produced per unit volume depends on the number of ions formed per cubic centimeter per second "I" and on the number of seconds exposure t, i. e., $N = I \times t$.*

2. The quality "I" will vary directly with the quantity of radiation emitted by the source per unit time, i. e., "I" is proportional to the quantity Q. In other words the ionization will depend directly on the quantity of radium used, or on the milli-ampereage going through the x-ray tube.

3. The quantity "I" will further depend on the total number of

ions produced per second by the radiations per unit of radiating substance, or radiations, used. Thus we know that the 13.6×10^{10} alpha particles of radium produced 2.56×10^{16} ions per second, per gram of radium when absorbed. The beta particles produce 9×10^{14} ions per second, while the gamma rays from 1 gram of radium produced 13×10^{14} ions. The total number of ions produced by the x-rays from a Coolidge tube operated at about 90,000 volts, with 10 milliamperes possibly yields about 4×10^{17} ions assuming that the efficiency of the x-ray tube is 0.2 per cent in producing x-rays and that each electron in the tube giving a homogeneous x-ray pulse would in matter give 3.5×10^{10} ions. This is an assumption which so far has not been accurately checked experimentally. It is here that some physical work must be done in order to enable one to compare x-ray ionization more rigorously with the radium rays. The value of 3.5×10^{3} was found by Rutherford's pupils for slow beta rays whose velocity is comparable with those of 90,000 volt electrons and checks in order of magnitude with the number of ions to be expected from energy considerations. It is possible that the number of ions estimated above may be in error by a marked amount. This error will make the ionization higher than it really is by a factor which depends on the homogeneity of the rays, and which with the data before me I am unable to estimate.

4. The number of ions per cubic centimeter per second formed in a given region will depend on the fraction of the total radiation from the units of radiation used which strikes the area considered. This fraction is determined directly from the solid angle subtended by the area in question at the source. It can be computed from the ratio of the area cut out of the surface of the sphere surrounding the radiating source at the place considered, by the cone whose apex is the radiating source and whose base is the area radiated, to the total surface of the sphere for the rays from radium, or to the hemisphere for the case of the x-rays. To a sufficiently close degree of approximation it is given by the area A of the region to be treated divided by $4\pi R^2$ for the radium rays, or $2\pi R^2$ for the x-rays, where R is the radius of the sphere, i. e. the distance of the area from the radiating source.

It is at once seen that this states that the intensity of radiation on a given area varies inversely as the square of the distance from the source. This so-called inverse square law of intensity in x-ray treatment has recently been called into question by certain experimenters. Such doubts on the inverse square law are incorrect. The intensity must and does fall off inversely as the square of the distance. The apparent failure of this law to hold in some cases, is due either to improper technique, or to the failure to include in the calculations based on this law the effect of variations due to another factor, namely the secondary radiation effect.

5. Except in the case of alpha particles, if any absorbing material is present such as human tissue, or, in the case of gamma ray treatment, wooden blocks, the ionization proceeds in such a manner that every centimeter of absorbing material cuts down the homogeneous radiations by the same factor. That is, if one millimeter of A1 cuts down the ionization produced by x-rays to 0.9 of their initial intensity, the next millimeter of A1 will cut down the intensity of the remaining 0.9 to 0.9 of its value, i. e. the intensity due to the two sheets will be 0.81 of the initial intensity. In symbolic form this may be written I is proportional to e^{-md}, where e is the base of the natural system of logarithms, d is the thickness of absorbing material, and m is the co-efficient of absorption of the rays. This varies not only with the different wave lengths of the rays, but also with the nature of the absorbing material. For the beta rays, as they are particles of matter with definite initial velocities, the law holds only *approximately* and only as long as they are not homogeneous. For the case of gamma rays and x-rays, however, the law holds in this form *only as long as the radiations are homogeneous.* For non-homogeneous x-rays the falling off of intensity can be computed by finding the values of m for the different rays present, determining the absorption for each type of radiation present independently and adding the effects. In modern therapy I believe the present movement is an attempt to utilize radiations which are as homogeneous as possible, the softer rays being filtered by aluminum and copper filters.

6. Finally there is a factor in the case of gamma rays and x-rays which has been more or less neglected in calculations up to the present, but which, according to recent work done in Germany by Dessauer, and by Friederich and Krönig, may amount to as much as 300 per cent in extreme cases. This occurs only in the case of treatments below the surface of the body, where the area radiated is relatively large. If the intensity of the ionization be measured on the axis of the cone above described, it will be found to be greater than at the sides. This is due to the fact that the rays falling on the tissue liberate many *soft* x-rays as well as secondary electrons. These are emitted in all directions and quickly absorbed. The result is that the radiation will extend beyond the edges of the cone for a short distance, and that the point on the axis of the cone will receive more of the secondary radiations from the sides than it sends

to the sides. The result will be that the ionization will be greater in the center of the cone. It is the neglect of this factor which has led some to question the validity of the inverse square law. This factor has been determined for x-rays by the writers previously alluded to. It is probable that more work may profitbaly be done in this field to determine these effects with greater accuracy. In studying the various factors we must then add that the intensity at the region studied must be multiplied by the secondary radiation factor F.

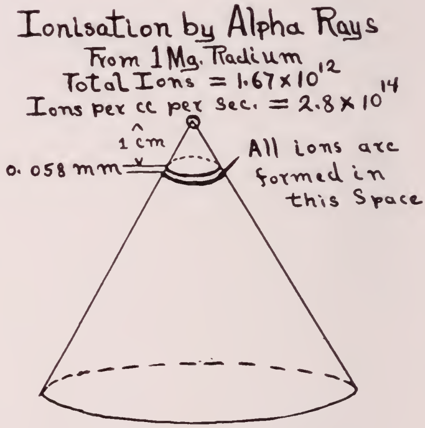
We may now combine all these factors into one equation which states, that the number N of ions formed per cubic centimeter at any distance R under a square centimeter of surface, by Q units of radiation, producing N_0 ions per cubic centimeter when ($d = O$, $R = 1$, $A = 1$, $Q = 1$, $T = 1$) acting through a thickness d centimeter of absorbing material whose absorption coefficient is m for the rays considered, for a time T is

$$N = \frac{T\ Q\ N_0\ F\ e^{-md}}{4\pi R^2}$$

This equation holds in general for *inhomogeneous* beta rays and for *homogeneous* x-rays and gamma rays. The constant N_0 must be determined once for all, for any particular source of rays. The equation is dependent on the use of a point source of radiation. The focal spot on the anticathode, and the short emanation tubes used in practice fulfill this requirement to a sufficient degree of approximation. For more than one source the effect may be computed by adding the effects of the various sources.

The alpha particles from radium consist of five different groups, having very definite ranges lying between 3 and 6 centimeters in air. The ionization by these is nearly constant over their range, and they lend themselves easily to computation by the equation above if we omit the e^{-md} factor which is not applicable to particles ionizing uniformly.

Fig 2.



On the basis of reasoning of this sort I have roughly computed and arranged graphically, the course of the ionizing action of the alpha, beta, gamma rays of radium, and x-rays, omitting the factor F which depends on data which were inaccessible to me. This is illustrated in Figs. 2, 3, 4, and 5. Fig 2 represents the ionization due to alpha particles from 1 milligram of radium. The total number of ions produced in that portion of the cone generated by the point source of radium and a circular area of 1 square centimeter at 1 centimeter from the radium, below this surface is 1.67×10^{12} ions. These ions are generated nearly uniformly throughout a depth of .058 millimeter below the surface, a very minute distance indeed. The total ionization is about 2.8×10^{14} ions per cubic centimeter for this feeble depth. There is no doubt but that these rays are the most powerful ionizers of all radiations They are, however, obviously impractical for medical treatment.

Fig 3

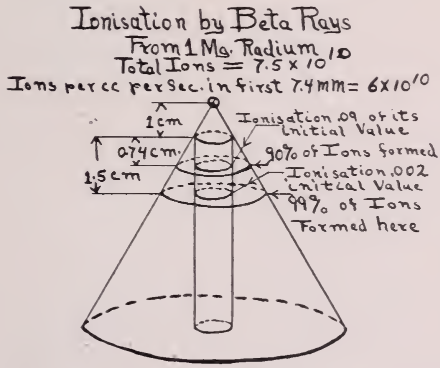


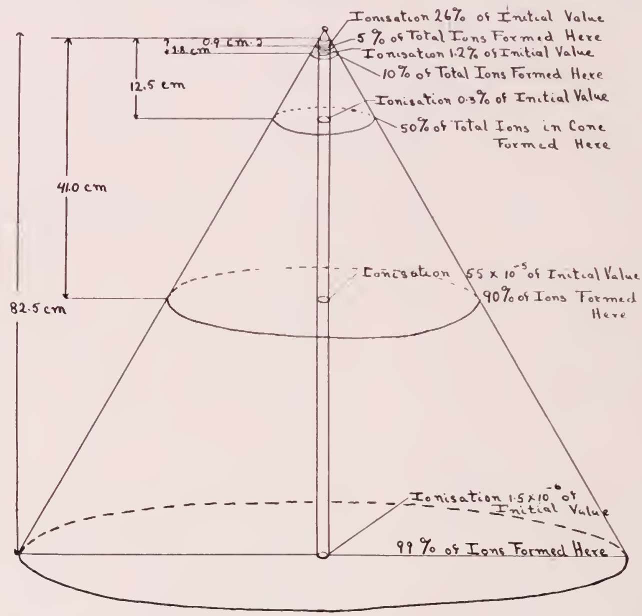
Fig. 3 represents the type of ionization produced by the beta rays from 1 milligram of radium placed 1 centimeter above an area of 1 square centimeter, the ionization taking place practically entirely in the portion of the cone below that region. Besides the cone a cylinder has been drawn on the 1 centimeter square area and prolonged downward. The medium chosen for calculation here is water which it has recently been shown has approximately the same absorbing power as human tissues. On the left are given the depths below the surface cut out by the cylinder, relative to the ionization in the 1 square centimeter at the surface layer. We see that owing to the spreading of the cone the ionization over the cylinder rapidly drops off; this is the effect of the inverse square law of intensity. Further, the number of ions formed, rapidly diminished with depth below the surface of the cone due to the absorption of the rays by the tissue. The total number of ions formed by beta rays in the cone is 7.5×10^{10} ions, a figure about 1/30 of the number of ions formed by the alpha particles. The ionization per cubic centimeter in the first 0.74 centimeters of depth below the surface has an average value of 6.17×10^{10} ions per cubic centimeter, a figure well below that of alpha particles. It is obvious that we have here a useful source of ionization for treating surface conditions where it is inadvisable to treat the portions lying below 1 cubic centimeter depth. In using beta rays the effect of the gamma rays also must be included, but as we shall see these are markedly less.

Figure 4 is a picture of the action of the homogeneous gamma rays from a milligram of radium studied in much the same way as is the beta radiation, omitting the action of the factor F. This placement of the radium is not very different from that actually used in treatment and it gives us a chance to compare it with the beta rays. We see that owing to the great penetrating power, the gamma rays can go through 82 centimeters before having produced 99 per cent of the ionization they are capable of producing in the cone. At this distance the ionization over the cylinder has been reduced 1/1,000,000 of its value, due to the inverse square law and the absorption. At 12.5 centimeter, 50 per cent of the ions formed in the cone have been formed and the ionization below the area cut out by the cylinder has been reduced to 3/1,000 of its value at the surface. At nine milimeters below the surface the ionization has been reduced to 25 per cent of its value at the surface, while 5 per cent of the total number of ions formed in the cone have been formed at this point. The total number of ions formed in the cone by the gamma rays is about 1.1×10^{11} ions per second. The ionization in the first 9 millimeters of depth is at the rate of 3.4×10^{9} ions per cubic centimeter per second. It is seen that while the total ionization for gamma rays is slightly greater than that due to the beta rays in the whole cone the ions formed in the first cubic centimeter are about 1/20 of the number

Fig 4

Ionisation by Gamma Rays
From 1 Mg. Radium

Total Ions in Cone = 1.1×10^{11} Ions per cc per sec. in first 9 mm = 3.4×10^{9}

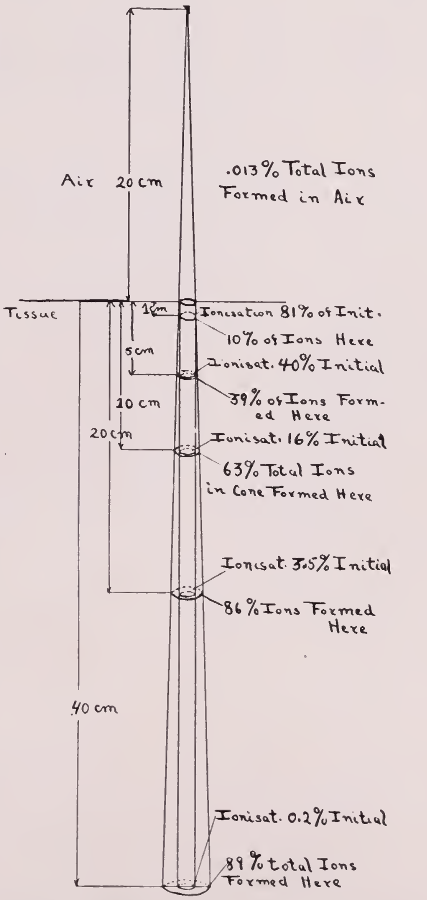


formed by the beta rays. That means in order to produce the same effect at the surface with gamma rays the treatment would have to be 20 times as long as with the beta rays from the same specimen of radium. For treatment below the surface it is obvious that the gamma rays will be far more effective. Though to get the same effect 12.5 centimeter below the surface that one gets at the surface with the gamma rays the treatment would have to be prolonged 300 times the time. This at the axis of the cone might be cut to 100 times the time were F included in the calculations for the axis of the cone. It is obvious that for deep treatments the gamma rays as used here would not work, for in treating the space 12.5 centimeter below the surface long enough to get effective results the surface would be severely burned. The difference in intensity at the surface and below due to the gamma rays could be reduced by increasing the distance of the radium above the surface. This, however, would increase the time of exposure many times. It is to be concluded that the usefulness of radium is greatest in cases where it may be applied right at the spot to be treated. For deep treatments where the distance of the radium from the surface is 6 or more centimeters the application lasts for many hours.

Finally in Fig. 5 we see the analogous diagram for the homogeneous x-rays. Here the focal spot of the anticathode is placed about 20 centimeters above the surface to be treated. The conditions assumed in making the calculations have been given else-

Fig. 5

Ionisation by X Rays
10 Mil. Amps. 90 Kilo-Volts Efficiency = 0.2%.
Total Ions in Cone = 1.5×10^{14}
Ions per cc per sec. in first cm = 1.5×10^{13}



where and it is possible that the total figure is somewhat high. However, one gets an excellent idea of how these rays act. At 1 centimeter below the surface the ionization is reduced to 81 per cent of its value at the surface in the cylinder. In the first centimeter of the cone about 10 per cent of the ions have been formed At 5 centimeters the ionization has been reduced to 40 per cent of the ionization near the surface, while in the cone about 30 per cent of the ions that are formed in it have formed. At 20 centimeters below the surface the ionization has been reduced to 3.5 per cent of its former value in the cylinder, while 80 per cent of the ions have been formed in the cone. Here, owing to the greater distance from the source, the reduction of the ionization in the cylinder, due to the inverse square law, is much less than in the case where the radium was close to the surface. It is seen that the radiation is more rapidly absorbed here than in the case of the gamma rays though not much more so. In fact if the inhomogeneity of the rays had been included this absorption would probably be much more uniform throughout the space because the source is further away. The total number of ions formed in this cone is about 1.5×10^{14} ions per second, while the ionization per cubic centimeter in the first cubic centimeter is 1.5×10^{13} ions per cubic centimeter per second. It is obvious that the ionization per cubic centimeter is greater than that produced by either beta or gamma rays from 100 milligram of radium in their first centimeter which are 6.2×10^{12} and 3.4×10^{11}. Furthermore this marked ionization extends much further into the tissues, due to the methods of application. This means that the gamma ray applications with 100 milligrams of radium must be of the order of 100 times that of the x-rays to produce the same result. Thus for treatment of localities well below the surface which are inaccessible to the close applications of radium the x-rays are very efficient. However, they suffer from the defect that they affect pretty rigorously a mass of healthy tissue lying below and above the regions to be treated. This objection is circumvented in practice by radiating the localities from different angles, thus producing a maximum number of ions in the region to be treated.

The sketch which I have given will serve to demonstrate how even a rough calculation based on data taken for other purposes can give one a fairly precise knowledge of what treatment the tissues are getting under the different radiations when applied in a definite manner. In fact I believe that if some institution such as the National Bureau of Standards could be induced to set a physicist to work for a year or two in cooperation with the medical men in determining the constants needed for this type of computation, a set of tables could be derived which would give the ionization per unit volume produced by all radiations used under all conditions of treatment. Such tables could easily be made accurate to within 1 per cent. With the ionization per cubic centimeter as a unit and with such tables the physician using radiation (either x-rays alone, gamma rays alone, or X and gamma rays combined) would then be enabled to fit his treatment to a given situation with the same ease and with the same relative precision for the objective in view as does the artillery man perform his gun-pointing evolutions from the tables computed for him. Some preliminary steps of this nature have been made in Germany for x-rays and some are being made in this country for gamma rays. However, it would be a great advantage, if, under the direction of the American Medical Association and the Radiological Society some *disinterested* institution such as the Bureau of Standards could be induced to take up the work in a systematic manner.

*This holds well within reasonable limits. Where exposure time t becomes so long that elimination of reaction products by the body as well as marked physiological changes can take place this no longer holds, e. g., in comparing the action of gamma rays from 200 mg. of radium for one hour with that of 4 mg. radium for 50 hours.

*—Read at the Annual Meeting of The Radiological Society at Chicago, December, 1920.

A New Type of Stabilizer For Use With The Coolidge Tube

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IN 1913 when Dr. Coolidge made the first tests of his hot cathode x-ray tube he found that to obtain a steady milliampereage through the tube he must keep the filament temperature steady. To this end, a storage battery was used as a source of current to heat the filament.

Storage batteries were all right in the laboratory but were far from satisfactory in the doctor's office for several reasons. The demand for something better led to the use of a "filament transformer". This device required no attention, was always ready for use and was so much better than the battery that it has now come into universal use. Substituting the filament transformer for the battery, introduced the factor of line voltage fluctuations and its effect on the temperature of the filament. To eliminate or neutralize these fluctuations various types of constant current transformers or stabilizers were devised with varying degrees of success (See Am. Journ. of Roent. Dec. 1915, page 891).

In all of these devices the aim was to hold a definite constant current through the filament regardless of line voltage fluctuations. This would prevent sudden changes in milliampereage through the tube due to line voltage changes, but would not take care of changes in milliampereage due to liberation of small quantities of gas in the tube during a long run.

With these facts in view it seemed clear that the ideal stabilizer would be one which would immediately correct any tendency toward a change in milliampereage caused by either line voltage or tube.

The following is a description of a new form of stabilizer which is operated directly by the high tension current which flows through the tube. Any change in this high tension current causes the stabilizer to act directly on the current flowing through the filament. If for any reason the high tension current through the tube tends to drop, the stabilizer immediately increases the filament current sufficiently to prevent the drop. The same holds true for a rise in high tension current; the filament current in this case is immediately lowered enough to keep the milliampereage at the desired value.

Fig. 1.—Shows diagrammatically the principle upon which the stabilizer operates. A is an electro magnet which is connected directly into the high tension circuit. All of the high tension current passes through this magnet. B is an iron armature which is free to vibrate when current passes through the magnet A. C and D are contacts. One of these is fastened to armature B and moves with it while the other remains fixed. These contacts are in series with the filament in the x-ray tube. There is also a small fixed resistance R which is connected across the wires leading to the contacts. S is a spring which pulls the armature away from the magnet.

The operation is as follows:

We will assume that a small current of say 1 or 2 M. A. is allowed to flow through the tube and magnet A. This current exerts a pull on the armature B, but if the spring S is sufficiently strong the armature will not move. Now if the current is increased to say 10 M. A. the magnet overcomes the tension of spring S, and the armature moves toward the magnet. The instant the armature moves contacts C and D separate and the filament current, which was purposely set at a higher value than that necessary for 10 M. A. now has to pass through the small resistance R. This resistance immediately lowers the filament current, which, of course, keeps the high tension current through the tube from going higher. This operation is repeated for each cycle of high tension current passing through the tube.

DIAGRAM SHOWING
STABILIZER IN HIGH TENSION CIRCUIT

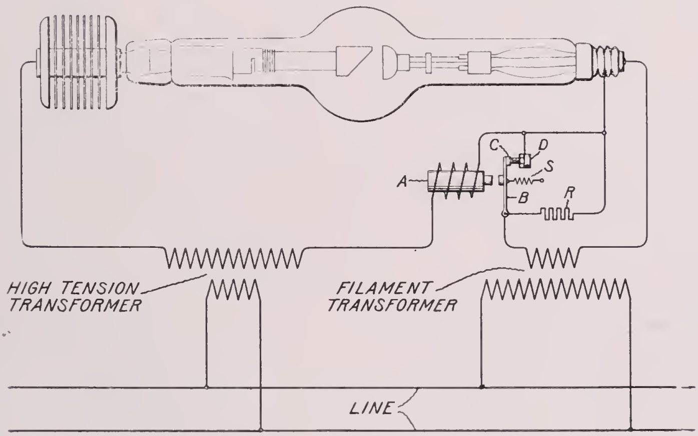


FIG. 1.

It will be seen then that the

high tension current through the tube is controlled by the tension of spring S. If 20 M. A. is desired instead of 10 M. A., the tension of spring S is increased. More current now has to flow through the magnet before the contacts will separate. Instead of changing the tension of the spring to get more or less current through the tube, the magnet may be moved farther away from, or closer to, the armature B which accomplishes the same result, or the number of turns of wire on the magnet may be varied by means of one or more taps, or in other ways.

Fig. 2.—Shows another method of connecting the stabilizer to the tube circuits. In this case the magnet coil is connected to the center taps brought out from the high tension winding of the transformer and the contacts C and D are inserted in series with the primary of the filament transformer. The operation is the same in either case. On those transformers having no leads brought out from the center point of the high tension winding, it is necessary to connect the stabilizer in the high tension lead to the cathode of the tube as shown in Fig. 1. In this case the stabilizer becomes part of the high tension circuit.

DIAGRAM SHOWING
STABILIZER IN LOW TENSION CIRCUIT

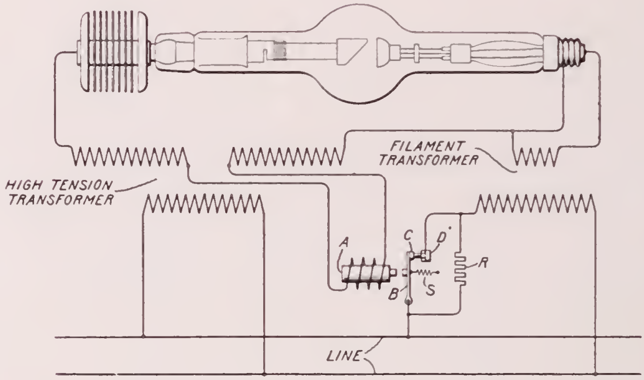


FIG. 2

Fig. 3.—Shows the effect of line voltage variations on a tube without stabilizer, and the same tube with the stabilizer in circuit.

Fig. 3.

Without Stabilizer. Volts	M. A.	With Stabilizer Volts	M. A.
77	2.2	70	2.0
80	3.3	77	2.0
82	4.3	84	2.05
84.5	6.0	87	2.05
86.5	7.0	90	2.05
89.5	8.4	93.5	2.05
91.0	10.0	96.5	2.05
92.5	11.5	99	2.05
95	13.8	103	2.05
96.6	15.0	106.5	2.05

The stabilizer in this case was set for 2.0 M. A.

Fig. 4.—Shows how the stabilizer maintains the current through

a radiator type tube during a long exposure. The tube was first connected to a filament control rheostat in the regular way and the current adjusted to 10 M. A. Readings were then taken every half minute up to three minutes. The tube was then allowed to cool and the stabilizer connected in circuit. Current was adjusted to 10 M. A. and readings were taken again.

Fig. 4.

Without Stabilizer. Time.	M. A.	With Stabilizer Time.	M. A.
0 Min.	10.0	0 Min.	10
½	9.6	½	10
1	9.3	1	10
1½	9.0	1½	10
2	8.7	2	10
2½	8.1	2½	10
3	7.0	3	10

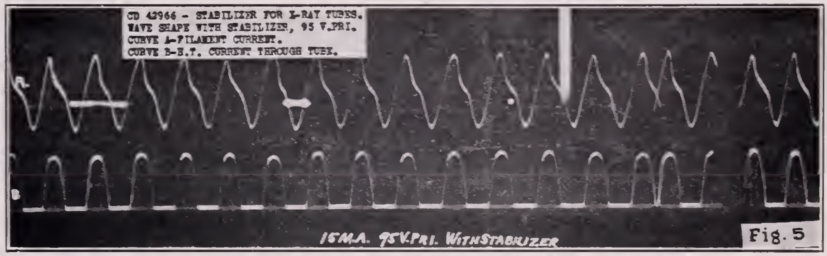


Fig. 5

Fig. 5.—Shows a curve made with an oscillograph. The tube was of the self rectifying type. The lower curve represents a high tension current of 15 M. A. through the tube, and the upper one, the filament current taken at the same time. The small irregular lines in the filament current curve show the points at which the stabilizer contacts opened to prevent a further rise in milliampereage through the tube. It will be noticed that there is a break in the filament current curve for each cycle of current through the tube. This shows that the vibrating armature vibrates in synchronism with the alternating current supplying the tube. This is important. If the armature did not vibrate in synchronism, the filament current would not be adjusted to the correct value on some of the cycles, which would cause a variation in the milliampereage through the tube.

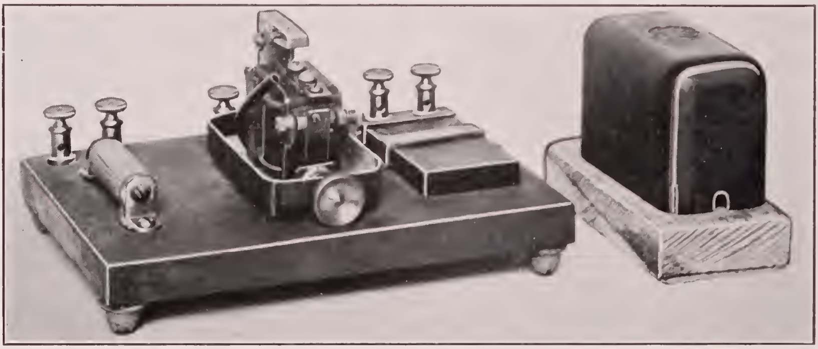
That the stabilizer does produce an even flow of current through the tube, even though the filament current is changed on each cycle, is shown by the evenness of the peaks of the waves in the lower curve, which is the curve of the high tension current.

Summary.

In the foregoing, a stabilizer has been described which is operated directly by the high tension current which flows through the tube. Using the milliampereage as the controlling element the stabilizer maintains the desired current through the tube regardless of changes either in the line voltage or in the tube itself.

It can be made small and it requires a negligible amount of energy for its operation.

It should prove useful wherever it is desirable to automatically maintain a definite amount of current through a Coolidge Tube.



*—Read at the Annual Meeting of The Radiological Society at Chicago, December, 1920.

Radiation and Thyroid Disease

Albert Soiland, M. D., F. A. C. P.
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TO the earnest student of radiotherapy there is no more interesting subject than the history of this science, and as we are all radiologists here, it may not be presumptuous to discuss briefly its evolution. Let us treat the subject under the heading: "The Three Ages of X-Radiation. First came the static age, when, with our large static induction machines, we had a combination of high voltage and low amperage, hard tubes and long exposures. In other words, we were using rays of the gamma type, but did not know it. It was in this period that many brilliant results were obtained, mainly empirically, which gave x-ray therapy its rapid rise to fame. In the second, the coil age, we had more simple apparatus, more easily operated, but a distinct drop in voltage and softer tubes. This combination, coupled with the rather indiscriminate use of these machines by men untrained in Roentgenology, produced many x-ray burns and bad therapeutic effects. For these reasons, the expectations of cures, which had been so successfully inaugurated in the first, or static age, were not, on the whole, fulfilled. The third age is of fairly recent origin and was ushered in by the modern transformer and the epoch-making Coolidge tube. We have now learned that it is the energy of radiation from the gamma radium and x-ray which contributes most to a satisfactory end result. This period has shown the limitations of, as well as the indications for, modern x-ray therapy, and has placed the whole subject upon a sound scientific basis, which you and I are doing our best to develop.

Now, as to the application of radiotherapy to thyroid disease, in a recent address delivered to one thousand medical men, a very distinguished American surgeon stated that the x-ray was practically useless as a cure for goiter, and that radium was not of much greater aid, although he believed that a temporary inhibitory influence might be achieved by this agent in certain cases. Another equally distinguished European surgeon states definitely that the x-ray is practically a specific for toxic goiter, and to substantiate this quotes one hundred consecutive cases successfully relieved by this treatment under his observation. Other observers again claim that radium is the best curative agent for this peculiar disease of metabolism, and cite numerous cases to prove their contention. In the face of such widely divergent views as these, the question is a pertinent one: What is the present status of radiation as applied to thyroid disease? Is it advisable to use the x-ray or radium or a combination of both in combating the disease?

It is not the purpose of the writer to go into the endocrin aspect of toxic goiter and other form of thyroid disease, but to give briefly the results of his own experience, extending over a great many years in the treatment of this malady by x-ray and radium. The first two cases in his records, where good results were obtained, were post-operative recurrences dating back to the static machine days of tube excitation, when if good results were obtained, it was partly by accident, but mainly because we were getting a very penetrating ray, the value of which we did not in those days appreciate.

In dealing with the toxic goiter we seem to be dealing with an organ functioning in a manner highly detrimental to the well-being of its possessor. Our knowledge of the potent action of radiation in discouraging abnormal cell activity is surely sufficient authority for its exhibition here. Radiation in these cases is not only indicated, but demanded, for where can you find another agent which will so surely inhibit and curtail the mischievous activity of these toxic cells, as radiation? It is not a question of carefully feeling your way with guarded application. It is a demand to lay down a radiation barrage, in which every pathological cell in the field must die.

In the treatment of toxic goiter, it is impossible to suggest an exact technique. In this class of cases, as in no other, the greatest possible variety occurs, and with the peculiar nervous manifestations which accompany them, care and good judgment must always be exercised in giving the treatment. As a rule, the modern deep x-ray therapy, pushed as rapidly as possible, is the proper procedure. It makes very little difference whether x-ray or radium is employed. In my own experience both give equally good results. Radium has one distinct advantage, particularly noticeable in the highly nervous cases, where the superiority of the innocent looking radium pellet over the large and complicated x-ray apparatus can be readily grasped. It seems to me that in the soft cellular enlargements, radium acts better than the x-ray. In the hard fibroid types, the x-ray is my choice. There are some conditions where both agents may be successfully combined. In the average case of toxic goiter, the x-ray technique is as follows: Six ports of entry, four over the thyroid, and two over the thymus region, through each port thirty-five milliampere minutes, with four millimeters of aluminum and one half inch cotton filter, under compression, at an eight inch skin distance, and ten inch back up, three applications through each port within three weeks. This is usually sufficient to control the symptoms, and the patient returns in sixty days for inspection. In radium cases, the technique is as follows: Through similar ports of entry, one hundred milligrams radium element to each port for four hours, with one-half millimeter of silver and two millimeters hard rubber filter, one-half inch skin distance. This is repeated in ten days, after which the patient reports in sixty days.

A very few cases of hypothyroidism have been observed where fairly good results have followed a few light exposures for the stimulating influence on the gland.

I have a total record of about two hundred personal cases of toxic goiter, seventy per cent of which were treated with the x-ray alone, twenty per cent with radium alone, and ten per cent with a combination of both. It is impossible to give the end result of all these cases, owing to the fact that California is a land of restless people. The population is ever changing, and this migratory tendency makes it wholly impractical to maintain an effective follow-up system. Conservatively stated, the results have been in the main gratifying.

The importance of treating the thymus region cannot be overestimated. It is surprising to note how quickly a favorable response will follow radiation to the thymus before any direct applications have been made to the thyroid. It is perhaps hardly necessary to add that in addition to radiation, an intelligent supplemental treatment is insisted upon, such as a rational hygiene, with a proper amount of rest, a reasonable diet, and an avoidance of strenuous exercise or other physical acts which might be detrimental to the general health of the patient. It is also well to bear in mind that excessive menstruation and increased ovarian function may have a distinct bearing on the progress of hyperthyroidism. I have one particular case in mind, where, after a rather prolonged and intensive course of radiation to the thymus and thyroid, no appreciable response or amelioration of the symptoms could be detected. In this patient, the ovaries were subjected to one course of radiation, after which the toxic symptoms diminished at an astonishing rate.

It is not the intention of the writer to decry surgery, or to detract one iota from the many brilliant results obtained by competent operators, but the fact must not be lost sight of that in radiation we have a proved therapeutic agent, far superior to any other given us up to the present time. The oft repeated statement that radiation over any field creates so much vascularity, or produces so many adhesions that surgery is rendered more difficult is entirely false. Radiation always diminishes vascularity in any region where it is applied long enough to have its obliterating effect on the arterioles established, and this is the essential status required in the successful termination of toxicity in this variety of goiter. There is surely no longer any excuse for denying a patient the use of this remedy, which if not successful, has at least prepared the way for possible surgery.

*—Read at the Annual Meeting of The Radiological Society at Chicago, December, 1920.

Radiotherapy Versus Operation in Cancer of the Cervix Uteri

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IT is a privilege to present the question of the best treatment for cancer of the cervix uteri to a body of expert surgeons. In a gathering of this kind one may at once proceed to the very heart of the problem and one may safely take for granted that the paramount importance of an early diagnosis and the pressing necessity of continuously spreading information among medical and lay circles are fully appreciated.

Let us first agree on definitions. It is now generally accepted that five years must elapse after an operation before we can pronounce the patient as permanently cured. This time limit is somewhat arbitrary, but it serves all practical purposes because recurrences after five years are met with only in a very small number of cases. It has been suggested to reduce this time limit for radiotherapy to three years, but experience has disproved the claim that return of the disease was not likely to occur after three years. If we are to compare the value of the two methods that are at present competing in the treatment of cervical cancer, it is best to adhere to the five-year limit in both the operated and irradicated cases.

The terms "operability" and "inoperability" are products of the exclusively surgical era of treatment and have lost their meaning to a great extent since radiotherapy made its appearance. Moreover, operability by no means denotes a fixed quantity. The percentage of so-called operable cases ranges within wide limits in different statistics, because it is largely dependent upon the subjective attitude of the individual operator. One surgeon will subject to operation cases which another may consider too far advanced for a permanent cure. In one case, personal skill and extensive practical experience will overcome technical difficulties which to another surgeon may appear insuperable. For the present, however, we may retain these terms for a more convenient grouping of the cases and we may classify—

1. As operative, those cases in which the cancer is strictly limited to its original site and where the most careful recto-vagino-abdominal palpation fails to reveal any extension of the

disease which would interfere with the free mobility of the uterus;

2. As borderline cases, those in which the cancer has only begun to invade the vesico-vaginal and recto-vaginal septa, and the parametria in close proximity to the uterus; where the uterus is still movable though to a lesser degree, and where glands may be palpated before or during operation, which, then, may become merely a palliative intervention, and the case will have to be assigned to the group next in order;

3. As inoperable, those cases in which the uterus is immured in its position by the involvement of a large part of the pelvic cellular tissue, and where adjoining organs have been invaded or metastases are found in remote parts of the body.

In the final appraisal of our surgical treatment we distinguish between an absolute and a relative cure. The percentage of absolute cure is obtained by computing the number of all patients with cancer of the cervix uteri who applied for treatment, with the number of those still alive and well after five years. The percentage of relative cure is derived from the ratio between the cases which have actually been operated upon, and those who thereafter remained alive and well at the end of five years. This percentage incidentally enables us to estimate the value of the particular method employed.

This distinction is not equally sharp in radiotherapy where almost all cases, whether operable, borderline, or inoperable, are subjected to treatment. The percentages of absolute and relative cure after radiotherapy will, therefore, be very similar or even identical. It may, then, become necessary in future to compare only the percentages of absolute cure from the two methods.

By operation is meant only the radical abdominal hysterectomy which bears Wertheim's name, though Ries, of Chicago, originated the idea, and Clark, of Philadelphia, Bumm, of Berlin, and a host of others had a great deal to do with perfecting its technique. There is a tendency among certain men to call a Wertheim operation any abdominal hysterectomy undertaken for cancer; but in this audience the fallacy of confusing a simple with a radical abdominal hysterectomy is obvious. The extended or radical vaginal hysterectomy of Schauta enters in competition with the Wertheim operation, but in this country, at least, it has never become popular enough to attain practical importance.

By radiotherapy is meant the employment of radium and x-rays, either alone or combined.

A witty Frenchman once remarked that if men who were about to launch into a discussion, would first agree on definitions, there would be no discussion. This, I hope, will not be the case today, but trust we shall at least all talk about the same things.

We can now proceed to take stock, as it were, of the actual results achieved thus far by the various methods under discussion. As we want to inquire how many cases we can cure, we must leave out the inoperable ones, which are abandoned as hopeless by surgical means, and confine ourselves to the operable and borderline cases.

Table I gives a survey of the *relative* cures after abdominal operation.

TABLE I.

Berkeley and Bonney	39.0%
Bumm-Sigwart	26.3%
Bumm-Schaefer	41.8%
Curtis	34.0%
Doederlein	28.0%
Franz	43.0%
Graves	27.6%
Jacobson	23.4%
(Eighteen American operators)	
Kroenig	32.2%
Peterson	47.3%
Sellheim-Mayer	31.0%
Wertheim	42.4%
Zweifel-Aulhorn	45.0%

On an average, then, 35.5% of the patients operated upon by the abdominal route, were alive and well after five years.

Table II. gives the percentages of *absolute* cure after abdominal operation.

TABLE II.

Berkeley and Bonney	24.3%
Bumm-Sigwart	16.0%
Bumm-Schaefer	32.3%
Doederlein	17.0%
Franz	28.0%
Graves	16.8%
Kroenig	25.3%
Sellheim-Mayer	20.0%
Wertheim	18.3%
Zweifel-Aulhorn	23.4%

This list shows that, on an average, the abdominal operation yields an absolute cure of about 22 per cent.

The vaginal operation produced, according to the statistics of Schauta and of Adler, a relative cure of 53.3 per cent and an absolute cure of 22 per cent.

Table III. shows the *relative* cures obtained with radium in operable and borderline cases.

TABLE III.

Baisch	28.5%
Bumm-Schaefer	25.0%
Eckelt	14.0%
Kehrer	45.4%
Taussig	31.5%

(Collective statistics of twelve operators.)

It appears from this list, that the average percentage of relative cure after radium treatment in operable cases is 24.7.

In Table IV. the figures for the *absolute* cure of operable and borderline cases after radium treatment are given.

TABLE IV.

Baisch	16.5%
Bumm-Schaefer	14.0%
Eckelt	7.0%
Kehrer	22.0%
Zweifel-Schweitzer	25.0%

This gives on an average an absolute cure of 16.5 per cent in this class of cases.

In a number of the cases in the two preceding tables radium was used in combination with x-rays. There are several reports in literature dealing with the *exclusive* x-ray treatment of operable cancer cases, but as the time limit of five years has not yet been reached, these statistics were left out of consideration.

The figures given above permit of certain deductions.

To begin with, Tables III. and IV. definitely dispose of the statement heard now and again that no case of cancer of the cervix has ever been cured by radium. Whatever doubt as to this point may have been in the minds of those who remained sceptical at first, is now set at rest.

The percentages both of the relative and absolute cure after radium treatment are lower than the corresponding percentages after abdominal operation. This difference may lead to the hasty conclusion that operation in itself is preferable to radiotherapy. But an unbiased examination must take into account the following points.

(1) The abdominal operation, in its present form, is almost twenty years old. Many thousands of cases have been operated upon, and the practical experience of the individual operator has increased from year to year. The primary as well as the late results laid down in statistics, reflect this growth of technical perfection. It may be assumed that the acme of surgical achievement in this class of cases has been reached.

Radiotherapy, on the other hand, has just now completed the fifth year of its existence. Its technique is still in a state of flux. We are only learning how to use these mysterious agents of radium and x-rays, and from analogy with our experience in the surgical treatment, we may confidently expect better results from radiotherapy as time goes on. As a matter of fact, one authority at least (Kehrer) has already accomplished results with radium that are in every way identical with those derived from surgery.

(2) Granting, however, for the sake of argument that radium cures fewer cases than does the operation, we find illuminating information on closer scrutiny of the statistics. In a collective review on the subject, Taussig very interestingly pointed out that in Doederlein's clinic 49 out of 110 early cases were cured by operation (44.5 per cent) whereas only 6 out of the 57 borderline can-

cers were cured (10.5 per cent). By radium, on the other hand, 17 out of 40 early cases were cured (42.5 per cent), while 14 out of 62 advanced ones were cured (22.5 per cent). A very similar proportion was ascertained in the material in Bumm's clinic. Taussig, therefore, concludes that while the percentage of surgical cures is greater in the early operable group, the percentage of radium cures is greater in the borderline group.

(3) The question of primary mortality must be taken into account. Graves, of Boston, has an amazingly low operative mortality of 5.2 per cent, which compares favorably with the best results obtained abroad. But the average mortality in Germany and England is still in the neighborhood of 20 per cent, and in general surgical practice in this country is probably much higher —so high, indeed, that several of my surgical friends have altogether abandoned the radical operation.

The mortality after radiotherapy is very low. Even the most enthusiastic advocates of radiotherapy will nowadays admit a mortality though it probably remains below 3 per cent. It is fair to assume that with greater practical experience this mortality will be still further reduced.

Applied to our problem, this difference in mortality makes up somewhat for the inferior final results. It means that one may resign oneself to less brilliant late results if one does not have to pay so high a toll in human lives.

These points have been raised to show that it is not advisable to conclude at once from the statistics that operation should be preferred to radiotherapy.

But the main issue, to my mind, is this: Is it permissible to construe any antagonism between the two methods? Should the question before us be: *Either* operation *or* radiotherapy? We know now that both methods can, and do, produce a permanent cure. Why not, then, combine the two methods in order to get the best possible benefit?

This is my personal attitude in this question, and in order not to delay any further a free exchange of opinion from which we may learn a great deal, let me briefly outline my own opinion.

I now believe, as I formerly doubted it, that radium alone may cure an early case of cervical cancer. I realize, however, that the penetrating power of radium does not exceed 3 to 4 centimeters. Beyond this distance, the radium rays are either inert or they are so weak that they stimulate cancer cells instead of destroying them. Hence the pelvic glands, which are at times involved even in the earliest cancers, cannot be influenced by radium. For this reason, I prefer at present for early cases the abdominal radical operation. In every case, the operation is preceded by a moderate dose (2,500 to 2,800 miligram hours) of radium applied within the cervical and uterine canals or buried in the tumor mass. Operation is performed after the radium reaction has subsided; 7 to 10 days later. In this time the ulcerated surface becomes cleaner and the tumor somewhat smaller; a few preliminary acetone treatments may hasten the process. This single treatment with radium screened as it is by the uterine walls, neither causes an undue degree of hyperemia nor reactive sclerosis of the pelvic tissues. After the operation, when the patient is well on the road to recovery, that is to say, in about three weeks, massive x-ray treatment is given to destroy any cancerous foci in the pelvis which may have remained behind, or to deal effectively with any freshly implanted cancer material. I have given up radium for post-operative treatment because of the repeated occurrence of fistulae.

Or take a borderline case of mild degree, where the uterus is still movable and the parametria are uninvolved. The disease has extended only towards the bladder, and on cystoscopic examination the vesical mucosa is found normal, but the vesico-vaginal septum involved. Our operative experience has taught us that such a case is predisposed to an early recurrence in the bladder wall, even if the dissection of bladder and vagina was successful. The preliminary treatment with radium will probably cope with the cancerous involvement in the vesico-vaginal septum and render the case readily operable. The operation, then, will be followed by energetic x-ray treatment in the manner described.

In all other borderline cases which are further advanced, I reject operation in the firm belief that combined radium and x-ray treatment will in the end yield better results with a minimum of danger, suffering, and annoyance. I cannot give any exact figures from the services of Dr. Taussig and myself at the Barnard Free Skin and Cancer Hospital, because we have had radium only in the last three years. But the signs are propitious in every way. We see early cases in increasing numbers every year, because the very existence of an institution such as ours attracts the attention of patients at earlier stages of the disease, and because our hospital has conducted a vigorous educational campaign. In our operative material, the primary mortality has declined steadily, and since the introduction of combined surgical and radio-active treatment, we believe to have observed fewer recurrences. On the whole, we have reduced rather than increased the number of operations, because most of the borderline cases have been subjected only to radiotherapy. In these cases, as well as those which were frankly in the inoperable category, our results have been particularly encouraging and will induce us to continue to work along the lines indicated and to concentrate our efforts on technical improvements of our radiotherapeutic measures.

I am well aware that the foregoing discussion does not cover the entire problem before us. The time alloted to me and the endurance of the audience both prohibit. The desirable and the undesirable by-effects of radiotherapy have not been mentioned, nor was the question of surgical and radiotherapeutic injuries touched upon. The awful problem of the inoperable case was omitted as not being within the scope of our inquiry, and for the same reason the cancer of the uterine body received no consideration.

What really matters in this afternoon's debate and what should form a basis for the discussion, can be condensed in the following propositions:

1 Cancer of the cervix uteri can be cured permanently, both by radical operation and by radiotherapy.

2 The former yields an absolute cure in 22 per cent, the latter in 16.5 per cent.

3 The present inferiority of radiotherapy in the permanent cure of cervical cancer is probably due to the deficiencies that characterize any new therapeutic method.

4 Even the highly developed surgical treatment restores life and health only to about one-fourth of the patients who seek our aid.

5 The present state of our knowledge seems to indicate that a further and much desired improvement of our curative efforts may result from combining operation with radiotherapy.

6 It is, therefore, inappropriate to speak of the two methods as so opposed that only one or the other of the two should be selected. Rather should we attempt, in future, the treatment of cervical cancer by operation and radiotherapy.

7 The writer's personal attitude for the present is this: Early cases receive a pre-operative application of radium and a post-operative treatment with x-rays. Borderline cases are treated altogether by a combination of radium and x-rays.

*—Read at the Annual Meeting of The College of Surgeons, Nebraska Section, Omaha, March 3, 1921.

Roentgen Observations Before and After Cardiolysis in a Case of Chronic Mediastinopericarditis.

Edwin C. Ernst, M. D.

St. Louis, Mo.

IN view of the fact that the pre- and post-operative findings in chronic mediastinopericarditis have been reported rather infrequently, American medical literature containing less than five authentic cases, and likewise realizing the importance of the fluoroscopic interpretations as an aid to the early recognition of this type of pericardial pathology, including the valuable sign of cardiodiaphragmatic "tugging", we present and describe this case.

The x-ray observations by such careful clinicians as Moritz Benedikt (1897), Stuertz, J. E. Summers and Brauer have been very incomplete, especially the findings following cardiolysis, and we therefore have attempted to describe in detail the numerous distinct phases of this particular case, the first symptoms of which presented themselves some twenty-two years ago.

In 1898, Mrs. D——., age 38, Case 5135, came under the observation of Dr. Ellsworth Smith, [1] suffering from mitral insufficiency, which apparently followed an earlier attack of polyarticular rheumatism. However, at that time a course of artificially prepared Nauheim Bath Treatments [2] gave the patient almost immediate relief. The extensive anasarca was rapidly reduced and the cardiac compensation was likewise completely restored. The patient returned to her occupation in a book bindery and continued her work successfully fifteen years up until the onset of her present trouble, the beginning of the second phase of her partial disability.

Second Phase (1913)

This second period of illness began in 1913, with a return of dyspnoea and inability to sleep lying down, which condition continued without showing any improvement during the following six years. Dr. Smith again examined the patient in February, 1919, and observed that she presented an entirely new symptom complex. Instead of being generally water-logged, as in 1898, approximately fifteen years previous, she now manifested an extensive ascites with practically no adema of the lower extremities, presenting an entirely new problem from every standpoint than the one observed during her first illness. Three gallons of fluid were removed during two sittings, and this was later followed by at least twenty additional tappings. During the past two years paracentesis was repeated every five or six weeks. At no time was the patient able to sleep unless propped up in bed.

Third Phase (1918)

An operation was finally advised in May, 1918, based on the diagnosis of hepatic cirrhosis. Consequently, in May, 1918, a modified Talma operation was performed, but without beneficial results. Dr. C. A. Wood reported all of the organs in the abdomen as being normal. The case was further examined at Barnes' Hospital in view of the negative operative findings, at which time the differential clinical findings were again reviewed by Dr. Smith, as follows:

"A repetition of her first attack of cardiac decompensation from valvular disease could be excluded from the presence of ascites with an absence of general anasarca. Peritoneal tuberculosis could also be excluded: first, on finding the peritoneum normal at the time of the Talma operation; secondly, on the absence of fever and emaciation; thirdly, the long course of the disease. Laennac's cirrhosis of the liver was excluded; first, by the absence of any etiological factors, as alcohol, use of strong condiments, etc.; secondly, by the absence of progressive loss of weight and strength during a period of six years. Cirrhosis due to chronic hepatic stasis is generally not recognized by pathologists. Therefore, by exclusion the diagnosis simulated a chronic condition of mediastinopericarditis; but inasmuch as the roentgen findings thus far reported had been negative and the physical signs not entirely typical, we did not feel justified in advising another operation. Consequently, the patient returned to her home.

Fourth Phase (1919)

However, seven months later the patient's clinical condition entered its fourth phase. On December 6th, 1910, entered St. Luke's Hospital and reported her condition as gradually growing worse. The previous clinical observations were again confirmed by Dr. Smith, but in addition at this time definite fluoroscopic evidence of an adherent pericardium was fortunately obtained. These findings could only be observed with the patient in a semi-oblique position, by which method it was possible to observe very graphically a distinct "tugging" upward of the diaphragm with each cardiac systole. The complete roentgen observations on December 19th, 1919, were as follows:

Roentgenological Findings, December 19, 1919

The fluoroscopic examination of the chest shows evidence of an increase in the heart shadow, both toward the right and left margins, more pronounced toward the right side. Then general cardiac enlargement is irregular and very suggestive of pericarditis with effusion. However, further observations do not reveal the usual characteristics of fluid within the pericardium. The cardiac pulsations could be clearly observed, and the position of the heart was unusually high in the chest cavity. It was very apparent during deep inspiration that the left diaphgram was more or less fixed toward the apical shadow of the heart, being pulled upward or tugged in synchronism with each heart throb These observations were more pronounced following rotation of the patient in the semi-oblique position, while the apex shadow was in close proximity to the fluoroscopic screen. This "tugging" was accentuated during

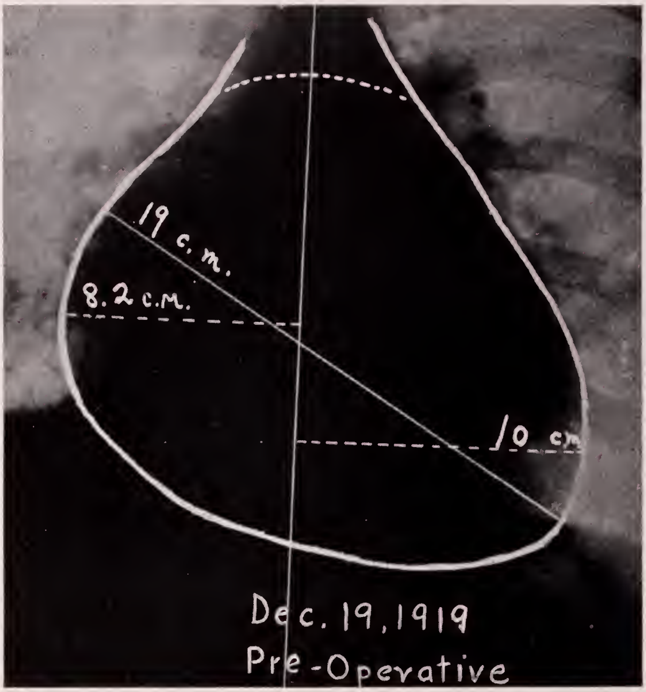

Fig. 1—December 19, 1919. Pre-operative radiogram of the cardiac shadow at one meter target plate distance. The fluoroscopic observations of the left cardiodiaphragmatic "tug" previously described cannot be outlined in the above radiogram. However, the increase in size and the high fixation of the cardiac shadow in the thorax are interesting diagnostic findings. Cardiac measurements were as follows: oblique diameter 19 cm., left transverse diameter 8.2 cm., right transverse diameter 10 cm., total transverse diameter 18.2 cm.

deep inspiration, forcibly pulling the left diaphragm for a distance of at least three centimeters with each pulsation of the heart. Further observation along the heart margins did not reveal similar fixations, with the exception of an area along the left superior ventricle border of the heart, at which point very moderate traction of the lung markings could be observed. However, the fixation was not very marked and not nearly so graphic as those observed in the apical region of the heart. The posterior mediastinal space density was definitely increased.

The radiographic observations corroborated the above findings, with the exception of the fluoroscopically observed left cardiodiaphragmatic tug. The actual fixation could not be visualized on the radiographic plate. The oblique diameter of the heart was 19 centimeters, while the transverse diameters totalled 18.2 centimeters at the usual one meter target distance.

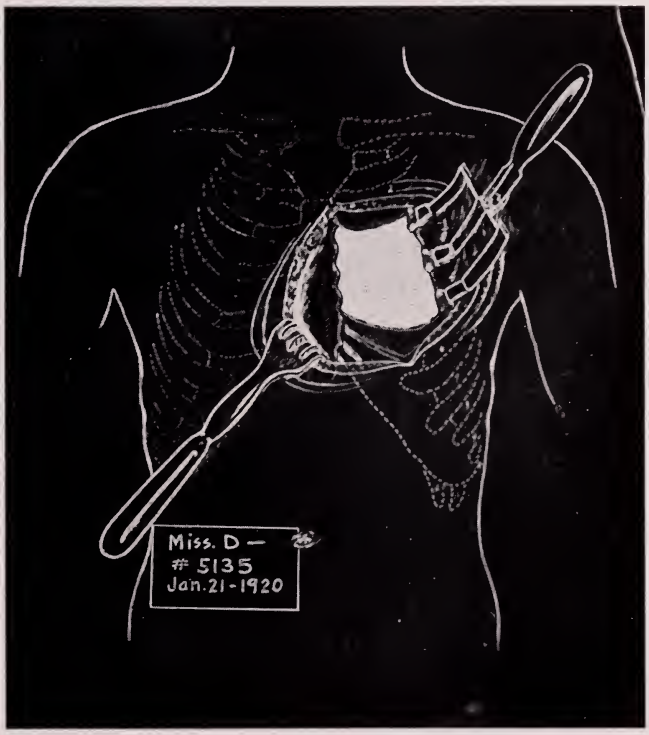

Fig. 2—Cardiolysis (Brauer's operation). Resection of the third, fourth and fifth ribs and cartilages in order to free the pericardium from its adhesions to the periosteun of the anterior chest wall. The adhesions were not directly severed, but the fixed bony structures were removed to allow the heart to descend to a lower level in the thoracic cavity, thereby relieving the anterior tension on the pericardium. Operation by Dr. Harvey G. Mudd.

Operation

In view of the above clinical and more recent conclusive Roentgenological findings, cardiolysis (Brauer's operation), was finally advised, and Dr. Harvey G. Mudd operated on January 21st, 1920, under a local black anaesthesia. A resection of the third, fourth and fifth left ribs was made for a distance of from three to four inches, beginning along the left border of the sternum and extending toward the axilla slightly beyond the limits of the cardiac pulsations. Immediately following the removal of the ribs and cartilages, Dr. Smith reported that a distinct and extensive pulling in of the soft parts with each systole of the heart could be seen, showing what difficulty the organ must have encountered before the operation in attempting a complete systolic contraction. Although convalescence was not uneventful, nevertheless on March 20th, 1920, two months following the cardiolysis, the patient's general recovery was remarkable. It was now possible for her to lie flat in bed and sleep all night, something she had been unable to do since the onset of her present trouble, the second phase of which began in 1913, seven years previous.

Dr. Smith further reports that while for a period of two years antedating cardiolysis she had required tapping every five weeks, a period of over twenty-two weeks has now elapsed without necessitating paracentesis, and her abdominal measurements have been reduced approximately six inches. The effect of digitalis upon this heart is likewise of great interest, for before operation the digitalis effect can be shown only in the removal of a small pulse deficit and a faint slowing of the apex rate, but with slight diuresis. While after the operation, we not only have a slowing of the pulse and obliteration of pulse deficit, but also a definitely marked diuresis. In addition to the above post-operative, laboratory and clinical findings we wish to report the subsequent fluoroscopic and radiographic observations, which were made two and nine months respectively following the cardiolysis.

Post-Operative Roentgenological Findings March 20, 1920

The fluoroscopic examination of the cardiac shadow two months following the cardiolysis operation does not show evidence of the previously observed left cardio-diaphragmatic tug at the apex. The radiographic examination does show evidence of a slight decrease in the size of the heart shadow and a definite rotation of the right side of the heart upon the axis of the apex. The position of the heart is somewhat lower than even the left apical region. The oblique diameter of the heart has decreased to 18.2 centimeters and the transverse diameter to 17.8 centimeters.

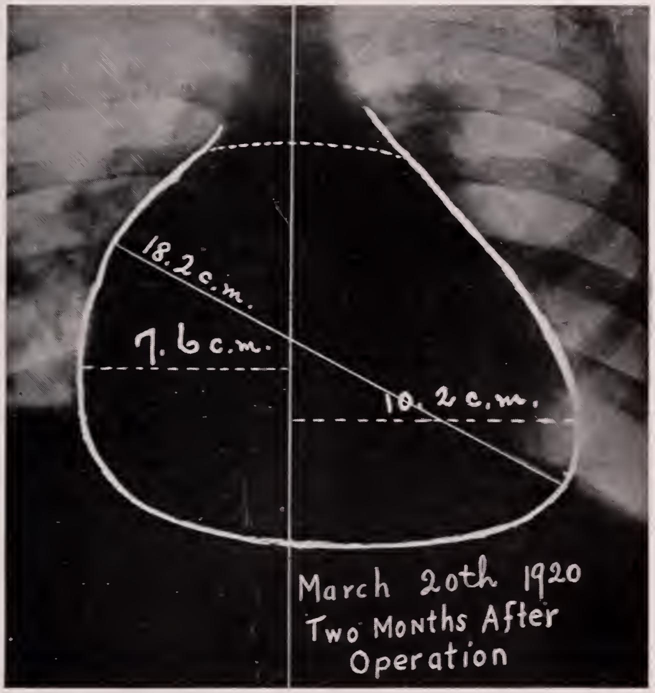

Fig. 3—March 20, 1920. Post-operative radiogram two months after cardiolysis. Note the decrease in size of the cardiac shadow. Oblique diameter 18 cm., left diameter 10.2 cm., right diameter 7.6 cm., total transverse diameter 17.8 cm. Target plate distance one meter. The position of the cardiac shadow can now be observed to be considerably lower in the thoracic cavity as compared with the pre-operative radiogram, Fig. 1. In addition, the right auricle and ventricle are likewise rotated downward upon the apical axis of the heart. The fluoroscopically observed cardio-diaphragmatic tug was absent,

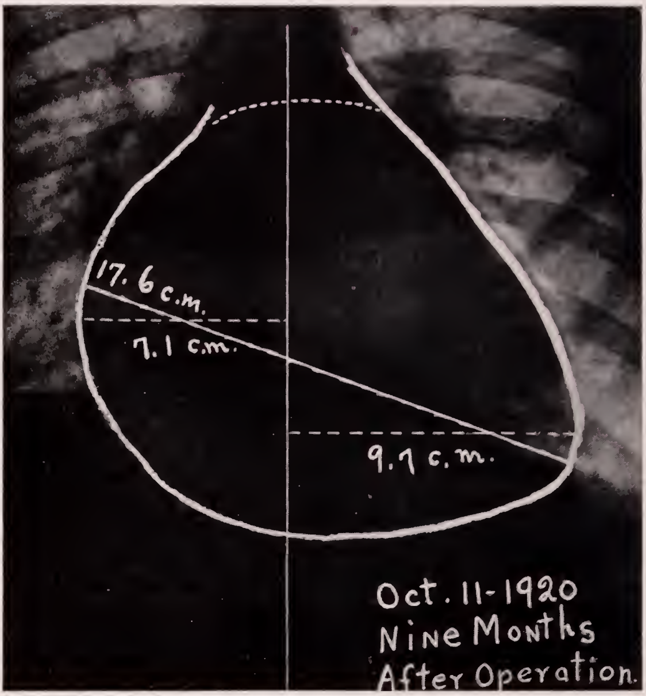

Fig. 4—October 11, 1920. Post-operative radiogram nine months after cardiolysis. A comparison of the present measurements with those observed in the pre-operative cardiac shadow shows evidence of a reduction in size of 1.4 cm. in both the oblique and the total transverse diameter. The inferior rotation of the heart, however, is comparatively increased. The cardio-diaphragmatic tug continues to be absent. One meter target plate distance.

Post-Operative Roentgenological Findings, October 11, 1920

The second post-cardiolysis fluoroscopic examination, nine months following the above operation, corroborated the previous observations. The heart shadows in both the oblique and transverse diameters were further decreased, the total transverse diameter now being 16.8 centimeters, while the thoracic cavity and the inferior rotation of the right side of the heart was still more pronounced. On December 14th, 1920, another fluoroscopic observation was made and it was interesting to note the depth of the excursion of the left diaphragm during deep inspiration without evidence of the "tugging" sign.

Fig. 5—Post-operative field after cardiolysis. Mrs. D., Case No. 5135, nine months following the previously described operative procedure.

oblique was decreased to 17.6 centimeters. It is interesting to note that both the oblique as well as the total transverse diameters were equally reduced 1.4 centimeters. The position of the heart continued to be slightly lower in the

In conclusion, we wish to state that the limited time at our disposal will not permit a discussion of the pericardial pathology in this case and at the same time be able to review the many radiological signs and methods employed in making a differential diagnosis to definitely determine the indications and contraindications for Brauer's operation. The fluoroscope, however, is essentially the most valuable aid in attempting to determine first of all the type of the pericardial pathology. A large heart hanging moderately high in the thoracic cavity, together with definite evidence of cardio-diaphragmatic tugging at the apex with each systole of the cardiac cycle for a distance of several centimeters, are in themselves invaluable roentgen findings and possible indications for cardiolysis.

A final examination of this patient was made fourteen months following the above mentioned operation, both from the physical and roentgenological standpoint. The combined reports of these findings show further evidence of continued physical improvement. In fact, the patient entered the fluoroscopic room dancing, apparently enjoying normal health, and spoke enthusiastically of her ability to sleep in comfort lying down, something she had been unable to do for a period of seven years. The fluorocopic examination did not show evidence of the previously observed cardio-diaphragmatic "tugging." Paracentesis has been resorted to on but one occasion during the past seven months, although previously this operation was necessary at intervals not exceeding five weeks. The above radiographic, fluoroscopic and clinical findings observed fourteen months following the cardiolysis operation, are in themselves evidence as to the value of the diagnostic methods employed and the procedure adopted

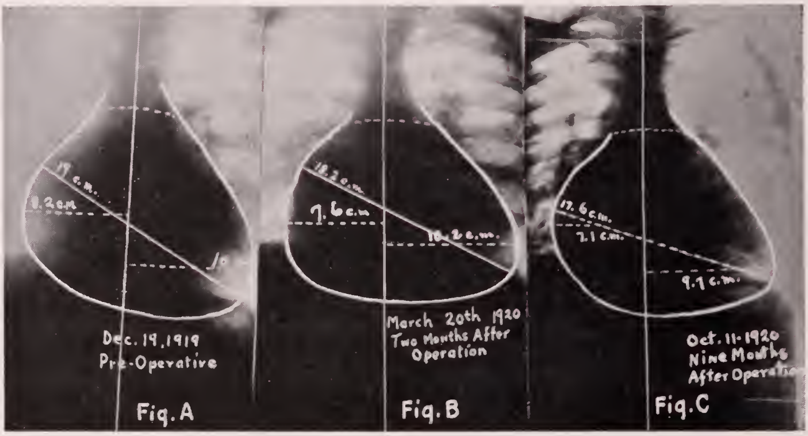

Fig. 6—Graphic comparison of the three stages before and after cardiolysis in the case just described of chronic mediastinoperaicarditis. (a) Before operation. (b) Two months following cardiolysis. (c) Nine months following cardiolysis. The size of the heart has been decreased, while the position and inferior rotation of the cardiac shadow has become progressively more pronounced.

to relieve this type of cardiac pathology.

Conclusions

1—Chronic mediastinopericarditis is a condition which, if allowed to progress, will certainly reach the stage when operative measures will prove valueless.

2—Cardiolysis is a valuable aid in obtaining relief from chronic mediastinopericarditis, provided such a measure be adopted during the early stages of this condition.

3—Therefore, an early diagnosis is primarily essential, and the roentgen ray offers the necessary advantages to the early discovery of such pathology.

4—It is likewise of equal importance that the systolic cardiodiaphragmatic tug be differentiated from the not infrequently observed slight pulling upon the diaphragmatic pleura.

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(1)—To whom I am indebted for referring this case and for the use of all the clinical data herein contained.

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*—Read at annual meeting of the Radiological Society of North America, Chicago, December, 1920.

Journal of Radiology

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Mid-Summer Meeting

EVERY meeting of The Radiological Society has certain peculiar characteristics. In a word, then, the mid-summer meeting held at Boston last month will live in retrospect for its subtle yet virile enthusiasm, for its delicate though profound inspiration —a meeting where ideals fructified, hope assumed form, and the gathering impetus of the years laid a positive urge against scientific knowledge for future achievement.

Quite simply, the mid-summer meeting served to impress on the minds of all, the distinctive part Radiologists will inevitably take in the larger career of all medical men.

Those in attendance—and they were many, because they numbered the largest registration ever recorded at a summer meeting in the history of The Radiological Society — came athirst for knowledge. Their evident sincerity of purpose, combined with an avowed respect for and appreciation of labor performed, their prompt attendance and studious mien, all served to provide incomparable stimuli for speakers and officers, galvanized past accomplishment into unequivocal promise that the progress of Radiology shall go forward unfettered.

Reviewing the two-day session briefly, it may be said that the mid-summer meeting was one at which, speaking strictly of shop, the various aspects of the newer therapeutic technique were elaborated on the physical side by such eminent authorities as Dr. N. E. Dorsey, Dr. W. D. Coolidge, and Dr. A. W. Erskine, while the clinical application of facts obtained through physical research was discussed exhaustively by Dr. James D. Murphy and Dr. A. F. Tyler. There were also many interesting and informative discussions concerning the different phases of x-ray and radium therapy and diagnostic problems in all branches of the profession.

The original papers will be published at length in future issues of The Journal.

Mention must also be made of the banquet on Friday evening, at which Dr. Patrick F. Butler of Boston so ably officiated as toastmaster, a fact which in and of itself proclaims an evening of rare good fortune. At the speakers table were such distinguished gentlemen as Dr. Harvey Ward Van Allen, president of the New England Roentgen Ray Society; Dr. Henry Schmitz, president of the American Radium Society; Dr. Arthur Carlisle Christie, president of the American Roentgen Ray Society; Dr. A. W. Barclay, representing the Roentgen Society of London; Dr. Alexander H. Pirie, president of the Canadian Radiological Society; Dr. W. D. Coolidge, Dr. Frank S. Bissell and Dr. I. S. Trostler.

It is perhaps well to record here, and to emphasize, the kindly feeling of the Radiological Profession of England toward the Radiological Profession in America, revivified so forcefully by Dr. Barclay, who stressed the value of close, personal inter-acquaintance, sketched the important work yet to be done, and bade us Godspeed.

Likewise Dr. Christie's plea for co-operation between Radiologists, between Radiologists and Physicists, between Radiologists and Clinicians is worthy serious consideration, because thereby Dr. Christie believes, much needed changes in medical practice acts, in insurance problems, in furtherance of scientific research, can be accomplished.

To our own president, Dr. Williams, and to the committee on local arrangements, especially Dr. Butler, much is due. The entire program was altogether so well balanced, the arrangements were all so thoughtfully and perfectly made, and the registration so carefully and efficiently handled, that the harmony and spirit of the ensemble engendered a wholesome spirit of good fellowship that was at once both infectious and invigorating.

No one who attended the mid-summer meeting will dispute the fact that its dominant result was an extended professional horizon, an increased vision of the potential possibilities latent in the correlated aspects of diagnostic Radiology, and an unconquerable desire to go forward in an ever widening influence of service founded on scientific fact.

Canadian Radiological Society

WITHIN the sound of that magnificent Colossus of the eternal verities—and while Gamma and Beta rays scintillated iridescently by day or mellowed in greenish hue at eventide, the Radiological Society of Canada held its first annual session at Niagara Falls, Ontario, May 31st and June 1st.

Here was symbolism! The placid waters of a thousand insignificant streams merged into a rushing compound of energy which perpetually separates two mighty nations, yet links them irrevocably as one people in a Herculean effort at mastery—the placid thoughts of individuals crystallized and energized by impact with the implacable zeal of a united profession seeking the truth.

That The Radiological Society of North America will have to look carefully after the preservation of its own laurels, those which distinguish it as a progressive organization was conclusively demonstrated.

The spirit of the Canadian organization is manifestly one which will carry it a long way toward the accomplishment of those things too often viewed as Utopian. The meeting was well attended and the program was excellent. Arrangements have already been made for publishing the papers read at the meeting in the Dominion Medical Journal.

But this is not all of the story. The Canadians planned a happy surprise, both unique and unparalleled in the annals of medical history, by conducting a two-day session at Niagara, and an adjourned two-day session at Boston in conjunction with The Radiological Society of North America, to which latter point they went by special train en masse.

To the retiring president of The Canadian Society, Dr. Alexander H. Pirie of Montreal, and to Dr. L. K. Poyntz of Victoria, who succeeded himself as secretary, there is due a very real and sincere expression of gratitude. And to the new president, Dr. G. E. Richards of Toronto, felicitations are extended over the distinct preferment of being selected as worthy the leadership of so unusual an organization.

When men undertake important things with the assurance and unbounded vigor with which the Canadians set about the formation of their Society, its first annual meeting, and the trip to Boston, there is every reason to believe they will accomplish much for their own benefit and the benefit of the medical profession everywhere.

The Radiological Society of North America is glad that among its members are most of the members of The Canadian Society, for in that fact is found a tangible basis for belief in the ultimate achievement of those things to which all aspire.

American Radium Society

DR. HENRY SCHMITZ, retiring president of The American Radium Society, performed a highly significant thing, when, at the sixth annual meeting of that Society in Boston, he invited Dr. Alden Williams, president of The Radiological Society of North America, to speak.

Every Radiologist, of course, knows that radium has a very proper place in Radiology, just as the x-ray has a proper place in Radiology.

But in the hurrying and scurrying of every day life, when demands on one's time and energies are so multitudinous that occasionally one would fain fly away and forget it all, it is easy to become partial to the one or the other; and in the ardent advocacy of the one to the exclusion of the other, obstruct the attainment of the most satisfactory results.

That is why Dr. Schmitz's act was really a significant event; it gave public recognition to the inter-relationship, one might almost say interdependency, of radium and x-ray in the intelligent treatment and obliteration of disease.

It is a recognized fact that all medical organizations should coöperate in every conceivable manner for the betterment of all by the exchange of ideas and newly discovered facts. But this coöperation too often takes the form of mere lip service; and in view of the greater necessity for intimate association and effort by organizations and societies striving to accomplish identical purposes and moved by identical ideals, it is sincerely to be hoped that the incident which is the subject of this article is but the forerunner of mutual helpfulness like which the profession has never known.

Much beneficial discussion was indulged concerning the physics underlying the action of radium on the tissues, and Wm. Duane, Ph. D. of Harvard delivered a very commendable thesis making "A Comparison of X-rays with Gamma Rays of Radium."

The meeting covered two days, the latter of which was devoted to clinical demonstrations at Huntington Memorial Hospital of the use of radium.

Dr. George E. Pfahler was elected president for the ensuing year.

A Licensing Board

THE science of Radiology has become an important factor in medical and surgical practice. Not infrequently, and with increasing occurrence, patients demand the scrutiny or treatment of their persons by men pursuing the Radiological Profession before submitting to the knife or accepting a pathological diagnosis as the basis for a course of action.

And what is the result? Simply that by its important place in the public mind, the Radiological Profession, like every other honorable profession at some stage of its progress, finds itself the father of what Theodore Roosevelt called a "lunatic fringe"—a bunch of incompetents, invincibly ignorant, but thoroughly conscienceless in their pursuit of "easy money."

It makes no difference so far as the public is concerned that the child is not their own offspring so long as it makes claim to their parentage and the Radiologists themselves do not publicly disown it. The fact is that by failing to proclaim its illegitimacy from the housetops, and to take steps forthwith to send it to a house of correction, the profession stultifies itself and provides the shield behind which these poachers on the profession can continue unrestrained their violations against common decency; provides the groundwork which they in turn pervert and use as a justification for preying on the public.

Recognition of these facts was responsible for the formation of The Radiological Society of North America and similar reputable organizations. As recognition of these same facts was responsible for the effort of the founders of The Radiological Society of North America to elevate their own standards by writing into its constitution the provision that only persons holding degrees from recognized reputable medical schools are eligible to membership.

But the mere exclusion of such persons from membership does not accomplish all that should be accomplished, all that must be accomplished if the Radiological Profession is to proceed unrestrained to its full fruition. The requirements of the Society as to its own members may serve to dignify the appellation "Radiologist" insofar as those are concerned who are rightly entitled to use it. It will, of course, indicate to such persons as know all the facts that members of The Radiological Society are competent and trustworthy diagnosticians.

But with the advent of deep therapy a new obligation is imposed on the members of the Society. They must not only keep the sanctity of their own household inviolate, but they must also guard the inalienable right of the public against assault by imposters. They must make it easy for the lay public to determine quickly and accurately the competence and reputability of every man who sets up a laboratory for x-ray diagnosis and treatment. They must provide the means by which the public can know when it submits its person to the skilled and painstaking diagnostician, schooled in searching for causes by the application of his knowledge of his own profession and of body structure and functions—and likewise provide the means by which that same public can know when it is being ravished professionally by a purely commercial x-ray photographer who "shoots" his patients without any sense of anatomy or knowledge concerning the incipiency and obliteration of disease.

To sum up: In view of their professional obligation, express and implied, Radiologists may not consistently or conscientiously say they have discharged their full duty when they have excluded the thief and rapist from their own particular organization. They must go further than that and make a sincere effort to protect the public which they serve from his operations.

All which calls for the ejaculation, "Yes, but how?"

To which there is but one answer —the creation of a permanent board for examination and licensure, with the hard and fast agreement on the part of every member of the Society that he will only employ licensed operators.

This done, and the fact made known to the public, together with the reasons supporting such a plan, a long step will have been taken toward the suppression of commercialized prostitution of the Radiological Profession by men neither worthy nor well qualified.

State Medicine

SO MUCH has been said by the press in a wholly superficial way about the immigration problem—a sort of "catch-as-catch-can" discussion of the most vital social question before the nation—that it seems almost necessary, as well as informative, to give very serious consideration to certain facts and figures, in which without doubt will be found those fundamentals on which the medical profession must build its future structure —from which, to be sure, spring those obligations and duties which the medical profession as an entity must fulfil and exactly perform.

To illustrate: If the members of the medical profession were asked simultaneously to give expression by the clock to their present and future socio-professional obligation, the result would unquestionably be a babel of tongues.

There is neither disrespect nor discourtesy in this statement. But there is in it full recognition of the fact that, under the present bucolic condition of affairs, the medical man, like most everybody else, finds himself betwixt and between, and is anxiously groping for a clear conception of the problem that will lead to a reasonable concert of opinion concerning what shall be the new order of things.

That is the reason for adherence to the declaration of purpose specified as public interest with which avowedly this discussion was begun.

And now, in order to get a correct and true perspective, it is necessary to get back behind the thing the public and the profession accept as the main issue, and try to discover causes in the long procession of events which give semblance of form and reality to the apparent demand for some form of state medicine.

No particular amount of mental brilliancy is necessary to discover that this equation is triangular in character. Given the base as that economic level incident to social subsistence, and the altitude, that social welfare which promotes physical and mental attainment, the medical profession is bound to determine the exact proportions of the hypotenuse of human progression so that it can serve effectually and intelligently.

And it is but a short step further in the process of logic, to the proposition that, the relative importance of ancestry, racial characteristics, and hereditary influences have a very incisive and precise effect on the efforts of the medical profession to accomplish a better public health by preventive methods.

Certainly no serious-minded person will question that this subject is one of utmost concern; and being of that opinion, the quest for specific data is both justified and creditable.

Following the principles laid down by Edward Grant Conklin, Professor of Biology at Princeton University, and in particular that one in which he said:

> "The best way of understanding adult structures is to trace them back in development to their simpler beginnings, and to study them in the process of becoming,"

the United States Census Figures under the heading "Foreign born population in 1910 distributed according to country of birth," when stated in detail, contain some highly interesting bases for certain conclusions, especially when taken in connection with the findings reported by The United States Surgeon General entitled, "Defects Found in Drafted Men," published in 1920. The 1910 Census shows a total "Foreign born population" of 13,515,886, distributed:

England	877,719
Ireland	1,352,251
Scotland	261,076
Wales	82,488
Norway	403,877
Sweden	655,207
Denmark	181,649
Netherlands	120,063
Belgium	49,000
Luxemburg	3,071
Germany	2,501,333
Switzerland	124,848
France	117,418
Portugal	59,360
Spain	22,108
Italy	1,343,125

Russia	1,602,782
Finland	129,680
Austria	1,174,973
Hungary	495,609
Roumania	65,923
Bulgaria	11,498
Serbia	4,639
Montenegro	6,374
Turkey in Europe	33,230
Greece	101,282
Europe not specified	2,858
French	385,083
Other	819,554
Newfoundland	5,080
Cuba	15,133
Other	32,502
Mexico	221,915
Central America	1,736
South America	8,228
Japan	67,774
China	56,756
India	4,664
Turkey in Asia	59,729
Asia not specified	2,591
Africa	3,992
Australia	9,035
Oceanic Islands—Pacific	2,415
Oceanic Islands—Atlantic	18,274
Total	13,515,886

And this is not all, for the Census in question, as is true of all Census figures, was compiled as of date April 1st, 1910. There must, therefore, be added the immigration statistics for the year 1910, given by the Immigration Department as 1,041,570, and distributed as follows:

Austria Hungary	258,737
Italy (including Sicily and Sardinia)	215,537
The Russian Empire and Finland	186,792
British North America	56,555
England	46,706
Germany	31,283
Ireland	29,855
Greece	25,888
Sweden	23,745
Turkey (including Serbia, Bulgaria and Montenegro)	23,142
Scotland	20,115
Mexico	18,691
Norway	17,538
Turkey in Asia	15,212
West Indies and Bermuda	11,244
Verda and Azore Islands	8,299
Netherlands	7,534
Denmark	6,984
Belgium	5,402
Switzerland	3,533
Spain (including Canary and Belearic Islands)	3,472
Japan	2,720
South America	2,151
Roumania	2,145
Wales	2,120
China	1,968
Other Asia	1,937
India	1,696
Central America	893
Europe not specified	151
Total	1,041,570
	13,515,886
Making a grand total of	14,557,456

Nor is this all. Congress has lately passed an emergency immigration bill limiting immigration into the United States during the next fourteen months to 3% of the foreign born population resident in the United States in 1910. Reduced to simple terms, that 3%, using the Census and immigration figures quoted as the basis of calculation, will permit the entry of approximately 450,000 immigrants in the United States during the next fourteen months. This means that the immigration for the period established will be forty-two and one-half per cent of the total immigration for the year 1910 and sixty-six and two-thirds per cent of the total immigration for the fiscal year ended June 30, 1920.

Using the scalpel of analysis for a little further separation, it is discovered that three per cent of the 1910 foreign population will permit the entry into this country during the next fourteen months of 75,000 Germans, 48,000 Russians, 40,000 Irish, 40,000 Italians, and 35,000 Austrians as the predominating races. In addition 210,000 more may be admitted distributed among a score of other races.

Nor is this all. The census figures include only those persons actually born in foreign countries. They take no account of offspring of foreign parents, even though those same parents may have been in the United

States but twenty-four hours at the time of delivery.

The figures quoted, a grand total of 14,557,456, must be multiplied three and a half times at least, to get a true picture of the medico-physico-economic problem at the present time. This is necessary because of high birth rate and additional immigration since 1910. Our national population is approximately fifty per cent foreign, a conclusion supported by the Surgeon General and visualized in a graph found in the forepart of the compilation already referred to.

That the facts disclosed by the Surgeon General were disturbing agencies in the minds of those men charged with the responsibility of a proper prevision for, and administration of the public welfare, is evidenced by the passage of this emergency immigration bill.

Whether Congress was not suffering from an acute case of "Three per cent sympathetic opthalmia" in disposing of so important a problem on this basis, may be somewhat of an open question, as will more fully appear hereafter in the critical processes of an exact analysis.

The point to all this is that there is a very intimate and important connection causally between our immigration problem and our public health problem. Of course, the medical profession realizes that fact. Of course, the medical profession knows that the public health problem is the larger, in fact, the inclusive problem. And knowing these things, no member of the medical profession will be heard to say that the scaling down or total abolition of immigration into the United States will in and of itself accomplish that state of public health to which the profession aspires.

But a clear conception of the relation between these two things, as well as a restatement of the motivating factors which lie underneath the health question, will furnish the groundwork for a long forward step. This on the assumption that the old rule which was learned at mother's knee—"An ounce of prevention is worth more than a pound of cure"—still holds good. That is the purpose of this and succeeding articles on this subject.

A Step Forward

IT is axiomatic, perhaps, that the one outstanding purpose of such organizations as The Radiological Society of North America is to promote the development of Radiology in order that it may be of greater scientific value to humanity. That, of course, means that the Society stands ready and willing at all times to encourage scientific research, to give by every honorable means stronger impulse to professional ideals, to procure for the labors of scientific men increased facilities for the conduct of their experiments, and to provide more universal recognition of, and usefulness for their accomplishments that their labors shall not have been in vain.

The progress of x-ray science during the past decade is one of the notable achievements. But there is now, as in every other occupation and profession, a very great need for a new impetus; an impetus which is not born of the vague enthusiasm of the dreamer, but which springs from the calculating mind of the expert as he applies his reasoning faculties and perceptive abilities to practical analysis and calm judgment.

Many such men have been steadily at work for a number of years in secluded laboratories. But the profession generally has had no means of knowing their aspirations or the direction which their labors assumed except through the unreliable channels of gossip, the vague and indefinite whisperings of "men on the inside," or the finished product which embodied the secrets of their souls when it was offered for sale.

Doubtless, it will take a long time and a hard fight to break down the spirit of reserve which at the present moment infests not only the research laboratories of the manufacturers of equipment for purely commercial reasons, but also most, if not all, of the publicly supported institutions of research. Speaking frankly, however, we see no value in that sort of thing. It is a well known rule of law and evidence among the more adept patent counselors that the more a discoverer displays his find and discusses it with whomsoever he will, the better chance of proving his right thereto because of the number of witnesses at his disposal, provided, of course, he is not himself guilty of laches.

That is aside from the purpose of this article, though perhaps it may serve to indicate some of the reasons why our emotions are somewhat mixed as we approach the problem of bringing these scattered forces into more harmonious relation. Greater men than we have attempted the job and fallen in despair. But we are thoroughly resigned, hope beats strong in our breast, and duty beckons us proceed with measured tread to the end that our protestations of devotion to scientific progress may not "become as sounding brass, or a tinkling cymbal" in the eyes of the world.

Believing sincerely in the efficacy of complete coöperation between Radiologists and the manufacturers of x-ray equipment and apparatus, and such other aids and instruments as give reality to the diagnostic possibilities and healing powers of x-rays, The Journal has created a department which will be devoted exclusively to impartial discussion concerning new equipment, projected and completed. This discussion will be undertaken, in all cases, from the scientific side in its relation to the profession, and with cognizance of the hazards which lie in the path of those persons engaged in original research. While we shall always strive to be tolerant, yet we shall hold firm in our insistance that those instruments and appliances which do not measure up to the ideals of the profession be scrapped and a new effort made to attain that result. In every case, full credit will be given, where credit is due, to the particular man or men devising a method or instrument applying more beneficially those previously discovered properties or opening the door to the proper and scientific use of latent and now unemployed energies.

We believe, we hope we speak for all reputable manufacturers, physicists, and Radiologists when we say that it is their desire this department of The Journal be conducted without commercial restraint and absolutely free from the debilitating influences of petty jealousies and personalities.

Such a department, maintained on such a basis, should, and we believe will, be of incalculable benefit to everybody in any wise concerned with the development of the x-ray diagnostically or curatively. It will exert a profound corrective as well as protective influence, and stand as a monument to the scientific exploration of men zealous in the performance of duty and jealous of their reputation for honesty of purpose.

So mote it be.

New Equipment

FISCHER "DE LUXE" DENTAL UNIT

THE dentist and orthodontist particularly, as well as radiographers enjoying a reasonable amount of dental work, will find a great many points in favor of the Fischer "de Luxe" Dental Unit, manufactured by H. G. Fischer and Company, Inc., of Chicago.

There are dials and indicators at every point controlling the tube arm, and a fixed seat is provided, so that if the operator will make proper record on each patient's card, an exact duplication of angle and posture can be made at any future examination. This is often of the utmost importance. This unit is also equipped with cut-off switch, auto transformer control, volt meter, milliampere meter, automatic timer, and a switch throwing the current into the tube. The unit is compact, occupying 21x22 inches of floor space, and is mounted on large free rolling double castors.

CAMPBELL "CLINIX" X-RAY PLANT

FOR the Radiologist who is constantly looking for the most compact yet complete equipment, the Campbell "Clinix" X-ray Plant is worthy consideration.

With a motor driven tube tilt table, to the under side of which is attached the transformer, it combines all the appliances requisite for radiography and fluoroscopy, and eliminates all overhead wiring.

In gastro-intestinal therapy the diagnostician secures the position of the patient by tilting the table—the patient is relieved of all physical exertion and the mental strain incident to compliance with instructions.

WAPPLER FLUOROSCOPIC TRANSFORMER

THERE is a big advantage in the convenience and diverse operability of a small transformer and converter of sufficient capacity to meet fluoroscopic requirements. This appears to be the chief purpose of the Wappler Fluoroscopic Transformer and Control.

Such an apparatus is particularly valuable in diagnostic work, because it provides a separate power unit. It is also an ideal apparatus for the general practitioner who desires to do both radiography and fluoroscopy.

HUGUENOT TREATMENT TIMER

PROBABLY one of the most serviceable devices lately perfected for the benefit of Radiologists and Clinicians is the Huguenot Treatment Timer, manufactured by McKenzie Engineering Company of New Rochelle, New York.

This treatment timer cuts into the primary circuit, with a time dial, so that by moving the indicator to the treatment period desired the current is automatically cut out when the indicator reaches zero, or, stated otherwise, when the time period has run.

The outstanding advantages of this device, in treatment work, are accuracy, safety, and dependability, so that the Radiologist or Clinician may give other patients attention while the machine is in operation.

Such a device is invaluable and meets a professional need, as evidenced by the many makeshifts in use.

CAMERON'S SURGILITIES

OF particular interest to the surgeon is Cameron's set of Surgilites—consisting of five lamps of various sizes and shapes to meet every operating condition.

The Surgilites are distinct from Cameron's Diagnostoset, already in use by a great many diagnosticians.

Complete information concerning the Surgilites will appear in a later issue. It is sufficient recommendation, however, that they have been unqualifiedly endorsed by such men as Dr. Bevan, Dr. Billings and Dr. McArthur.

PATTERSON INTENSIFYING SCREEN

WITH the advent of the Potter Bucky Diaphgram the need for intensifying screens is greatly accentuated.

While the principle of intensification is not new, double screen technique is comparatively new.

Mottling and grain are the most frequent faults of intensifying screens. A good screen must be coated with a chemical combination of great permanence and stability so that the screen may last indefinitely and be unaffected by heat, light and dampness. A good screen should not require any seasoning.

The idea of "Double-screen technique" is to place the film or plate between two intensifying screens—the one fastened to the bottom of the cassette, the other to the lid or top. As the screen in the bottom of the cassette will be the one nearer the tube and between it and the negative, it necessarily must be of such a structure as not to interfere seriously with the action of the x-rays on the film or plate and on the other intensifying screen.

It was to meet these limitations that the Patterson "Special" was developed. This screen is made of the same fluorescent chemical as the Patterson "Standard." It has the same fine, smooth, glossy surface, and in addition, is thin and pliable.

In "Double Screen Technique" Patterson uses a combination of a "Standard" screen and "Special" screen. The one at the top is Patterson "Standard" and the one at the bottom is a Patterson "Special."

In cases where great penetration is required, as in radiography of the spine and head, double intensification is almost indispensable to satisfactory results.

Abstracts and Reviews

The purpose of this department is to furnish its readers a succinct epitome of current interesting articles and books. We will be glad to review articles which have been presented for publication or any manuscript or book sent us.

New Conceptions Relative to the Treatment of Malignant Disease, With Special Reference to Radium in Needles. William L. Clark, Philadelphia. Paper read before the General Meeting of the Medical Society of the State of Pennsylvania, Pittsburgh Session, October 5, 1920.

THERE is much yet to be learned in the treatment of malignant disease. But more can be accomplished now by combined methods than by surgery alone, as in the past. Operative surgery, electrothermic methods, radium and x-rays, alone or in combinations, are the most effective agencies.

Basal cell epitheliomata or rodent ulcers involving the face, especially about the nose, eyelids, etc., seldom metastasize. Total eradication by any method will cure. Squamous-celled and glandular types metastasize early and are hard to cure. The most difficult are the malignancies of the lips, buccal surface, tongue, floor of mouth, alveolus, antrum, tonsils, soft palate, pharynx, epiglottis, larynx, esophagus, stomach, breast, uterus, rectum, etc. Block dissection of glands involved and uninvolved is insufficient. The lethal action of radium, and in a lesser degree of the x-ray, upon malignant cells of all types has been proven in the laboratory and in practice. Undue exposure causes stimulation. Eighty to 100 mg. of radium will kill cancer cells in seven hours. To get a lethal dose at a sufficient depth, the gamma rays are essential. Immature cells are most susceptible. On healthy cells small doses cause stimulation, larger ones congestion and even fibrosis. If the dose is too large, sloughing occurs. With proper exposure there will be inflammatory reaction, which will subside slowly. If the dose has not been too great the blood supply will be cut off and a fibrous scar remain. Radiation effects depend on quantity of radium, filtration, distance, and length of exposure. Radium should be given in sufficient quantity before operation where possible. A week should elapse. At least three cross-fire treatments should follow operative procedure. The x-ray, less potent, may be used to supplement this treatment.

Most physicists and radiumologists believe there is but little choice between the action of radium element and the emanation. The emanations decay and must be freshly prepared to meet expectations.

The adaptation of hollow metallic needles, each containing radium salt, representing a known quantity of radium element, has revolutionized radium technique. The author uses needles containing 5 to 10 milligrams. These are used for insertion into malignancies, growths and glands, or into an organ in the peritoneal cavity after the abdomen has been opened, or otherwise.

Radium needles are particularly adapted to growths too large for outside treatment by capsule or plaque. As many needles as necessary may be inserted 20 to 25 mm. apart, to any depth. The needles do not need to be used alone. They may be used in any combination. When inserted, the entire radiation is used in the tissue surrounding it. Filtration by selected metals is essential.

One case of pyloric cancer was treated by operation and direct insertion of radium into the pylorus. It is now one year since treatment and the patient is alive and well. Another case treated in the same way improved for a time, but later died.

The needles vary in length from 20 to 30 mm. In thickness they are about 2mm. The needles are made of alloy of steel and nickel. They may be introduced by hemostat or special application. A braided silk thread is always attached to the needle so that it may be withdrawn easily from the issue and to obviate losing the needle. Local anesthesia by two per cent novocaine and adrenalin is ordinarily used. If many needles are to be inserted a general anesthetic may be used.

Clinical experience disproves the objection made by some that secondary radiation causes sloughs and irritation. The soft, moist tissue may absorb the irritating rays; anyway the needles may be left in for twenty-four hours without causing sloughing. Of course, tissues of low vitality may break down if the dose is not accurately gauged. No damage has ever been known to arteries to cause bleeding. In some cases the needles have been left in for forty-eight hours and no sloughing has occurred.

Radium needle treatment should be given in a hospital under the strictest sterile conditions. In carcinoma the needles are left about eighteen to twenty-four hours; in sarcoma, about twelve hours. The treatment is repeated, if necessary, in six weeks.

Radium in needles has been used for too brief a time to permit of final analysis. This is a preliminary report. The results have been encouraging. It has been used for two years. Some malignant growths seem more resistant than others. One must guard against over-exposure. If there is no response in three or four full radium treatments, the lesion cannot be favorably influenced by further treatments.

Physicians and attendants must use great care in the handling of radium. Never once must one grow careless. Radium applicators should be handled with forceps. If a lesion can be treated more effectively and satisfactorily by some other method, no temporization should be allowed. All methods should be used, the safest first. In many cases radium needles will be the best.

E. W. ROWE.

Four Deaths from Working at the Radium Institute. Journal A. M. A., p. 1360, May 14, 1921.

WITH the facts shrouded in mystery, there are reports of three deaths from working in the London Radium Institute. A sister and two laboratory workers died of aplastic anemia. This is a newly recognized danger to the workers with radium and roentgen ray. Another death from the same cause occurred when Dr. Ironside Bruce succumbed. At the Radium Institute every precaution is taken to safeguard the staff. No nurse or attendant works longer than three months with radium. This period is followed by rest or a change in duties. All workers have two free days per week in the open. Blood examinations of every person employed in the Institute are made at frequent intervals. On the slightest show of anemia work is suspended. Radium is always handled with special instruments, but even from touching the apparatus the skin peels off and the nails become impaired. Fourteen persons on the nursing staff are employed in the direct application of radium. They carry on without any complaints.

E. W. ROWE.

Studies in Roentgen Ray Effects. W. Nokahara and J. B. Murphy, New York City. Journal Experimental Medicine, p. 433, April 1, 1921.

THE resistance of mice to transplanted cancer can be definitely raised by proper roentgenization of the lymphoid tissues. Heat and the injection of homologous living tissue produce more stimulation. The resistance in mice treated by roentgen rays is raised, but probably not as much as by these two other methods.

E. W. ROWE.

Roentgen Ray Indications for Tooth Extraction, and a Diagnostic Chart. Byron C. Darling, New York City. Journal of Dental Research, Sept., 1919.

THERE is no better way to diagnose teeth conditions that may need extraction than by the roentgenograms. Tooth extraction is not done as often as it should be. No other method will cure dental abscesses or remove the focus of systemic disease. Preferably the roentgenologist should make the interpretation, because he has his own viewpoint and cannot be biased by the dental work done in the past or by that to be done in the future. Commercial laboratories offer no professional service. Even a dentist cannot do his own x-ray work. That requires all the time of a competent man. The roentgenologist has a special training of his own which fits him for his work. The roentgenologist assumes a share of the responsibility which is an advantage to the patient. The writer's graphic chart is offered, which is good if the one who uses it is neat and accurate in placing his notations upon the space provided.

E. W. ROWE.

The Scope of Radiotherapy in Disease of the Skeleton. Isaac Levin, Clinical Professor of Cancer Research, New York University and Bellevue Hospital Medical College X-Ray Bulletin, Hospital Division, U. S. Public Health Service.

REPAIR in tissue is accompanied as a rule, by changes in the normal tissue. Bone changes are different from those in other tissues. In bone there are special cells for regressive processes called osteoclasts, and for progressive changes they are called osteoblasts. Osteoporosis occurs just as in any tissue reaction to an injury from inflammation or a growing tumor. Osteosclerosis is the tissue reaction to the irritation, or Nature's method of healing, of overcoming the pathological process. Both processes may be present, and one of them so predominate that the other is difficult to see.

In skeleton metastases of carcinoma these two reactive processes are present. Usually the osteosclerosis is very imperfect and the spontaneous healing imperfect.

The writer has demonstrated that radium and roentgenotherapy may enlarge the healing power, destroy a part of the malignant tumor, and surround it with newly formed bone. Two cases are presented which illustrate this action of radium on tumors of the skeleton. One was a patient with a tumor of the breast and a pathological fracture through the humerus. This was treated with radium. In two weeks' time roentgenograms were made showing abundant callus. In the other case a malignant tumor was excised from the tibia. Radium treatment stimulated new bone formation and in one year the cavity was filled.

Dr. Levin thinks that radium stimulates a rapid formation of new bone and that callus occurs more quickly than in ordinary traumatic fracture. He thinks radium will hasten callus formation in fractures of all kinds and in bone grafts.

In the discussion of the relative value of radium and roentgen rays he thinks that radium is superior for this purpose, but that roentgenotherapy may in time, due to improvement in technique, approach it.

E. W. ROWE.

The Roentgenologist and the Hospital. Byron C. Darling, New York City. The Modern Hospital, December, 1920, Vol. xv. No. 6.

"FOR the hospital desiring competent roentgenology service — an indispensable aid in obtaining accurate diagnoses, there is but one course open: the development of a well-equipped x-ray department in charge of a physician who is thoroughly acquainted with the technical and photographic phase of this work, as well as the medical possibilities and limitations of the x-ray examination. To secure this type of service the hospital should allow sufficient funds to permit its development, and establish a scheme of remuneration based on a consideration of the different classes of patients—the roentgenologists receiving fees as do physicians and surgeons, and sitting with the medical board whenever it meets."

This is the author's own abstract of a thorough and frank discussion of the relations between the roentgenologist and the hospital. His discussion is summarized as follows:

1. The x-ray department is most important, since diagnosis is assisted, unnecessary operation avoided, the stay in the hospital shortened, the bed capacity raised, and the cost of maintenance lowered.
2. A competent medical man should be placed in charge, with sufficient funds to develop the department.
3. Salary or percentage basis is unsatisfactory. Both methods have questionable ethical and business values. He should receive fees from private and workmen's compensation patients, and do the charity work without charge.
4. To have technicians in charge of the x-ray department without medical supervision is contrary to sound practice and unfair to the medical roentgenologists.
5. The hospitals should uphold medical roentgenologists by insisting upon proper medical supervision.
6. Remuneration may be ideally arranged on the basis of classification of patients: private, workmen's compensation, and charity patients. The roentgenologist would receive fees from the private patient just as a visiting physician or surgeon does, adjusting the fees to the patient's means; he would give free service to the charity patients; he would charge workmen's compensation cases at a standard rate.

7. The roentgenologist should receive the title of visiting or associate physician, and be given a seat on the medical board.

E. W. ROWE.

X-Ray Treatment of Epithelioma with Thin Filters. John Remer and W. D. Witherbee, New York Medical Journal, December 11, 1920.

"FILTERED roentgen rays, from the viewpoint of dosage, require only twice the time for a given number of skin units at full distance as at half distance, whereas in unfiltered dosage four times the time would be required to produce the same effect."

Results in the treatment of basal cell epithelioma are most satisfactory. They seldom metastasize, but remain local. Neglected cases with the mucous membrane invaded, showing marked induration, do well with the unfiltered treatment. This applies more particularly to the ulcerative type. The lesion and one half to three-quarters of an inch of surrounding tissue should be subject to radiation.

The following technique is recommended: Filter of one-quarter of a millimeter of aluminum, six-inch gap, five milliamperes, ten-inch distance, and time varying from three to seven minutes. The filter may be up to three-quarters of a millimeter in thickness, just so the total dose of rays is from one and one-half to two and one-half skin units.

The advantages are:

1. Treatment can be repeated in two to three weeks' intervals without local reaction.

2. These treatments at short intervals are more favorable because they have a direct action on the malignant cells while undergoing mitosis. Moderate doses at frequent intervals to reach the young embryonic cells are the main objects to attain.

3. There is less danger from the size of the dose because the filtered ray is not too great in quantity.

4. This method is applicable for use on the smaller (2 k. w.) machine.

E. W. ROWE.

Arithmetical Computation of Roentgen Dosage. George M. MacKee, New York Journal of Cutaneous Diseases, Dec., 1919, vol. xxxvii., pp. 783-789.

THIS is an excellent summary of the principles involved in superficial therapy. For those wishing to master cutaneous therapy the exposition here given is essential. The so-called indirect or electrical method of estimating the roentgen dose antedates all other methods. The introduction of interrupterless transformers and the Coolidge tube have made this method more reliable and simple than the direct method, the use of pastiles and photographic paper.

The discussion of electrical measurement, biological standardization and radiometric standardization is followed by concrete examples to show how the formula may be applied. There is nothing new in the paper, but it is a complete resume and exposition of dosage as applied to cutaneous therapy. It will be a good reference for study and a guide to one wishing to be exact in the treatment of skin diseases.

E. W. ROWE.

Pathology of Rheumatoid Arthritis in Relation to X-Ray Findings. Assistant Surgeon S. Woldenburg (R), U. S. Public Health Service X-Ray Bulletin, May 15, 1921, p. 75. ......

THIS paper contains an excellent description of rheumatoid arthritis from the roentgen, clinical and pathological standpoint. The author presents a case which has been all worked out. But his thesis and his conclusions are in direct variance in an unusual manner. He says, "The x-ray as an aid to diagnosis in rheumatoid arthritis has proven of little value." In conclusion—"This case was one of the instructive types and yields sufficient evidence to show that the x-ray findings in this affection are of little positive value." The entire discussion shows that the pathological changes in rheumatoid arthritis are pronounced and definite. The roentgen findings are clear-cut and of great value in making a diagnosis. In fact, from his own description they appear almost pathonomonic. Why the writer does not claim more for the roentgen findings is not apparent in his paper.

E. W. ROWE.

BOOK REVEW

Injuries and Diseases of the Bones and Joints. Their Differential Diagnosis by Means of the Roentgen Ray. By Frederick H. Baetjer, Associate Professor of Roentgenology,

Johns Hopkins University; Roentgenologist to the Johns Hopkins Hospital; and Chas. A. Waters, Instructor in Roentgenology, Johns Hopkins University; Assistant Roentgenologist, Johns Hopkins Hospital.

THIS is a moderate sized volume, containing 332 radiographic reprints, carefully selected for the purpose of illustrating the various points in differential diagnosis.

The authors emphasize the importance of a thorough knowledge by the radiographer of the histology, anatomy and physiology of normal bones, all of which may have to be considered in arriving at a diagnosis in pathological conditions.

Attention is called to the fact that after all in the roentgenological study of bones and joints there are only two main points from which conclusions can be drawn, that is, bone destruction and bone production.

The following list of the subjects covered indicates the inclusive character of the book—normal bones, epiphyses, congenital dislocations, acquired dislocations, bone infections, joint lesions in children, joint lesions in adults, bone tumors, the spine, abnormalities, dystrophies.

The chapter on joint lesions in children and on bone tumors should be particularly commended, as they show a keen sense of the value of roentgenological interpretation and deductions.

The book is a treatise on diagnosis exclusively, and technique is not considered; neither does it offer a review of literature, its purpose being the presentation of a concise, complete, original contribution to the value of roentgenological study of bone and joint diseases.

The classification of bone tumors with the presentation of a method of elimination in arriving at a diagnosis shows a practical common sense method such as could only be developed by men of long experience in teaching.

This is one of the best American contributions to Roentgenology and meets a long felt want.

B. H. NICHOLS.

Roentgen Ray and Tuberculosis in Infants and Children. Frederick W. O'Brien, Forrest B. Ames. Journal A. M. A., May 28, 1921, p. 1474.

TUBERCULOSIS is recognized as a curable disease if its treatment is begun soon enough. The use of the roentgen ray is now a routine endorsed by all clinicians. Forty-four cases were studied in the Boston Consumptives' Hospital. History, clinical findings, sputum and roentgen studies formed the basis for analysis.

As a result it was found that the von Pirquet and intracutaneous skin reactions were reliable guides. In twenty-six out of thirty-six positive cases the roentgen ray disclosed the site of infection to be intrathoracic. D'Espine's sign was less reliable, occurring in only eleven cases out of the twenty-eight found positive by roentgen ray. In three cases was the sputum found positive. Fourteen cases of chronic pulmonary tuberculosis of the adult type were found. This number is greater than usually considered as occurring. In fifteen cases clinically negative, the roentgen ray sign showed marked structural changes suggesting strongly tubercular infection.

E. W. ROWE.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC. REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of Journal of Radiology, published monthly at Omaha, Nebraska, for April, 1921.

STATE OF NEBRASKA } ss.
COUNTY OF DOUGLAS }

Before me, a Notary Public in and for the State and County aforesaid, personally appeared Herbert S. Tyler, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Journal of Radiology, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Radiological Publishing Company, 511 City National Bank Building, Omaha. Editors, Dr. Bundy Allen, Iowa City, Iowa; Dr. B. H. Orndoff, Chicago, Illinois; Dr. A. F. Tyler, Omaha, Nebraska; Dr. E. W. Rowe, Lincoln, Nebraska. Managing Editor, Dr. A. F. Tyler, Omaha, Nebraska. Business Manager, H. S. Tyler, Omaha, Nebraska.

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HERBERT S. TYLER,
Business Manager.

Sworn to and subscribed before me this 14th day of April, 1921.

(SEAL) HAROLD F. KEMP,
Notary Public.

The JOURNAL OF RADIOLOGY
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VOL. II AUGUST, 1921 No. 7

Pathology of the Mouth and Surgical Principles of Its Removal

Wm. L. Shearer, B. S., M. D., D. D. S.
Omaha, Neb.

THE definite establishment of the relationship between mouth infections and systemic disease has fixed a new responsibility on all of us. The sequellae following in the wake of pathological processes are so far-reaching that one can not treat the conditions, surgically, without considering thoughtfully, the different kinds of bacteria usually present. This phase of the subject will not be treated in this paper, for the reason that it has been thoroughly covered by Rosenow, Billings and others, and is easy of access to all. However, I wish to quote from Billing's work on Focal Infection, the following pages 125-126 and 135-136:

"The focus of infection which undoubtedly causes the streptococcus veridans bacteremia and chronic malignant endocarditis is often alveolar abscess. Of this we have had numerous clinical examples. Coincident cultures from the alveolar abscess and from the blood have yielded strains of the streptococcus veridans. When these nascent cultures were intravenously injected into animals, typical endocardial lesions resulted. Doubtless a focus containing this streptococcus may be located in the tonsil or nasal sinus or elsewhere, which may be the cause of the cardiac infection.

"In mild rheumatic fever, and in chronic infectious forms of arthritis the focal cause should be removed early. Even in these mild and chronic types of infections, arthritis and myositis, one occasionally witnesses serious results.

"A girl of eighteen, who had suffered for a year from a disabling chronic polyarthritis and myositis, due apparently to multiple chronic alveolar abscesses, had many teeth extracted and the alveolar abscesses curetted. Streptococcus bacteremia developed with acute hemorrhagic myositis, pleuritis, pericarditis, myocarditis with submucous and subcutaneous hemorrhages and death. The streptococcus isolated from the muscles, when injected intravenously into animals caused rheumatic arthritis, myositis, endocarditis and pericarditis."

"A girl of ten, a patient in the Presbyterian hospital, suffered from a mild arthritis and myositis. The family physician had the enlarged and apparently infected tonsil removed. Immediately there developed an acute general myositis, which gradually changed to a non-febrile type with much deformity, due to the shortening of the muscles. Experience of this kind affords proof of the focal origin of certain systemic conditions and that the operative technique of removal of foci of infections should be of a kind which will

Figs. 1, 2, 3, 4, illustrate the complete external alveolectomy.

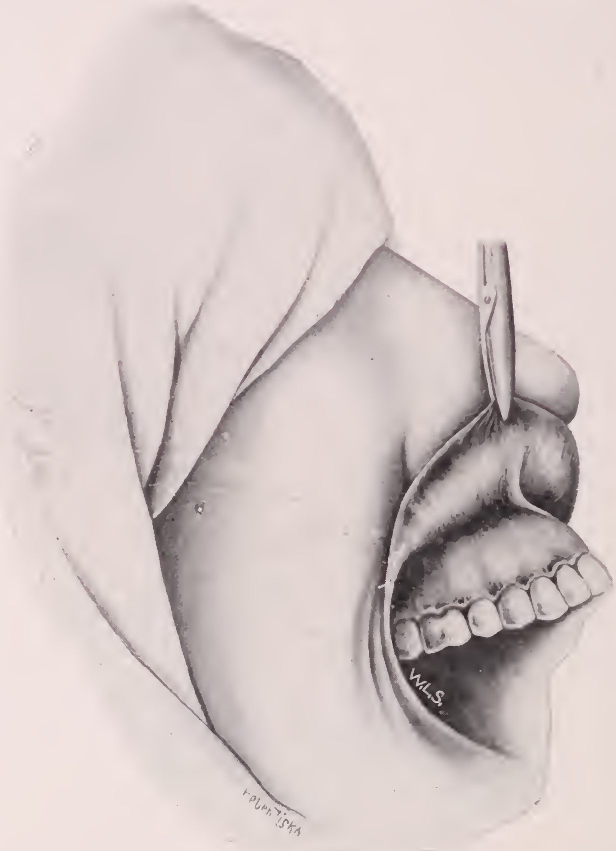


Fig. 1—Diagramatic of the superior maxillary. Assuming that the pathology of the teeth and body of the jaw requires the removal of all the teeth.

not overwhelmingly inoculate the patient. In acute rheumatic infections, the removal of the original focus, usually tonsilitis may not prevent future attacks, for the streptococcus rheumaticus may occur in other focal sites, notably in alveolar abscesses and maxillary sinusitis. The prompt removal of every recognizable local infection of the head in people who suffer from repeated attacks of acute rheumatism may prevent the disease. This result, experience of recent years has conclusively proved."

In this connection it is important to note the lymphatic drainage of the jaws. So far as I am able to learn, the lymphatic system of the jaws was presented first by Dr. Frederick B. Noyes and Kaethe W. Dewey, of Chicago, before the 69th annual session of the American Medical Association, June, 1918, from the standpoint of histology only. Then, in December, 1918, "The Lymph Drainage of the Jaws," from the standpoint of focal infection was presented by Dr. Albert D. Davis before a meet-

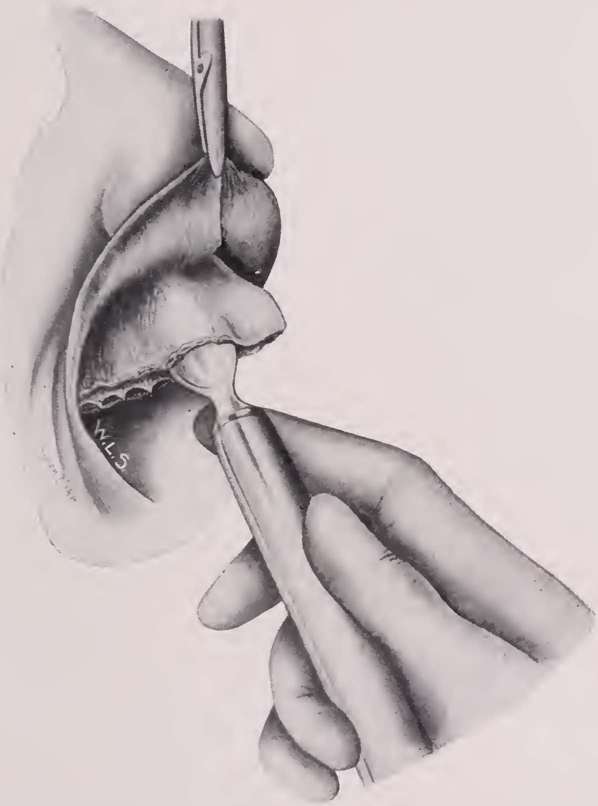


Fig. 2—Illustrates case after the removal of the teeth, the mucoperiosteum denuded from the bone and lifted upward and above the root ends of the teeth.

ing of the Anatomical Society of the faculty and students of the University of Nebraska College of Medicine. In April, 1919, I read a paper on the same subject before the Omaha Roentgen Society.

sense than a menace to the health. Not enough serious thought has been given to mouth pathology. Not enough thought has been given to surgical principles dealing with certain pathological problems of the mouth. The

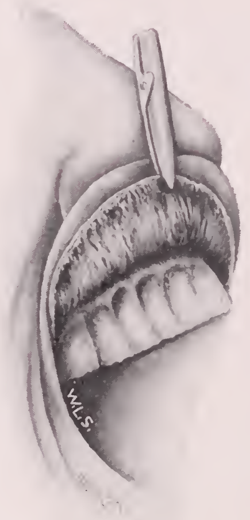


Fig. 3—The muco-periosteum reflected up to the root ends of the teeth and the external alveolar plate along with diseased tissue attended to under the eye. The lingual, buccal, gingival mucosa trimmed. No jagged bone edges are left.

Fig. 4—The muco-periosteum carried back into position and sutured with horsehair. I advise continuous horsehair suture in the hands of those experienced, either buttonhole or over and over stitch.

The members of the allied specialties of medicine are awakening to the fact that better management of the morbid processes of the jaws is necessary. It certainly is up to the specialist of dentistry to devise means of successfully treating these conditions of the jaws. Unfortunate as the loss of certain or all the teeth may be, it is entirely justified when combating such foci which can be considered in no other

surgical technique has been sadly neglected. Too much operating has been and is being done without a sufficient knowledge of the pathology present. Too often the pathology is not removed, and as a consequence, if recovery followed, it was in spite of us and not because of us. As a result, many have discredited the true relationship of mouth infection because of the unhappy results. Great good will result from our coöperative work when we better understand pathology of the mouth, and better and more thorough surgical principles are employed. It has been my privilege to observe both the clinical and operative end results in a large series of cases representing the various systemic manifestations with which mouth infections seem to be associated. When

Figs. 5, 6, 7, illustrate partial external alveolectomy.

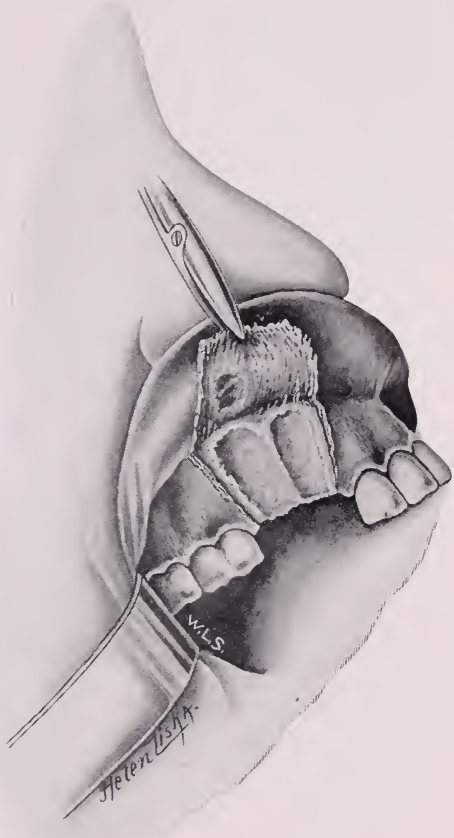


Fig. 6—Partial external alveolectomy ready to close.

we critically examine the end results of the old operative procedures, we are convinced that they have failed in their objective. We have been content, heretofore, with the mere extraction of diseased teeth. The inefficiency of this procedure, I think, has been definitely proven. Radiograms taken some time after the usual methods of extraction had been employed disclosed unmistakable evidence of failure in our efforts to remove disease. Remaining osteomyelitic

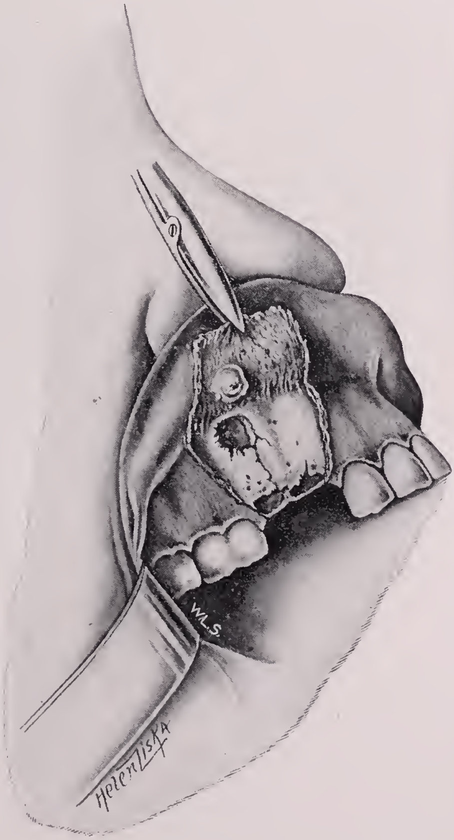


Fig. 5, shows conditions of the bone often revealed after the flap is laid back, the granuloma attached to the mucoperiosteum. It is necessary in many instances to employ the knife in order to remove the diseased tissue.

areas, granulomata, etc., have been definitely shown in several cases when all the teeth had been removed ten, fifteen or even twenty-five years previously. These were proven at operation. Furthermore, the systemic reactions following these procedures, especially when the extractions had been numerous, and the curettements extensive, were at times alarming, as shown by the case cited by Billings above. The tooth sockets drained for days and weeks with a foul discharge, which oozed from the reddened, inflamed gums and responded slowly to any form of treatment. In addition to the local disturbance, systemic reactions frequently occurred, which were manifested by chills, fever and lassitude, which would last for days. Increase in the leucocyte count was common. It required months for the alveolar process to become smooth enough for the comfortable wearing of a plate.

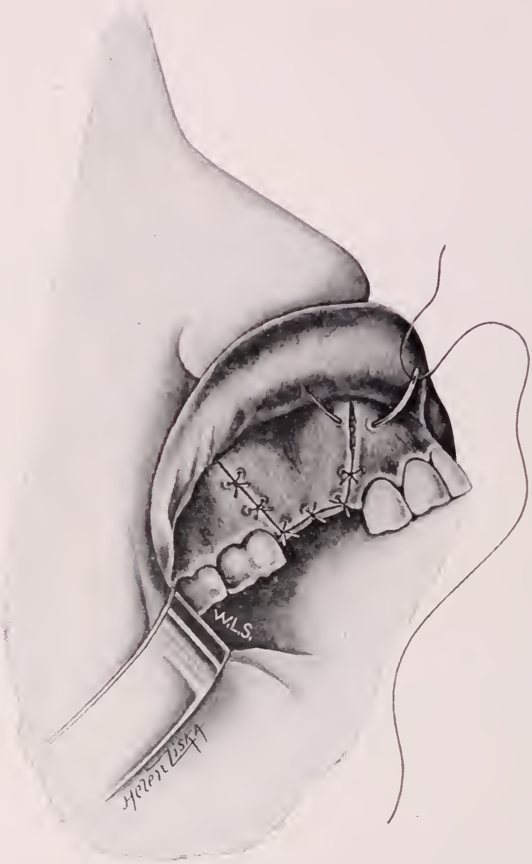


Fig. 7—Replacement of the muco-periosteal flap into proper position.

These failures and complications can be easily explained when we appreciate that in treating chronic dento-alveolar abscesses and their contiguous diseased areas we are dealing with chronic osteomyelitis of the jaw bone and that the major portion of the pathology is in the bone and not in the tooth. As I have said many times in former papers mere extraction disregards the fundamental principles of bone surgery. We know well that bone surgery demands the removal of dead bone, removal of granulomata and collapse of the bone cavity as far as possible. I do not believe we can too strongly assert that the end results of an operation and the realization of the desired results by the physician and patient depends upon the certainty with which the entire pathology is removed. Failure on our part to completely remove the pathology promises just as uncertain results as when the laryngologist fails to completely remove the diseased tonsil which has been acting as a focus of infection. The responsibility incident to coöperative medicine and surgery must be given more serious thought in the light of many of our failures.

In 1905 I designed an operation for the complete removal of the external plate of bone from the jaw in order to facilitate the fittings of more pleasing dentures. Later I employed the operation extensively for the complete and certain removal of mouth pathology. The technique of the operation is as follows: The teeth are removed, the muco-periosteum is reflected up to the root ends of the tooth sockets the external alveolar plate of bone is taken off, the diseased tissue is attended to under the eye. The bone is smoothed, leaving no jagged edges, the lingual, buccal, gingival mucosa trimmed and sutured with horse hair. The sutures are removed in from four to five days. Special instruments, such as rongeur forceps of different kinds, chisels, etc., are needed. To better satisfy certain steps of the technique, I designed a special rongeur forcep, which, it is hoped will be found useful to those doing this class of surgery.

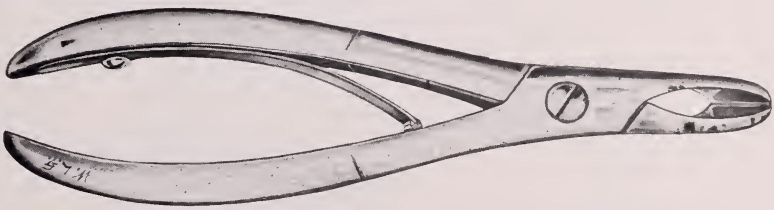


Fig. 8—Special rongeur forcep designed to better carry out certain steps of this class of surgery. Presented to the profession for what it is worth.

The removal of two or three chronically abscessed teeth, at a time, waiting ten or twelve days, then continuing the procedure, vaccinating the patient each time, is bad therapeutics. It is the continued vaccination of the patients due to liberation of the toxins of the organisms in the blood stream which we are endeavoring to relieve. They have been vaccinated daily for from one to forty years or more, by the presence of the infection, so why continue the offence in the hope of relieving them? The systemic manifestations are only exaggerated and often made worse by such methods. We might just as well remove part of an appendix and later go back and get the rest of it, providing the patient still lives. Febrile reaction following such a seemingly radical operation as described above for the removal of infection is almost always absent.

Figs. 9, 10, 11, 12, illustrate different stages of the operation for the removal of imbedded and impacted teeth, lying in the roof of the palate distally to the roots of the teeth.

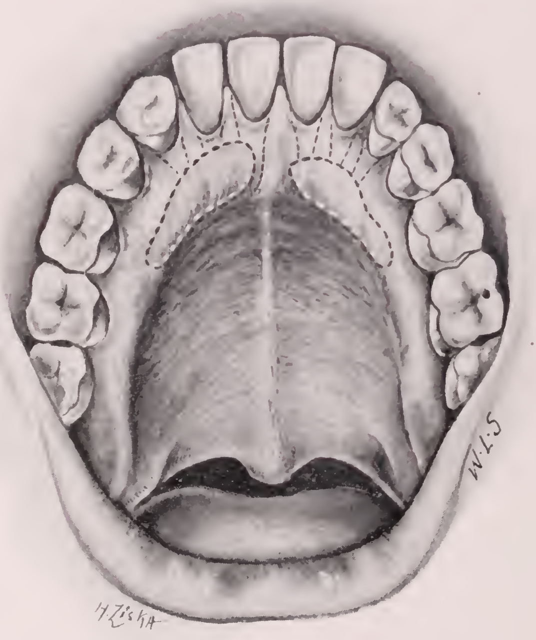


Fig. 9—Diagramatic of imbedded cuspid.

A very large proportion of the chronically infected maxillary sinuses are of dental origin. Infections of the maxillary sinus are often chronic due to faulty drainage, and only when a new cold is acquired do they present local symptoms. In many instances the predisposing etiological factor is drainage into the sinus from a dento-alveoloar abscess at the root ends of non-vital teeth. The following fundamental principles should govern our treatment of chronic infection in the maxillary sinuses.

A. If they are of dental origin, the dental pathology should be taken into consideration and removed.

D. One which would present the least annoyance to the patient should be employed. One which would have the greatest respect for the anatomy.

E. In the event unhealthy granulations occur during the process of healing an operation should be employed whereby the

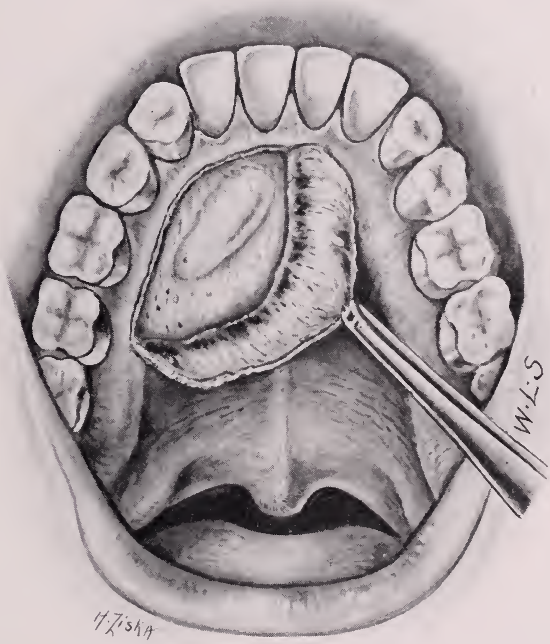


Fig. 10—First step in operation. Incision is made close to the teeth, leaving just enough muco-periosteum to suture to. This incision involves only the terminal branches of the descending palatine artery and thereby avoids excessive hemorrhage.

B. A well established drainage must be considered.

C. The type of operation, of choice, it seems, would be one whereby an ocular observation of the entire antral cavity could be had. (This would be especially necessary where polypi were present.)

antral cavity could be easily reopened and examined.

G. In some cases where the antrum heals with considerable contraction of the tissue, a slight operation should correct.

One type of operation is not sufficient in the proper handling of infected maxillary sinuses

They must, in my opinion, be designed and carried out in accordance with the findings.

Vitality of teeth in close proximity to the floor of the maxillary sinus is too often destroyed, in different operations on the maxillary sinus by men who are not familiar with dental anatomy. which are demonstrated by drawings.

Imbedded Teeth: Imbedded cuspids and bicuspids lying under the nose and distally to the front teeth and hard palate, present one of the most difficult surgical problems, due to anatomical relationships, blood and nerve supply.

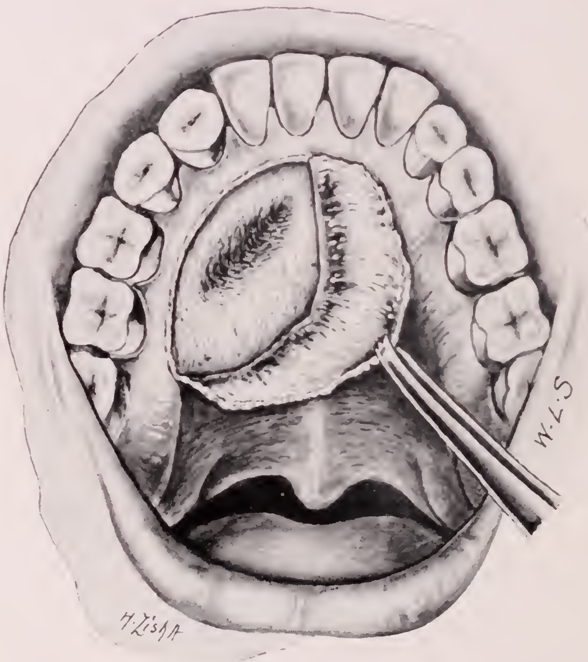


Fig. 11—Illustrates the condition of the bone trimmed and smoothed, leaving no jagged edges after the removal of the teeth.

With some of the old operations upon the maxillary sinus, for chronic infection, a greater damage has resulted to the patient than that for which they sought relief. I have designed different operations to approach the sinus which, it seems to me, present the least post-operative complications of any yet given, all of

Neurological complications accompanying imbedded teeth of the different forms are past our recognition. To properly remove this type of imbedded tooth requires great care, not to destroy the adjoining teeth. Some of the complications of the old type of operations were excessive sloughing, bleeding and depression in the hard palate. Often the sac which encapsulates an imbedded cuspid of this type, where left in the body of the bone, serves as a nidus for a subsequent cyst or growth.

Impacted lower third molars: By the old technique of the removal of impacted third molars so-called pick and crowbar methods. In former years no definite design of operation has been presented which met all the requirements incident to a careful surgical technique. Where the third molar is wedged against the second in such a manner as to preclude its removal by different

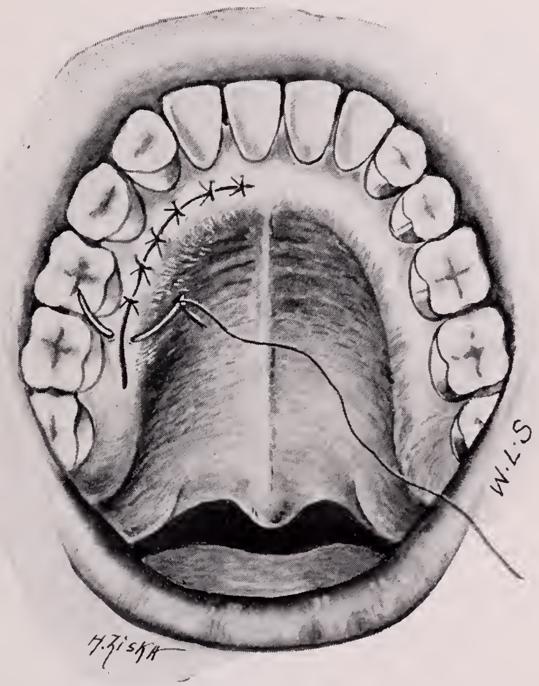
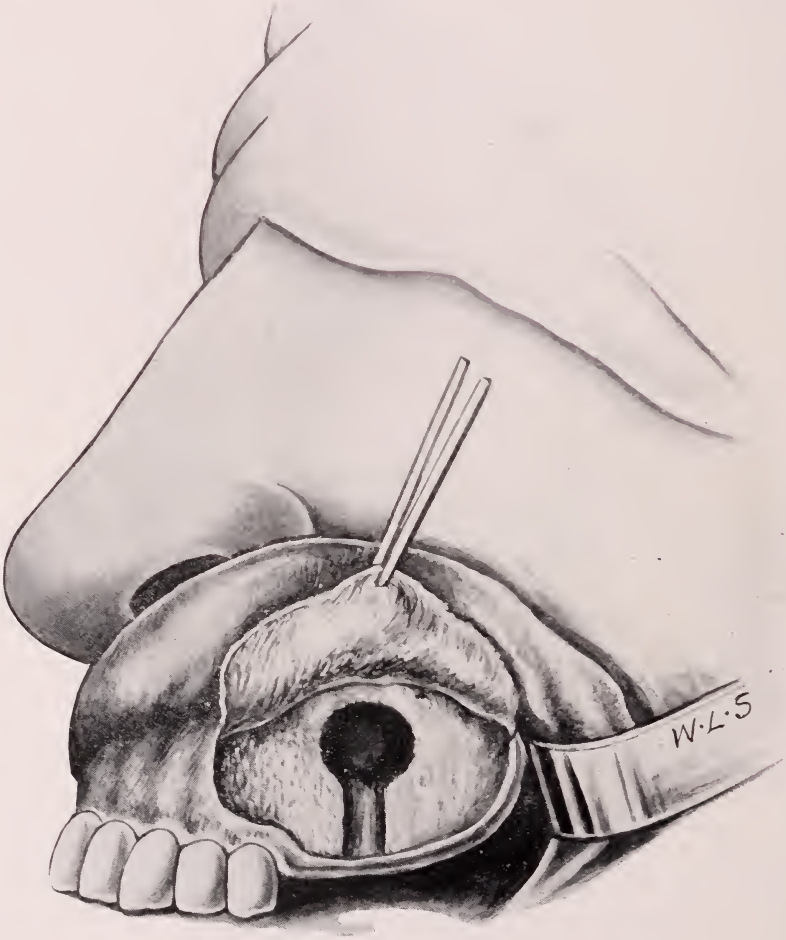


Fig. 12—Closing of the muco-periosteal flap with horsehair. With this technique there is no depression in the palate and usually no sloughing.

with the pick-ax and crow-bar method, great damage has resulted. I am convinced that no one will criticise my nomenclature in describing many former techniques employed in the removal of imbedded and impacted lower third molars. Countless thousands of people have suffered irreparable damage by the elevators without serious damage, it presents a most difficult surgical problem. Undue injury to the following nerves, the mandibular, lingual and chorda tympani, often resulted by employment of poor surgical technique when removing lower impacted and imbedded third molars. It is this type of impaction for which I designed an operation which is illustrated by drawings.

Too often the cemento-enamel junction of the second molar is permanently injured and destroyed so that following in the wake is a pyorrhea pocket which results in the subsequent loss of a useful member of one's masticatory apparatus.



Figs. 13, 14, illustrate steps in method of approaching the maxillary sinus, where there are one or more teeth removed. In this way an ocular observation of the maxillary sinus may be had. A small groove is chiseled in the body of the bone, which permits of drain plug. When the patient recovers there is scarcely an indication of an operation having been performed.

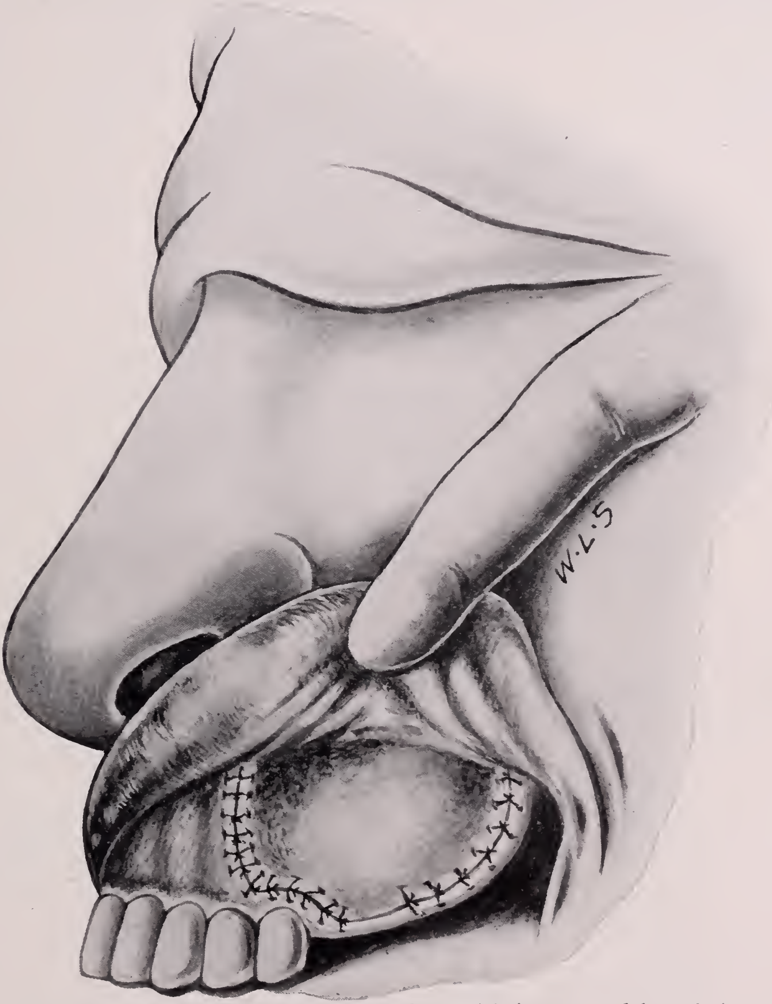


Fig. 14, shows flap sutured back in place with interrupted horsehair, a few stitches omitted at the site of drainage.

Figs. 15 and 16 illustrate an operation designed to remove the bony floor of the maxillary sinus when diseased, such as a chronic osteomyelitis, leaving the mucous membrane intact.

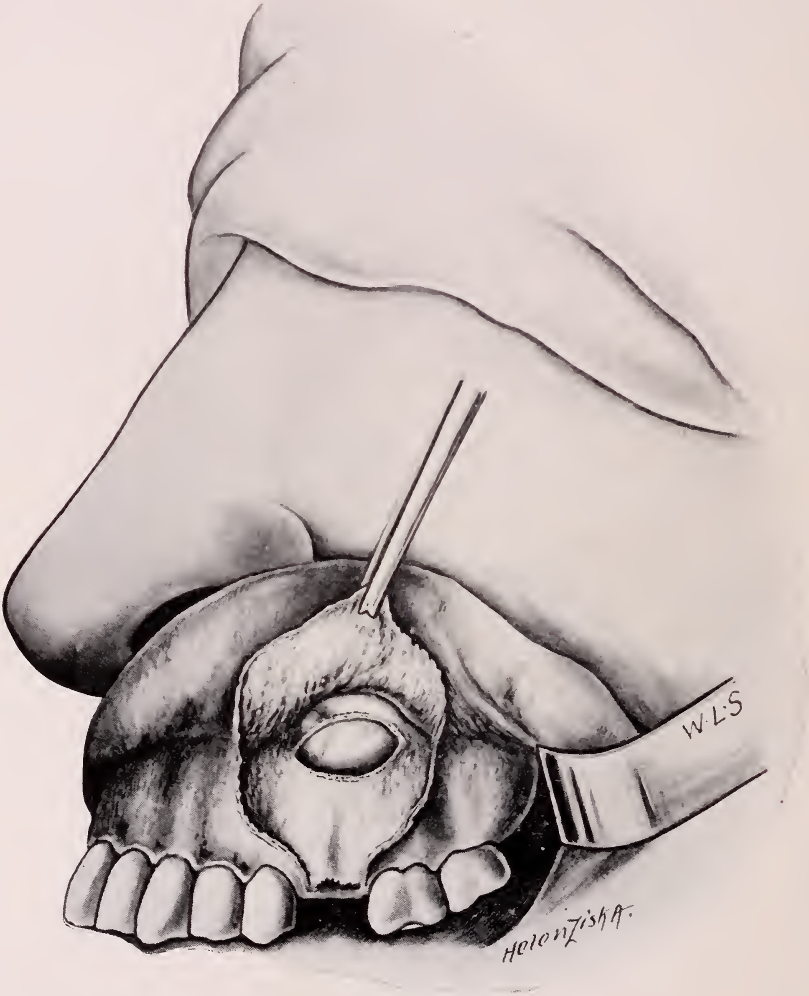


Fig. 15—First step.

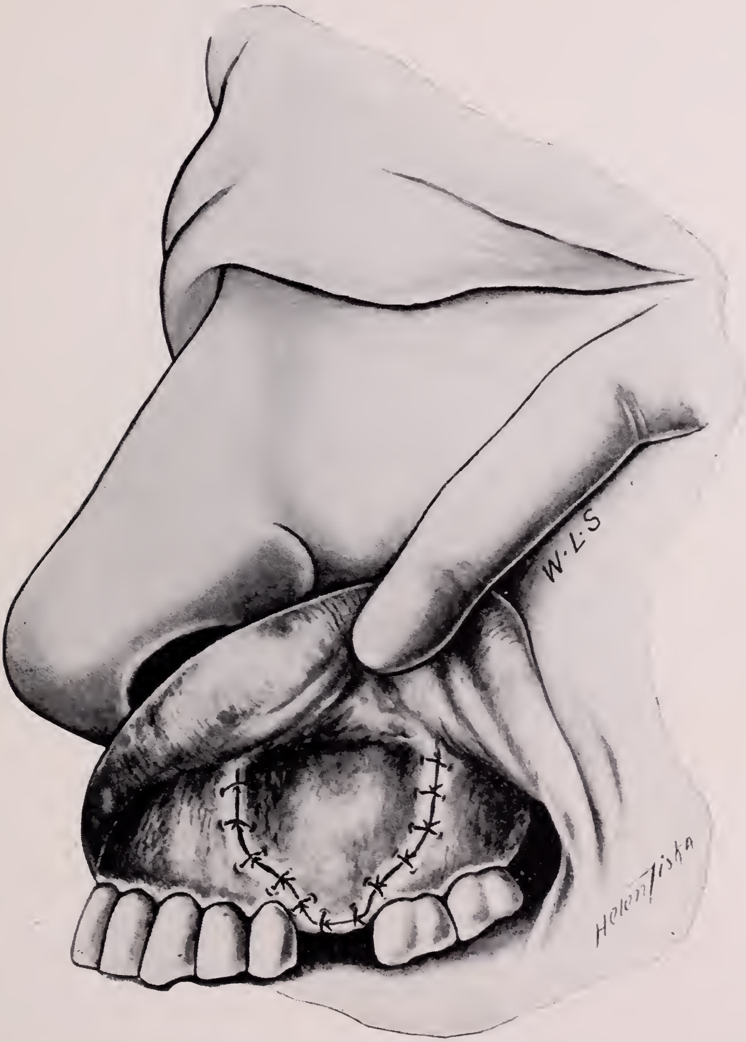


Fig. 16—Operation completed.

Figs. 17, 18, 19, illustrate steps in the design of an operation for the removal of impacted and imbedded lower third molars.

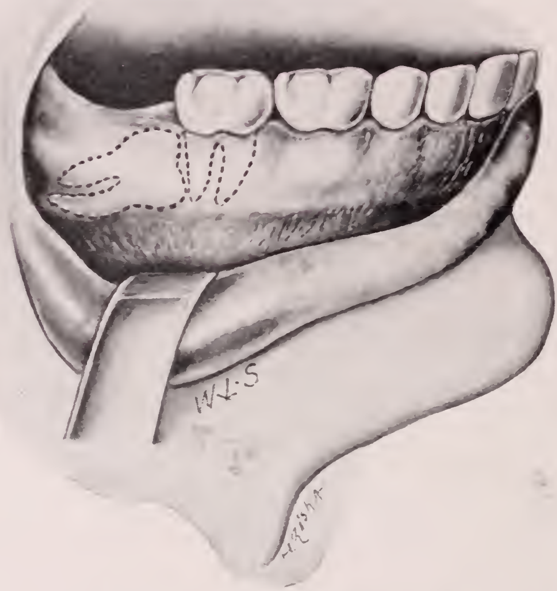


Fig. 17—Diagramatic of imbedded tooth.

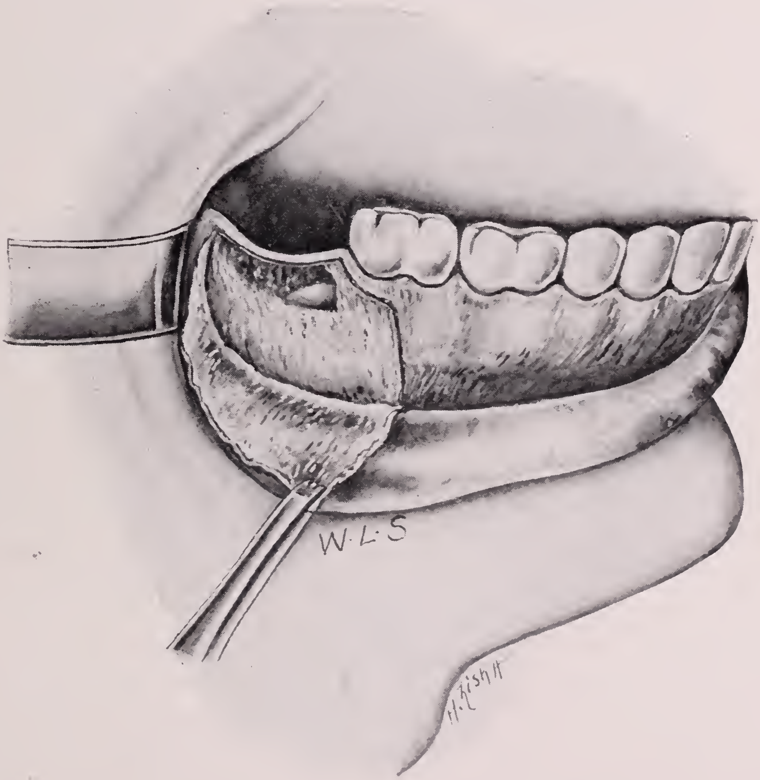


Fig. 18—First step in showing line of incision.

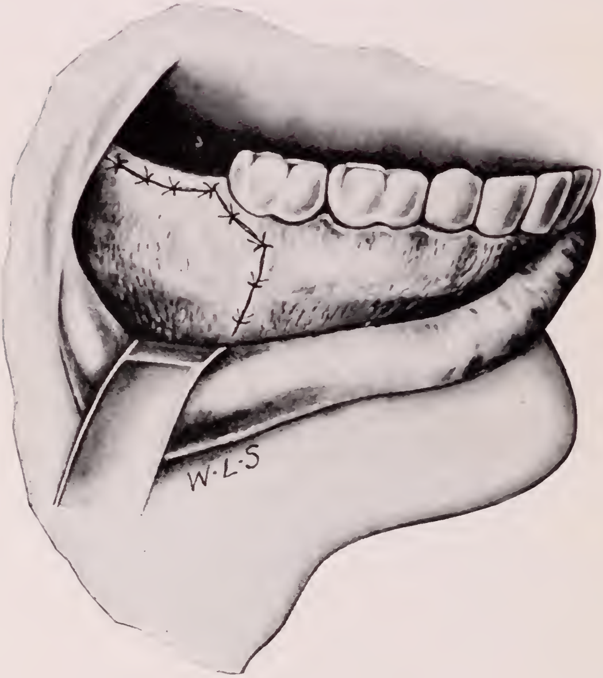


Fig. 19—Finished operation.

Figs. 20, 21, 22, show plaster models of sharp alveolar margin found several years after ordinary extraction in patients unable to wear plates. The muco-periosteum is laid back and this sharp ridge removed with the rongeur forceps. The pain is relieved and plates can be worn comfortably.

Fig. 20, shows very clearly the condition of the ridge of the mandible two years, four months after the universal method of merely extracting the teeth, with no further attention given.

The Alveolar process, being a transitory tissue, after the teeth are removed, gradually fades away. In the fading process there is a collapse of the center of the alveolar process and the buccal and lingual surfaces collapse, as it were, like a couple of boards being pushed together, thus leaving a knife edge of very hard, bony process, which is lacking in blood supply. It is this knife edge of bone which accounts for the severe complications so many people have in wearing artificial dentures.

The condition as shown in this model is a condition I have observed after cutting down upon the center of the ridge of the edentulous mandible of five hundred and twenty-seven cases, ranging all the way from one to ten years after the teeth were removed.

Fig. 21, shows condition of mouth after alveolectomy has been improperly performed. In this case only part of the external alveolar process was removed. If external alveolectomy is properly performed, the internal and external alveolar process should be removed.

Fig. 22, shows clearly what happens to the process a year or so after the teeth have been removed.

The Roentgenologist and Group Medicine

F. S. Bissell, M. D.
Minneapolis, Minn.

THE need of a radical change in the fundamental conditions under which medical men have been trying to accomplish the greatest good was sharply emphasized by the great war and its aftermath. It has become axiomatic that there is a close interdependence between men, as between countries, between groups of men, as between individuals. It is no longer possible for the individual within such a group as the medical profession to go the even tenor of his way without at some point establishing intimate relations with other members of the same group. Neither will the profession itself thrive and flourish unless it so organizes its activities that they may become as accessible and as adaptable as possible to the public need. A study of social progress reveals well defined eras or periods many of which have their apparent origin in war. Medical history follows the same law. The period which has just passed may be designated the era of specialization, while that now dawning may be known as the era of coördination of specialties, or the era of medical coöperation. For it is inconceivable that the demand for efficiency and economy will not require the medical profession to so coördinate its manifold and intricately variable functions that there may be less wasted energy and more service to mankind. There is already a marked tendency toward state medicine and this tendency will become progressively accentuated unless the profession recognizes and meets a self evident need for greater efficiency in practice, less commercialism and more unselfish service.

The development of new methods of diagnosis and treatment of disease has brought with it infinitely greater responsibilities which can be met and transformed into opportunities only through close coöperation of coördinate branches of medical practice.

Let us apply the principles employed in present day practice of medicine to the manufacture of an automobile. The prospective purchaser would go to a body maker to buy his body. This manufacturer would give him a letter of introduction to the wheel maker, who would refer him to the motor manufacturer, who would send him to the carburetor establishment, whence he would find his way to the maker of electrical devices. Having now spent all of his available funds, he would trade the useless, half built conveyance for a cheap bicycle, fully assured that all manufacturers were thieves or fools, or both. Is this experience unlike that of the patient who is referred from one specialist to another each without any clear conception of what the others have done, until utterly discouraged and nearly penniless, he turns to the charlatan, who makes a positive if falacious diagnosis and an equally definite promise of cure.

The fact that charlatanism and medical mysticism never flourished as abundantly as they do today should be accepted by us not so much as evidence of ignorance and gullibility on the part of the public, as of our own shortcomings and failures to make the most of the rich opportunities which have been ours. For surely we are liberally endowed. The standards of medical education have been raised to a high plane and the researches of both European and American scholars in medicine have added greatly to the fund of knowledge which is our most priceless asset. Yet it is a daily experience of every practitioner to meet patients who have passed through medical hands without careful study and undiagnosed. The exploratory operation is still in vogue, either openly or under the guise of bizarre and snap-shot diagnoses. In short, it is perfectly apparent to any one who has not adopted the comfortable habit of the ostrich that we as a profession are not using our talents to the greatest advantage. Yet this criticism of the whole does not apply to the individual average. Never have we been blessed with such highly trained specialists, with such worthy ideals and sincere purposes.

Specialization in medicine has had a Topsy-like growth. The earlier conception of the specialist was that of one who devoted himself to a definitely circumscribed branch of medicine and who kept himself *a courant* with the studies of others in the same field. Thus the oculist became an authority upon everything pertaining to the eye, the gastrologist to the stomach, and the proctologist to the rectum, and the man who treated every subject with equal superficiality was regarded with distrust, at first by the profession, then by the laity.

The surgeon symbolized the first departure from this conception of the specialist. The rise of surgical procedure during the era following Lister required that men be specially trained in the use of the knife and in asepsis. The method of treatment rather than the specific organ or part of the body here constituted specialization. The internist, too, became a specialist in the same sense, basing his claim to specialization, not so much upon a limitation of his sphere of special knowledge as upon his greater knowledge of the whole. His mental energy instead of being concentrated upon definitely circumscribed material is widely dispersed over the whole field of human physiology, chemistry, anatomy and living pathology. His only limitation was that imposed by other specialists, since it was unnecessary for him to possess more than a superficial knowledge of the eye, ear, nose and throat, of the skin or of any surgical procedure.

Thus the internist was carrying a heavy load and was already feeling the need of a division of labor when the discovery of the roentgen rays with their wide application to diagnostic problems opened another large field of medical study and investigation. This was a study which called for qualities of mind training and temperament which the internist did not possess, or failed to develop, and for a time the field was neglected except by physicists and a few medical men with a genius for mechanical manipulation. Gradually, however, diagnosticians of the highest training were attracted by the glorious vista of the roentgen ray future in diagnosis and became absorbed in its study. And as its possibilities rapidly expanded into probabilities and then into scientific accomplishments, it became apparent that here, indeed, was a new specialty of medicine, one which would demand and reward the undivided thought of the most highly educated minds. And, as we review the history of roentgenology we find that it differs in no sense from that of other human activities and that its advances have been due to the efforts not of the dillitante, but of the specialist.

We who are gathered here from all parts of North America believe that progress in roentgenology has but begun and that as the science expands into greater maturity, the glorious achievements of the past will be credited to its period of infancy. In this period barber surgery is repeating its manifestation in the person of the technician roentgenologist. Not the pure technician or operator who fills a useful function in performing only non-medical duties in the roentgen service, but the technician who attempts through the agency of the roentgen ray to diagnose and treat disease of which he has no fundamental knowledge.

The roentgen therapist or diagnostician should be as thoroughly trained in all of the fundamental branches of medicine as the surgeon or internist, and must be afforded the same protection if he is to maintain a like stature. Yet it is not unusual to see learned professors of medicine or surgery, apparently devoid of a saving sense of humor or the fitness of things, seek the opinion of a man whose sole claim to medical knowledge is his ability to manipulate an x-ray switch board, relative to such complicated diagnostic problems as bone tuberculosis or pulmonary cavitation Or the surgeon who will fearlessly attack a breast cancer following the lymphatic chains with a skill born of anatomical knowledge, rely upon the judgment of a common school technician to administer a lethal dose of roentgen rays to the remaining cancer cells.

The writer believes that failure to include roentgenology as a specialty coördinate with internal medicine is an inherent and fatal weakness in most of the group clinics which are being developed in such prodigal numbers since the war. For whether this exclusion is prompted by necessity, expediency or economy, it makes impossible the attainment of an ideal efficiency, the avowed aim of group medicine. If there is need for this new form of organization, it is founded upon a demand for more perfect coördination of all medical activities to the end that the interests. health and lives of patients may be better safeguarded.

When, therefore, any motive other than that of efficiency prompts the exclusion of any specialty, the group begins to fail to be a symbol of progress and tends to become merely an agency for the material betterment of its own members. The usual group clinic is composed of a small number of highly trained specialists, each with a lay following which is appraised as a valuable asset contributed to the organization. Since the nature of roentgenological practice makes it distinctive as a pure consulting specialty, the roentgenologist has no lay following to bring into the group. He, if successful, must derive his support from a large number of specialists and general practitioners, and he well knows that this support would not follow him into a group clinic. Nor could he hope long to remain content with the more restricted clinical opportunities which the clinic could offer him.

Hence, the group clinic is usually impelled by expediency either to eliminate the roentgenologist entirely or to hire a beginner, who through lack of broader opportunity must inevitably find himself laboring under a handicap on account of his group connection. Thus, since a chain is only as strong as its weakest link, the clinic begins its career as a new-born child with spinabifida or cleft palate. To exclude the roentgen laboratory as well as the roentgenologist would be too patent a confession of inadequacy and each member of the group is thus compelled again by expediency to become his own roentgenologist. While this may prove an advantage in certain isolated instances, it surely does not promote that refinement in specialization which is so essential to modern diagnosis. The internist who spreads his talents over too wide a field is in danger of becoming a dillantante. If roentgen diagnosis becomes his hobby, all other diagnostic agencies will be made subservient to it, whereas, if it fails to become an obsession, it will indeed be a hobby which he rides but does not feed.

It is not the writer's purpose to disparage the laudable efforts of any specialist to keep himself informed in roentgenology, but merely to emphasize the danger of self-deception in any attempt to extend a specialty over too broad a field. For it must be apparent to all active practitioners that not only internal medicine but roentgenology must be subdivided if specialization prove true to its aim toward concentration of thought and effort. Who among us does not daily feel his inadequacy to meet and solve the infinite variety of medical and surgical problems which is poured into the hamper of the busy x-ray laboratory.

But if these great specialties are to be subdivided into smaller component parts, it is even more essential to efficiency and progress that the various subdivisions be closely coördinated, not only with each other, but with all other branches of medicine and surgery.

So long as the evil influence of competitive commercialism tends to guide the destiny of the profession, such coördination is admittedly difficult. But if competition can be confined to scientific attainment, then coöperation in practice, founded upon a solid foundation of confidence, will become universal, because it is essential to a satisfactory solution of the intricate problems of modern medical practice.

If we assume that some form of coöperative medicine is to be desired and that group medicine, as ordinarily conceived, only partly meets the problem, it becomes incumbent upon us to devise a mechanism whereby our ideals may be attained.

It would seem almost self-evident that such an attainment is possible only through the establishment of a common clinical center in each city or community. For the sake of illustration, let us style this the "Clinic," and the organization housed therein the "Clinical Association."

The privilege of becoming a member is open to any doctor of medicine who is strictly ethical in his practice and who is elected to membership by the board of trustees. By joining the association he does not lose any of his independence, but may continue to practice exactly as in the past if he desires to do so. He is merely required to purchase a certificate of membership upon which a cumulative annual dividend is paid. He is also required to sign a pledge to avoid all unethical practices and to abide by the rules and regulations of the association. Within the clinic there is established a fiscal department under the headship of a capable business man. It is his function to manage the business affairs of the clinic, including the determination and collection of fees from those who are treated as association cases. The department has the most modern facilities for keeping the accounts, rendering statements, etc., for individual members, thus saving them the expense of a private bookkeeper. Through his credit associations he is able to keep members informed as to the credit standing of their patients, so that all charity work may be done knowingly. The scope of the activities of this business department may be widened to include safeguarding the investments of members as well as those of the association itself if this seems advisable to the trustees. With a membership of one hundred or more, such a department would not only be self supporting, but would be an important contributor to the treasury of the association.

The division of clinical laboratories thoroughly equipped and manned to do the most refined and dependable laboratory work of all kinds, should have at least two subdivisions, chemical and pathological. The heads of these subdivisions must be selected with the greatest care and paid adequate if not generous salaries. All fees for laboratory service are charged to the member requiring the same, and a liberal discount is allowed for their prompt payment the first of each month.

In the division of roentgenology all equipment is owned by the association and is kept in the highest possible state of efficiency. At least three subdivisions should be provided for and allowed to develop as soon as the volume of work justifies them. These are:

(1) Heart and lung diagnosis.

(2) Abdominal diagnosis.

(3) Therapy including radium.

Other subdivisions may be:

(4) Bone diagnosis, including the skull and sinuses.

(5) Urological diagnosis, in charge of an accomplished cystoscopist.

The financial policy should provide that a liberal percentage of the net earnings of the department shall go into the association treasury. One roentgenologist may be made general supervisor to coördinate the activities of the various subdivisions, but each sub-head should be the supreme authority over his own subdivision.

Each sub-head is expected to make frequent visits to the world's radiological centers, to bring home successful ideas and incorporate them into the daily work of the department. The expense of such trips should be borne by the department and the duties of the absentee carried on by other workers in this division. In this way the roentgen ray department will be kept in the vanguard of progress. Just as each department head in any great mercantile establishment is required to make his department a paying one, so will each subdivision of roentgenology be expected to stand upon its own merits. Since the department is conducted upon a strictly coöperative basis the need or desirability of the small inadequate private x-ray installations will be eliminated, and with their passing a great economic waste will have been stopped.

Any member of the association who prefers to make his own roentgen examinations without the assistance of the roentgenologist will be offered all of the facilities of the department for doing so. Trained technicians and operators will be placed at his service, and only when the advantages of roentgenological consultations become obvious to him is he under the slightest moral or other obligation to resort to them. Thus the roentgenologist will be placed entirely upon his merit and roentgenology as a diagnostic specialty will stand or fall according to the ability of the roentgenologist to make himself indispensable. Are there any here who would question that ability, if he is given such a fair and unprejudiced opportunity?

A highly important feature of the roentgen department is the plate reading room. The appointments here should be such as will invite liesurely relaxation on the part of visiting doctors. Here, in a quiet, spacious room, out of immediate contact with patients, but with their clinical problems visualized before them in the roentgenogram, men will be encouraged to discuss their cases freely and confidentially to the common advantage of themselves, their patients and their confreres.

One of the obvious advantages of group medicine is the free interchange of ideas between various specialists, the fee therefor being controlled by one man and paid in one sum.

In the association which we are now considering such a composite fee is determined by the business manager, perhaps with the advice of the referring physician. Specialists to whom clinic cases are referred are elected by stockholders after having been nominated by the trustees. Since the reputation of the organization is at stake, great care must be exercised in the naming of these specialists. The trustees must be sure that their training and experience has been of the best. Higher specialization is encouraged and made possible. Thus a member may practice general surgery outside the clinic, but be designated a specialist in brain surgery within the clinic. Is it inconceivable that he may soon develop such a reputation as a brain surgeon that he can confine his work to this higher specialty, a consummation never to have been achieved except through such an organization's support?

Let us now recapitulate the advantage of coöperative or community practice as compared with group practice.

1. The former does not exclude the general practitioner, but offers him the same clinical facilities enjoyed by the specialist, who needs no greater advantage than that afforded by his more intensive knowledge.

The community association may be joined without fear of compromising affiliations because the individual loses none of his freedom of action, none of his personal prestige with the public, none of his financial independence.

3. In the community association, the specialist is not required to "pool" his knowledge and his skill or any part of his income with that of other specialists.

4. Yet the organization provides an adequate mechanism for pooling the knowledge and skill and all of the facilities of its members in selected cases. And a single fee to cover this combined service may be collected by the business department and equitably pro-rated among those participating.

5. When the need of a combined service has been met, the patient returns to his original physician for treatment and management and the organization has no further concern in the case.

6. All clinical facilities are the property of the members and may be used by them subject only to the rules and regulations of the association.

More concisely, the purposes of the association may be defined as follows:

(1) To establish, maintain and operate clinical, pathological, medical, surgical, research and other laboratories and facilities, as well as hospitals, necessary or desirable for the diagnosis and treatment of disease.

(2) To create a coöperative organization of duly qualified and experienced physicians and surgeons representing as near as may be the various branches and requirements of medicine, surgery, and disease prevention, with a view to the greatest convenience, facility, and certainty in

the diagnosis and correct treatment of disease, and of securing the advantage, when needful, of the combined judgment, skill and attention of the associated members, through which each shareholder hereunder may more effectively conduct his practice of medicine or surgery, and under which each will secure the maximum advantages of "group medicine" without the loss of individuality in the practice of his profession.

(3) To facilitate research, instruction, and specialized work in all branches of medicine and surgery.

(4) To furnish accounting, credit, and other business facilities for the shareholders hereunder.

(5) To develop the science of medicine and to advance the best interests and promote the welfare of the profession, and particularly of the shareholders hereunder.

A clinical association designed to promote the interests, not merely of a few men, but of all of those within reach of its influence, must be founded upon mutual confidence and actuated by a spirit of coöperation. It must be constantly borne in mind that the success of any ethical member of the profession redounds to the credit of all. The time-honored principle that the physician's greatest asset is a well satisfied patient may well be applied to coöperative community practice. If the public learns, through experience, that in a given community the physicians and surgeons are all working together with a single purpose, that community will inevitably become a great clinical center.

*—Read at mid-summer meeting of the Radiological Society of North America. Boston, June 3, 1921.

X-Ray and Radium Technique in the Treatment of Lesions Involving Skin and Mucous Membranes

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MY experience in the use of radium and the x-rays covers the relatively short period of five years. During the first two and one-half years my treatment work was done almost exclusively with radium, while I used the x-ray almost solely for diagnostic purposes. The explanation of this is that I had been led to believe that radium was infinitely better than the x-ray as a therapeutic agent in the treatment of malignant and allied conditions; and, secondly, I was unduly apprehensive of the danger of the x-ray. I say this with all due regard for the potency of the modern Coolidge tube, and a full realization for harm when used injudiciously.

The results obtained with radium were, on the whole, satisfactory, and, of course, improved with experience. However, as the volume of my work increased I found it rather difficult to give each individual case the necessary time, especially as a large number of my patients came from out of town without previous appointment, thus making it necessary to dispense with the treatment as rapidly as is consistent with thorough work. Also, the personal equation has much to do with the successful use of either x-ray or radium; and my experience has been that it is almost impossible to get an assistant to whom one may feel satisfied to turn over unreservedly all the details of treatment. In fact, it takes years of experience and a capacity for details, in addition to an aptitude for the work to develop into a first class radiotherapeutist.

For these, and many other reasons, I found it necessary to either get a larger quantity of radium, so that I might treat several patients at one time, or else use some auxiliary treatment in conjunction with the radium that I had. Furthermore, I had, in the meantime, conceived the idea that possibly the varying results obtained by the separate use of the two agents, radium and x-ray, were due mainly to variations of technique. That, the disastrous results obtained with the early use of the x-ray had made us over cautious, and, consequently, we were not giving sufficient dosage. Also, I could see no reason why both agents, if need be, could not be used over the same area when treating lesions in which the skin and mucous membrane were already involved; and that too high voltage, too much filtration, and insufficient length of exposure were being used in the treatment of lesions involving the cutaneous or mucous surfaces. The voltage factor is varied, of course, according to the relative depth of the lesion. The benefit that is derived from radiation, whether radium of x-ray, is due to the rays that are obstructed by the tissues and absorbed therein, rather than to the rays that pass beyond the affected area.

Consequently, I began very cautiously using the x-ray in conjunction with radium in the treatment of surface lesions. During the first year I depended largely upon radium, as I was more familiar with its effects. However, I gradually increased the x-ray dosage and decreased the radium dosage, until, at present, I am giving what I once considered huge doses of x-ray along with a relatively small dose of radium. It is now only about one year since I worked up to the point of such large x-ray dosage along with the smaller radium dosage, and is, of course, too early to arrive at incontrovertible conclusions. Besides, there are several points that are at least debatable, some of which I will mention briefly.

In the first place the beta rays from radium have a greater inhibatory effect upon malignant tissue than either the gamma rays from radium or the x-rays, and, for this reason, I have gone on record as favoring radium in the class of work under discussion. However, after further observation and thought, I am not so certain that my earlier impression is entirely correct. For, it is also true that the gamma rays from radium, and the x-rays have a very definite and pronounced destructive effect upon malignant tissue. Also, because of the abundance of the x-rays and their more homogeneous penetration, it is possible to obtain a more uniform irradiation at a given depth below the surface. Furthermore, the results obtained at my hands by the combined use of the two agents have certainly been as satisfactory as when I used radium alone. So, taking it all in all, the relative merits of the two agents in certain accessible lesions are, in my mind, still debatable, and the last word has not yet been said. This does not imply that either agent can, or will supplant the other, for the man who has radium at his command, in addition to a modern x-ray plant, can do infinitely better work than one who has no such advantage. This is especially true in treating lesions about the eye, nose, mouth, vagina, etc. Also, in the treatment of lesions in which it is desirable to bury radium beneath the surface.

In order to give an idea of the technique referred to in this brief paper, I should like to relate a few short case histories.

Case Reports

Mr. H. Age 50. Epithelioma of the right inner canthus involving almost the entire lower lid, including the mucous membrane. This would be considered a difficult case to treat. Adequate protection was given the eye by using a curved spoon-shaped applicator, covered with rubber. Treatment was given as follows: January 13, 1920. As filter, one thickness of flank-leather was used with 45kv., 10 ma., 5 min., or 50 ma. min. Also one mm. aluminum filter was used with 60 kv., 10 ma., 10 min., or 100 ma. min., making a total of 150 ma. min. On January 13, 1920, a treatment with 50 mg. of radium element for two hours was given. The patient returned February 16, 1920, at which time he was greatly improved. The above treatment was repeated. He returned again March 30 entirely well and with a cosmetic result that was perfect.

Mr. P. Age 64. Epithelioma on the left temple region about the size of a 50-cent piece. He had been treated about one year with fractional doses of x-rays without results. May 22, 1920, the following treatment was given: A filter of one thickness flank leather was used with 40 kv., 10 ma., 15 min., or 150 ma. min. Also a filter of one mm. of aluminum was used with 60 kv., 10 ma., 15 min., or 150 ma. min., making a total of 300 ma. min. On May 23, 1920, 100 mg. radium element (four 25 mg tubes) was applied for one hour. He thus had a total of 300 ma. min. of x-rays and 100 mg. hours of radium. He returned on July 2, 1920, at which time the lesion was entirely healed.

Mr. M. Age 74. Epithelioma on the right cheek about one inch in diameter. This growth was an indurated affair, extending more than one fourth inch above the level of the surrounding tissues, and apparently of an intractable nature. On May 29, 1920, treatment was given as follows: One thickness flank leather filter was used with 50 kv., 10 ma., 30 min., or 300 ma min. Radium element was applied for two hours. On July 7 he returned for further treatment. At this time the growth had almost entirely disappeared, and there was no open wound such as one might expect following such intensive treatment. The following treatment was given: A one mm. aluminum filter was used with 55 kv., 10 ma., 30 min., or 300 ma. min. One hundred mg. of radium element at one-fourth inch distance was used for one hour. On August 24, 1920, the tumor was entirely gone.

Mrs. S. Age 62. Epithelioma on the right cheek about ¾ inch by 1½ inch. She was treated as follows on June 22, 1920: One thickness of thin leather filter was used with 45 kv., 10 ma., 10 min., or 100 ma. min. A one mm. aluminum filter was used with 50 kv. 10 ma., 10 min., or 100 ma. min. A two mm. aluminum filter was used with 60 kv., 10 ma., 10 min., or 100 ma. min., making a total of 300 ma. min. One hundred mg. of radium element was applied for one hour. It was practically well on August 3, 1920, when she returned for inspection.

Mr. D. Age 91. Epithelioma, about three inches in diameter, involving the entire right ear and adjacent tissues, apparently an entirely hopeless proposition. On July 1, 1920, treatment was given as follows: No filter was used with 45 kv., 10 ma., 10 min., or 100 ma. min. A one thickness flank leather was used with 50 kv., 10 ma., 10 min., or 100 ma. min. A one mm. aluminum filter was used with 60 kv., 10 ma., 20 min., or 200 ma. min., making a total of 400 ma. min. In addition, he was treated with 150 mg. of radium element, at a distance of one inch for thirty hours, making a total of 4,500 mg. hours radium element. On August 7, 1920, he returned entirely well, except for one small spot just within the concha of the ear.

Mr. D. Age 55. Epithelioma, about one inch in diameter, of rapid growth, on the dorsal aspect of the left hand. On July 10, 1920, treatment was given as follows: A one thickness flank leather filter was used with 40 kv., 10 ma., 30 min., or 300 ma. min. One hundred mg. of radium element was applied for one hour. On September 9, 1920, he was entirely well.

Mr. S. Age 63. Epithelioma, about one inch in diameter, under the right eye. This was a rather deep indurated growth. On July 21, 1920, treatment was given as follows: A one thickness flank leather filter was used with 35 kv., 10 ma., 10 min., or 100 ma. min. A one mm. aluminum filter was used with 45 kv., 10 ma., 20 min., or 200 ma. min., making a total of 300 ma. min. One hundred mg. of radium element was used for three hours. The patient returned on September 10, 1920, for inspection and was found entirely well.

Mrs. H. Age 48. Epithelioma involving the right upper lip. On July 24, 1920, treatment was given as follows: O one thickness flank leather was used with 45 kv., 10 ma., 20 min., or 200 ma. min. A one mm. aluminum filter was used with 50 kv., 10 ma., 20 min., or 200 ma. min., making a total of 400 ma. min. One hundred mg. of radium was applied for one hour. On September 12, 1920, the patient was entirely well.

In all these cases, a skin-target distance of approximately seven inches was used.

From the above reports the following facts are evident.

1. That the x-ray dosage is much larger than that generally used.

2. That the radium dosage alone is entirely too small to produce definite results.

3. Whether or not the short radium exposure aided materially is not known.

4. That the results are satisfactory, and were obtained quickly, with a minimum amount of time consumption to both operator and patient.

5. That no attempt has been made to standardize the technique with respect to the bearing that voltage, milliamperage, filtration, and length of exposure have upon the lethal dose.

6. That nothing has been brought forth to determine the superiority of either agent in lesions that are accessible to both.

The cases reported are typical of scores of others that I have treated within the past year, and I am quite positive that I am getting just as good, if not better, results by the combined method of treatment as when I used radium alone. Also, in no case has there been any untoward result from treatment, and the healing process has been unusually rapid. I hope within the next few months to arrive at more accurate conclusions with reference to standardization of technique in the treatment of surface lesions.

I have made no attempt to discuss the necessity of raying the contiguous glands, for this is a matter with which all of you are familiar. So far as the surface is concerned, we are here dealing with normal skin and an erythema dose, and not with diseased skin and a lethal dose.

In conclusion, I should like to mention the value of thermocoagulation as a preliminary measure in the treatment of surface lesions, in which it is advisable to remove more or less tissue before using x-ray or radium, and to bring to your attention the multiple needle method that I improvised for my own use. The greatest trouble that I have encountered in using thermocoagulation has been the pain incident to the operation as it is usually done. By anesthetizing the part, and using two sets of connected needles for the two poles, the operation is made both painless and bloodless. It is thus possible to remove any amount of tissue desired, and, in my opinion, is the best method at our command.

X-Ray Diagnosis of Osteomyelitis

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X-RAY diagnosis of osteomyelitis is not amenable during the active stage, as it can only be made when the disease has become more or less chronic, in fact, there are usually no definite radiographic findings during the first ten days.

In reviewing the anatomy of bone, we recall that it consists of a marrow cavity, containing the medullary fat, the blood and lymph vessels as well as the nerves. Then we have the cortex, or the dense hard bone surrounding the marrow cavity, which in turn is covered by a strong fibrous sheath, called periosteum. When an inflammatory process involves the marrow, it is called a myelitis, whereas, if the cortex only is involved, we term it osteitis, and when the same applies to the periosteum it is called a periostitis, but when they are all involved simultaneously, it is an osteomyelitis.

The nature of the organism causing the disease may vary, but the end result is always the same, provided the infection is of sufficient severity and duration.

The portals of infectious entry in osteomyelitis are recognized as hematogenous, lymphoid and direct. The two former may arise in the shaft beneath the periosteum, or in a joint space, while the latter or direct, is carried in from the outside, as seen in penetrating wounds and compound fractures.

The hematogenous and lymphoid type, as seen in myelitis, attacks the medullary canal by way of the nutrient vessels, the infection traveling rapidly up and down through the soft structure and is usually limited within the bone, with no involvement of the cortex and periosteum.

In periostitis and osteitis the infection becomes lodged beneath the periosteum. It is more or less limited in action and has a lesser tendency to spread. When the infection originates within a joint space, there usually results an extensive destruction of the articulation surfaces, which may permeate the same and proceed to destroy the cancellous area in the head of the bone, but usually has a slow tendency to proceed throughout the medullary cavity.

In compound fractures and in penetrating gun shot wounds, the infection is carried directly to the medullary canal, as well as to the loose, exposed, bony fragments present, so that all the bone structure becomes involved.

The bone changes which occur in osteomyelitis are destructive as well as reproductive, at one and the same time; and x-ray diagnosis is made by the variation present in these two processes, remembering that bone reproduction does not take place before nature is getting a mastery of the situation and that destruction is present both during the acute and chronic stages.

Normal bone is pierced by numerous so-called Haversian canals, which are in direct communication with the marrow cavity, and you can readily understand how a medullary infection can and will enter these canals. When this takes place we soon find evidence of bone destruction along these same Haversian canals, which, finally by their tortuous ramifications, will eventually surround completely a portion of normal bone, and thus devitalize it and produce the formation of a sequestrum.

The cortex may also be pierced at one or more places, leaving areas of normal bone between and the rapidity of this change, together with the formation of sequestrae, is, of course, dependent on the virulence of the infection. This is an important factor to remember in the differential diagnosis of malignancy, as in the latter, when of the destructive type, never do we find intermingling areas of normal bone and neither does the cortex destroy in part, but instead completely, as a whole.

Remember, that as long as there is no destructive bone process present the radiograph must of necessity be negative, although an active, acute and virulent osteomyelitic infection may exist, and one must always take stock of the clinical history and symptoms before making a final radiographic interpretation.

Chronic osteomyelitis manifests itself by a beginning bone reproduction at the edge of the infection, due to the irritation or the stimulation at this point, which means that new bone will follow the edge of the infection as well as deposit on bone shafts, sufficiently so as to give an appearance of bone expansion, which, however, under close inspection, reveals itself as an external bone deposit.

Sometimes the medullary cavity becomes obliterated through this same process, or a bone shaft becomes thickened and irregular in contour with areas of increased and decreased density throughout.

To recapitulate, the following statement holds true, that in acute osteomyelitis there is bone destruction with but little bone reproduction, whereas, in chronic cases the reverse is present.

You will thus understand that the x-ray plate in osteomyelitis is not a definite one, as it may show shadows representing one or more of the following changes such as increased or decreased density, areas of destruction or bone necrosis, areas of bone reproduction, enlargement of bone with irregularity in outline, and the presence of sequestra and involucrum.

The forms of osteomyelitis thus far considered, represent the pyogenic infections; and before closing I will mention briefly a constitutional bone infection, which is quite frequently seen, namely syphilis.

This usually manifests itself by being existent in multiple bones, and the clinical symptoms are rather mild, when compared to the apparent pronounced pathology shown on the x-ray plate. If the luetic infection is periosteal, as so frequently seen on the tibia, the bone deposit is parallel to the shaft along the anterior border, producing the so-called saber deformity. In the acute stages the periostitis shows as multiple distinct laminae laid down upon the old cortex, and has a lacy appearance, whereas, the chronic form has the dense condition as above stated.

In conclusion, I wish to state that the x-ray study of osteomyelitis should always be associated with the patient's clinical history, to better aid the roentgenologist in a true interpretation of the various densities which a radiograph may present.

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Pathology and Etiology of Cancer

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Introduction

THIS paper is based largely upon material received at the Pathological Laboratory of the State Institute for the study of Malignant Disease, Buffalo, N. Y., and is written for the surgeon, from the standpoint of the pathologist.

The Buffalo Institute was the first of its kind to be established in the world for the exclusive study of malignant disease, the primary object being research of cancer and allied diseases, and as far as I am aware, the only institution for exclusive medical research supported by a state.

The Institute also offers to the surgeons of the state, a free diagnostic service of pathological tissues. Since this service was instituted, we have received over 20,000 specimens. At present we are receiving from forty to fifty daily.

By the use of the freezing microtome we are enabled to return a diagnosis the same day the specimen is received, and if requested, we gladly send a telegraphic report, which means that in the majority of cases, the surgeon in any part of the state can receive his report by this means within twelve hours of sending the specimen.

The title of this paper, "Pathology and Etiology of Cancer," covers an extremely large subject, inasmuch as we have come to consider that cancer is not a single disease, but a great group of diseases which have certain characteristics in common. For example, we may cite malignant disease in the uterus. Cervical malignancy differs distinctly from corpus malignancy in regard to etiology, anatomical structure and clinical course, and are as different as measles is from scarlet fever.

In the time allotted we can only touch briefly on the most salient points.

By the word cancer, we commonly understand the epithelial malignant neoplasms. These make up ninety per cent of malignant disease, but many also include in this term, the connective tissue group of malignant tumors, the sarcomata, which nearly constitute the remaining ten per cent.

Cancer is essentially an unlimited, disorderly proliferation of cells. The best known factor in instituting this unlimited growth is chronic insult or injury. It would also seem from clinical observation and experimental evidence, especially in relation to the hereditary tendency to malignant disease in the breast of mice, that an inherited instability of certain groups of cells is also a potent factor in the development of this disease.

Probably every cell in the body has potentially the power of reproduction, but the more highly developed or specialized a cell becomes, just so in proportion does it lose its power of growth. I like to think of the cells in which a malignant neoplasm originates, as being unstable cells, in which continued insult causes them to revert to the growing type.

The cells from which cancer may spring may be either (1) misplaced embryonic calls or teratoid growths; (2) benign tumor cells; (3) previously normal cells.

Of the tumors springing from previously normal cells, and these constitute the great majority, we may distinguish two types; first, those highly specialized cells which make up the glandular tissues of the body, and second, the normally growing cells, as those that constitute the epithelium of the skin and non-glandular mucous membranes. It is easier to conceive that the latter type of cells which are normally growing cells, might be made to grow atypically with less stimulus than the highly specialized cells.

Etiology

Considering that cancer is not a single disease, but a group of diseases, it is not, therefore, possible to have a single etiological cause for the entire group. The most definite outstanding factors in the causation of malignant disease may be grouped under four heads, namely:

(1) Infectious.
(2) Mechanical Injury.
(3) Thermic Conditions.
(4) Chemical Influences.

It is often stated that we do not know the cause of cancer. If we mean by this that we do not know the exact biological mechanism by which certain influences stimulate a cell to take on excessive unlimited growth, the statement is quite true. Neither do we know the exact mechanism by which the toxin of a specific organism kills a cell, as in the case of the toxin of the tubercle bacillus in tuberculosis. The trouble in cancer is that there are many and varied influences which can stimulate a susceptible cell or group of cells to abnormal proliferation, and that any one of these various influences may cause the biological change in the same type of cell in the same organ at different times. Therefore, we must accept that there is not always a single specific cause for malignant growth comparable to that which we find in the infectious diseases of known etiology. We know that in some cases the onset of the malignancy may be brought about by the continued action of heat, or by certain chemical substances, by toxins and metabolic products of organisms, and also probably by purely mechanical injury as caused by contracture of scar tissue.

I wish to make plain that different types of malignancy have different causes, that the same type of cell may be made to grow atypically by different influences acting upon it, and that we can never hope to find a single specific cause for the entire group of malignant neoplasms.

In human pathology we have no outspoken evidence of a specific organism as the causative factor, but in experimental pathology we have malignant lesions which may be considered in this light; first, the chicken sarcoma of Peyton Rous, which histologically is a spindle cell sarcoma, and which may be reproduced indefinitely by the injection of a cell free filtrate, which evidently contains an ultra-microscopic organism, and which attacks the cells of the host, producing a neoplasm.

A less definite type is carcinoma of the stomach in rats, produced experimentally by Fibiger of Copenhagen, by feeding these rats with cockroaches which have in their tissues the embryonic form of a nematode worm. This worm burrows in the mucosa of the stomach, and in a certain number of the infected rats, there is produced true tumor formation of a papillar type, some of which give a typical histological picture of carcinoma and show infiltration with the production of metastases.

A similar condition is found in human beings, in which a nematode worm, the Distoma Hematobium in Bilharzia's Disease, deposits its eggs in the mucosa of the bladder, causing in certain of these cases a malignant neoplasm.

Carcinoma of the thyroid in fish, contagious lympho-sarcoma in dogs, and the infectious epithelioma of cattle, are types found in nature in the lower animals, where organisms or infectious agents seem responsible for the new growths.

Much more apparent is the effect of mechanical injury. The great majority of epitheliomata of the lip is associated with pipe or cigar smoking, while malignant disease of the tongue is associated constantly with ragged teeth. I might mention that fifty per cent of our tongue cases give a positive Wasserman reaction, thus showing association with syphilis, which suggests the influence of the toxin of an organism in relation with mechanical injury.

Carcinoma of the liver and pancreas is intimately connected with cirrhosis of these organs.

Cancer of the gall-bladder shows a remarkable relation to cholelithiasis, gall stones being present in ninety per cent of the cases, and probably five to ten per cent of cholelithiasis is followed by malignant disease.

Epithelioma of the scrotum in chimney-sweeps and carcinoma of the lung in stone-cutters are other well known examples. The site of predilection of malignant disease in the stomach and intestines is closely related to points of fixation and mechanical injury.

As examples of the thermic influence in the causation of malignant disease, we have notably the epithelioma of the skin of the abdomen in those natives of Kashmir who wear the kangri-stove. Epithelioma caused by continued exposure to x-ray or following x-ray dermatitis, and the well known occurrence of epithelioma in scars from burns are also familiar examples.

Chemical influence is shown by the frequency of cancer of the bladder in anilin workers, epithelioma of the skin in paraffin workers, and experimentally, epithelioma has been produced in animals by long continued injection of coal tar.

No doubt insult and injury so subtle as not to be recognized grossly, is often offered to cells, which may alter their biological characteristics and institute that process which we recognize as malignant disease.

In dealing with the etiology of cancer there are certain conditions so often associated with this disease that they have been termed "precancerous lesions." These might be classified into three groups, namely:

First, those potentially malignant, as in Paget's Disease, and papilloma of the urinary bladder. These lesions if allowed to continue will probably always produce carcinoma.

Second, those conditions which frequently undergo malignant change, examples of which are papillar serous cysts of the ovary, over half of which undergo malignancy, papilloma of the larynx, and especially chronic cystic mastitis, thirty per cent of which is followed by cancer of the breast. Unhealed leukoplakia undergoes malignant change in twenty-five per cent of all cases, while ten per cent of hydatid mole is followed by chorion epithelioma.

Third, those lesions which are occasionally followed by malignancy. This class would include the congenital papillar naevus, benign adenomata of the thyroid and breast, adenomatous polyps of the intestine and other similar benign lesions. No doubt in all of these cases chronic insult and injury plays an important part in instigating the malignant change.

Age

The importance of age in the etiology of malignant disease has been given too much significance, especially in regard to its relation to carcinoma. While no doubt the majority of epithelial cancer occurs past forty, one ought never to forget the fact that this type of malignant disease may occur at any age. We have amongst our statistics many cases of carcinoma in the twenties and even earlier. Whether it be that cancer is occurring earlier in life than formerly, or whether we are seeing more, the fact remains that cancer of the stomach, cervix, intestines and also other organs of the body, is being frequently met with in the early decades of life. An important factor in regard to age is the observation that the earlier cancer occurs in an individual the more malignant it apparently is.

Sex

The influence of sex is largely due to anatomical structure and environment in the great majority of cases, although it is said that in regions where pipe-smoking is as common with women as with men that epithelioma of the lip does not begin to occur as frequently in the female as in the male. On the other hand, among certain of the natives of India, where both sexes chew the betel-nut, malignant disease of the mouth and tongue is as frequent in the female as in the male.

An interesting point in regard to environment and customs, is the fact that carcinoma of the breast is second in frequency of all cancer in the women of England, occurring in eighteen per one hundred thousand, while in Japan it occurs next to the last in frequency, being but 1.8 per one hundred thousand. The only marked point of difference in custom in regard to this condition, would be the fact that the English women wear corsets, while the Japanese women do not.

Classification

Often considerable confusion exists in the nomenclature of malignant disease, due to the classification in some cases being from a histological viewpoint, and in other cases from the clinical.

We will first consider a classification based upon the histological findings and then a classification according to the clinical types and try to correlate these types. We have endeavored to make this classification as simple as possible.

Histologically, epithelial new growths may be classified under three main divisions:

(1) Epithelioma.

(2) Adeno-carcinoma.

(3) Medullary or solid carcinoma.

The epitheliomata, which take their origin either from the epithelium of the skin or non-glandular mucous membranes, are distinctive from the glandular epithelial neoplasms. They may be conveniently divided into three groups:

(1) Pearl or prickle cell epithelioma springing from the skin.

(2) Basal cell epithelioma springing from the epithelium of the hair follicles, or glands of the skin.

(3) Mucous membrane epithelioma, which arises from the mucous membranes covered with stratified squamous epithelium, as in the cervix, mouth, vagina, oesophagus, etc.

The adeno-carcinoma is a histological type springing from glandular structures, and characterized by the cells, aping, more or less, the structure of the glands from which they spring. These include usually duct and papillar adeno-carcinoma.

The term medullary carcinoma has been given to those tumors which histologically show solid masses of growing epithelial cells, which do not tend to differentiate themselves in gland-like structure.

But at times in medullary carcinoma groups of cells appear to arrange themselves in such a manner as to form small central lumina, thus showing some tendency toward polarity, and this structure has led to the use of such terms as alveolar, acinar or tubular carcinoma. As a general rule, the nearer a cancer cell tends to differentiate itself toward the normal form, the less malignant it probably is.

Thus is may be accepted, that tumor cells which tend to imitate the normal structure are probably more slowly growing cells, and tumors of this type are thus less malignant. The medullary or solid type of cancer being composed of more immature cells represents the more malignant type.

Clinical Types

The classification of cancer from the clinical type is based upon the appearance or other gross characteristics of the neoplasm. Consequently we have:

(1) Papillar or fungoid carcinoma, characterized by papillary outgrowth on surfaces.

(2) Infiltrating carcinoma, a tumor growth with a tendency to grow into the surrounding tissues.

(3) Ulcerating carcinoma, which is often but a later stage of the papillar or infiltrating, but may have originated in an ulcer

(4) Medullary carcinoma, the term applied to the very cellular soft varieties.

(5) Scirrhous carcinoma, a term used where the tumor is extremely hard.

(6) Gelatinous or colloid carcinoma, in which there is a great tendency to the production of mucin, which gives a jelly-like appearance to the cancer.

It is not always possible to correlate the histological and the clinical types, for many of the histological types may appear in any of these clinical forms. Papillar carcinoma, springing from mucous membranes covered by stratified squamous epithelium are most always mucous membrane epitheliomata, while those springing from glandular mucous membranes are usually adeno-carcinoma.

The infiltrating type is usually medullary or solid carcinoma.

Scirrhous cancers are characterized by an excessive amount of connective tissue stroma.

In epithelial neoplasms the stroma is merely a part of the framework and does not partake of the malignancy. It is formed by proliferation of connective tissue cells and these cells have a definite rate of growth. When the cancer cells grow rapidly, they outstrip the connective tissue, and we have a soft cellular or medullary carcinoma. When the cancer cells grow slowly, the connective tissue elements outstrip the cancer cells, and in this case we have a preponderance of stroma and thus a scirrhous carcinoma. But the condition is evidently local, for it is quite the rule that scirrhous cancer metastasizes nearly as frequently as medullary carcinoma, and very often, the metastatic growths do not show the scirrhous type, but are bulky cellular growths.

The gelatinous type, frequently called colloid carcinoma, is characterized by a production of mucin or a degeneration of the tumor cells into a mucinous substance, and histologically is adeno- carcinoma.

The significance of these various clinical types may briefly be summarized as follows:

The papillar or fungoid growths are usually comparatively benign. They are characterized by late metastasis and it is this type of malignant tumors in which we may expect the happiest results from surgical procedure.

On the other hand the infiltrating, ulcerating and medullary types are characterized by infiltration in the surrounding tissue with early metastasis.

Scirrhous carcinoma, as mentioned above, is usually characterized by slow growth and is the type usually seen in older people.

Gelatinous carcinoma has little tendency to metastasis, but has marked invasive characteristics, penetrating into the muscular walls, and in the case of the intestines and gall-bladder, where it is most commonly found, it becomes extensively disseminated throughout the peritoneal cavity.

The different types of epithelioma have their distinct clinical differences, which may be briefly stated as follows: the basal cell epithelioma occurs most frequently in the later decades of life, and is almost exclusively confined to the regions above a line corresponding to the angles of the mouth. Metastases are extremely rare.

The prickle or pearl cell epithelioma usually occurs earlier in life than the basal cell. While the great majority occur at the orifices, as the lip, vulva, and anus, and on the penis, it may originate anywhere in the skin.

Metastases occur often, but comparatively late.

The mucous membrane epithelioma springs from mucous membranes covered with stratified squamous epithelium, and is characterized by its early occurrance in younger people, and by its marked tendency to early and extensive metastases.

Metastasis

As is well known, metastasis, in epithelial malignant growths, is usually through the lymph-channels into the regional lymph-nodes, and is accounted for by the facility by which epithelial cells grow into lymph spaces.

Occasionally tumor cells penetrate the vessel walls and metastasis in this case, occurs by the blood stream, often producing distant metastasis and carcinomatosis.

Apparently there are some biological phenomena associated with metastases, for the size of the primary tumor, or the duration of the disease, does not always determine their presence. Very small, apparently early tumors of the breast, frequently show extensive metastases in the axilla, while on the other hand, large tumors of relatively long standing, show only hyperplasia of the lymphnodes, but no infiltration with malignant cells.

In experimental cancer we have found that in definite strains of transplanted breast tumors of mice, metastases occur when there is some evidence of a loss of immunity in the animals. This is evidenced by the appearance of sudden rapid growth in the tumor mass, after a period of moderate growth, and is quite constant for strain. An interesting point in this connection is the fact that we can artificially produce, prematurely, metastases in these animals, by rough handling or massage of the tumors, a significant point to have in mind when palpating suspicious lesions.

The presence of metastases is of grave prognostic import, for in the majority of cases of malignant disease, the chances for cure after the primary tumor has metastasized are greatly reduced.

*—Read at meeting of American College of Surgeons, Nebraska Section, Omaha, March 3, 1921.

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Oral Radiography

IT is probable no other particular branch of radiology warrants more earnest consideration and conscientious study, at this juncture in the development of the science, than oral radiography. Radiology is surging rapidly to the fore, but that it may not later fall because of its own shortcomings, a supreme effort should be made to round out its structural foundation.

This is a far-reaching statement, and it is made with full cognizance of the vast possibilities radiology has already opened up for extended certainty of service in the scientific discovery and treatment of disease.

But from the fact that it has in so short a time accomplished so much arises an enormous obligation to avoid the treacherous consequences of acts of omission as well as commission. The fact is oral radiography has been sadly neglected. No other branch of this specialty has furnished so rich opportunity and at one and the same time has been so grossly and wantonly abused.

Two things appear with alarming clarity: one, that medical radiologists know comparatively little about the pathology of the mouth; and two, mighty few dentists know enough about the technique of radiology to function properly.

There is an old adage to the effect that the pot should not call the kettle black. Mindful of the wisdom of that saw, crimination and recrimination will neither be indulged nor tolerated. Whatever is said on the subject from either the medical or the dental side will be absolutely free from that contemptuous form of professional suicide. There shall probably be points of difference. But there is no harm in disagreement—rather progress most often springs from the bowels of disagreement. And even in disagreement man may evince those little refinements and little elegancies which have since time immemorial been recognized as the mark of gentlemen.

In the first place, two matters of vital importance must be worked out if the radiologists on the medical side are to fulfil their functions, and if the dentists on their side are to advance in the practice of their science commensurately with public demand. Those two things are: One, uniformity of nomenclature; and two, standardized technique based on a thorough understanding of mouth pathology. At present, there is such a multiplicity of terms describing identical oral conditions, and such a paucity of knowledge concerning the technique of oral radiology, that both dentist and medical diagnostician experience keen disappointment in the results obtained.

There is also so much mediocrity in product that oftentimes interpretations are made from intra-oral radiograms which are not in any measure interpretable either because of over or under-exposure, distortion, or lack of detail. There is, too, a deplorable tendency to make dental radiograms with too great a degree of penetration, which results in burning up the delicate bone detail so essential in diagnosing a dental case. In such cases, areas of residual infection in the sites of old extractions go undetected and only gross lesions are observed.

These are only a few of the avenues of approach to the bigger problem of the relation of oral foci to systemic disease, a problem worthy the best combined efforts of the dental and medical professions. With this as the ultimate goal, The Journal will from time to time, beginning with this issue, print articles written by reputable dentists on the various aspects of oral radiography. They will be written by such men as Dr. Frederic F. Molt of Chicago, Dr. Clarence O. Simpson of St. Louis, Dr. William L. Shearer of Omaha, and Dr. Howard R. Raper of Albuquerque, New Mexico.

Without being guilty of presumption, in view of what has been said, The Journal feels that it may rightfully bespeak the sincere and intelligent coöperation of dentists and radiologists everywhere in the direction indicated.

Chicago Roentgen Society

OFFICERS of the Chicago Roentgen Society for the ensuing year are: President, Dr. B. H. Orndorff; Vice President, Dr. B. C. Cushway; Secretary, Dr. E. S. Blaine.

Canadians License Technicians

AT THE recent meeting of the Canadian Radiological Society which was held at Niagara Falls, Ontario, a resolution of considerable importance was passed. This resolution had to do with relationship of the Canadian radiologist to the technician. In so far as possible they are attempting to follow the British plan of licensing technicians. The scheme of the Canadian Society is to have a licensing board appointed by the society to which any technician may make application for license. They must then pass an examination and in addition to the examination must show two years actual experience under a competent medical radiologist. After the examination has been passed the technician receives a license issued by the license board of the Canadian Radiological Society. This license is active only so long as the technician is associated with the radiologist. If he should sever his relationship with the medical radiologist and attempt to establish a lay laboratory, his license would immediately become invalid.

Resolutions Adopted by The Radiological Society of North America at Annual Meeting, Chicago, December, 1920.

WHEREAS, the question of the ownership of the roentgenogram has never been definitely settled, and

WHEREAS, other points regarding the ethics and conduct of radiologists relative to the disposal of their roentgenograms, records and reports of their findings, have never been clearly outlined; therefore, be it

RESOLVED, by The Radiological Society of North America, that it is the sense and judgment of this society, that all roentgenograms, plates, films, negatives, photographs, tracings or other records of examinations are hereby declared to be the exclusive property of the radiologist who made them (or the laboratory where they were made); and be it further

RESOLVED, that the ethics of this society shall be in full harmony with the "Principles of Medical Ethics of the American Medical Association, with the following additions, to-wit:

The radiologist is hereby declared to be a consultant in all cases where he is called upon to examine patients.

The radiologist shall not make known to patients, their relatives, friends or guardians, any of his findings or conclusions, nor shall he deliver to them any of the plates, negatives, films or prints, unless expressly requested to do so by the physician or surgeon who referred the patient for examination, or is in charge of the case.

It shall be considered unethical to advertise by circularizing in the medical or lay press with price lists or fee tables, descriptions or illustrations of office apparatus or facilities, or to advertise by displaying signs stating the medical specialty; or in the public press, telephone directories, or city, state or national directories, which are published for general use.

It shall be considered unethical for any one to claim superiority in diagnosis or treatment, due to some secret process, method or apparatus held to be known only by the claimant.

American Roentgen Ray Society Meeting

THE annual meeting of the American Roentgen Ray Society will be held at Washington, D C., on September 27th, 28th, 29th and 30th. President Arthur C. Christie calls attention to the fact that the meeting will be arranged this year so that approximately two days time will be given over to the discussion of therapy and two days to the discussion of diagnostic problems. The program is now complete and is made up of men of the highest rank in our own country, as well as from foreign countries. Dr. Ledoux-Lebard of France will deliver the Caldwell lecture.

It is extremely important that all who expect to attend make hotel reservation at once. Headquarters will be at the Hotel Washington. Hotel accommodations for members and guests may be arranged at the Washington Hotel and The New Ebbitt Hotel. Requests for reservations should be addressed to these hotels, stating that accommodations are desired for the meeting of the American Roentgen Ray Society. This will assure reservation.

State Medicine

DEPENDING on the measure of importance which they attach to the science of medicine as a preventive agent or curative factor, the individual members of the medical profession may, or may not, find solace in the findings of the Committee of the American Engineering Council that the annual industrial or economic loss in the United States from "preventive disease and death exceeds $3,000,000,000.

Depending also on their willingness to meet the issue squarely in an effort to discover that practical plan which will make it possible for the medical profession as a socio-economic unit to fulfill its full purpose, those same members of the profession may, if they will, discern the reason for the economic demand for some form of state medicine in the fact just recited. As they may also find cause for serious thought concerning the future of the profession in the manner in which the committee in question disposed of so important a problem. One of two conclusions is inescapable, that is, that the committee did not desire to assume the responsibility for attempting solution of the problem set up or that it is satisfied with the present agitation looking to state medicine. That is essentially true, because the committee is authority for the statement that 42,000,000 persons lost 350,000,000 days from illness and disease and non-industrial accidents last year.

The importance of this latter fact becomes apparent when it is known that 42,000,000 persons constitute the entire wage earning population of the United States, including every person earning $5,000 yearly or less.

Stated conversely, the average annual loss to each one of the 42,000,000 persons composing the industrial and commercial fabric of the United States last year was eight and one-half days, from causes which can very largely be removed or controlled by a properly organized and administered system of preventive medicine.

That is a big assumption. But nothing less than its comprehension and reduction to practical accomplishment will save the neck of the medical profession as a scientific complement of the bread and butter existence of the people of this country.

And because this problem is of such magnitude and so vital to the profession, as well as the public, it is not something to be discussed vaguely in the whispering gallery of idealism. It must be met fearlessly with the combined acumen and sagacity of the profession and some arrangement devised that will be capable of understanding by, and in sympathy with, the needs and aspirations of 42,000,000 wage earners and their dependents. The ideals of the medical profession must be expanded from the individualistic type of human service to a national size, and coördinated effort of the entire profession toward the accomplishment of a national purpose, that is, the public health, become the new vision which will impel the individual members of the profession to its achievement.

Undoubtedly some of these thoughts surged in the mind of Dr. Hubert Work, president of the American Medical Association, as he contemplated his presidential message, delivered at Boston last June, for he said:

> "Thoughtful men believe that a crisis threatens established principles, and that physicians must now earnestly address themselves to the cause and prevention of disease and disability as the primary concept of medicine. If its members become piece workers it may fail of public appreciation as an essential economic factor in the preservation of national wealth, because of a depreciating national health."

Dr. Work also emphasizes the need for some inclusive medical program, as evidenced by his statement that:

> "The art and science of medicine is comprehensive and rational. It can never be dogmatized or restricted, for it comprehends a knowledge of every art and science which may contribute to it, for the single purpose of obviating the tendency to death."

He also realized the public demand for preventive functioning by the profession, as disclosed in the following excerpt:

> "The needs of mankind have created and developed the physician, but we now have progressed in the curative art as applied to the relief of a single organ as far as we may safely go without advancing a philosophy of medicine applicable to a nation."

And that Dr. Work is convinced the solution for the present problem which confronts the profession must be based on a practical philosophy of economics is proven by his declaration that:

> "Medicine cannot be dissociated from economics without inviting the deterioration which has come to older civilizations whose histories have been written."

In view of the large picture of opportunity for public service and the responsibilities of the medical profession, drawn by Dr. Work, one may not accept his next assertion without some chagrin.

To quote again:

> "Our scheme of governmental administration provides for a sec-

retary of labor to guard wage rights; a secretary of agriculture to study animal husbandry; a public health service under a lay secretary of the treasury, BUT THERE IS NO ONE CHARGED WITH CONSERVING THE PHYSICAL ABILITY OF MEN TO DO A DAY'S WORK."

With due respect to Dr. Work's position and the well established attitude of the American Medical Association on the question of professional obligation, it is somewhat difficult to harmonize this statement with the balance of his address. It would seem that the concept of the medical profession is, or should be, the conservation "of the physical ability of men to do a day's work."

This is especially true when one remembers that labor has found it necessary to guard its wage rights through organization independently of and as a means for forcing political recognition. When one looks for the motive behind animal husbandry and discovers that in the main the farm vote is a subtle though controlling influence; and when, as Dr. Work admits, one realizes that the public health service is not now a functioning unit of the government. In other words, it has been proven too often to need further demonstration that a governmental agency for constructive effort must be vitalized constantly from without; and that such a unit, under our form of government, almost always proves to be more efficacious as a corrective influence than as a power imbued with the initiative demanded for the successful comprehension of the diverse ramifications of the public health question.

Believing that the burden rests on the medical profession to present some plan which will ultimately accomplish a better condition of public health through intelligent living on the part of the public, and preventive measures established and administered by the profession itself, the prime purpose of this writing is to set up the outlines of a true picture of the national, physical and mental problem; to point out the trend of our physical wellbeing; to help lift the curtain of uncertainty from the future of the medical profession, and to assist in charting a course which will meet the urgent needs of the social body as by substituting conscious purpose for tradition.

In any comprehensive study of the public health question, whether from a preventive or curative standpoint—but more especially the former—it is absolutely essential to determine three facts as the premise on which to rear the superstructure of an intelligent and inclusive plan of procedure. Those three facts are:

1. Distribution of nativity for the purpose of affording comparison of hereditary characteristics and environmental influences.
2. Ratio of defectives according to geographical subdivision and occupational tendencies.
3. Distribution of defectives according to specific disease.

For this reason the surgeon general's report is a very valuable compilation. It gives the results of the first and only comprehensive survey of our physical and mental stamina, and furnishes the information with which the three primary facts can be established. Notwithstanding the fact that the information which the surgeon general's report contains was compiled for purely military purposes, the medical profession enjoys the unprecedented opportunity of using it for social, economic and medical account, as by proceeding from the facts which it discloses to a better understanding of the relation which our polyglot nativity and occupational tendencies bear to the question of public health.

Acting on the assumption that the medical profession will be in entire accord with any sincere effort to arrive at an incontrovertible base from which to proceed in this matter, certain facts have been taken from the surgeon general's report and are set up here for the purpose of giving the profession a true picture of our national health problem. The geographical units established by the War Department have been accepted and used, and the figures which follow are allocated according to the geographical groupings fixed by the War Department in its examination of drafted men under the selective service act. The three facts mentioned as the primary base of a study of this character are shown as to each of the nine geographical groups, which make it a comparatively simple matter for any member of the medical profession to study in detail the conditions of the particular unit in which he is interested, unhampered by the reduction of all the groups to a single national composite unit. By setting the data up in this form, also, it is easy to make comparisons and draw conclusions not otherwise possible.

There is much data for serious consideration by the thoughtful members of the profession in the figures given. It is hoped they will be given the sincere study they merit and that they will afford tangible benefit to those persons seeking honestly to bring the profession to a conception of the social problem it, and it alone, can solve with that degree of advantage which will enhance materially the public welfare.

Population stated in percentages of nativity; ratio of total defectives per 1,000 men, and ratio of five principal defects per 1,000 men.

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GROUP I.—Composed of states of New York, Pennsylvania, New Jersey and Delaware.

Percentage of nativity

Native White	45 %	Negro	1½%
Austrian and Russian	15 %	Canadian	1 %
German	12½%	Scotch	1 %
Irish	12½%	Hungarian	1 %
Italian	5 %	Scandinavian	½%
Other Foreign White	2½%		
Mexican and West Indian	2½%		100 %

Ratio defects per 1,000 men

New York	502.7	Pennsylvania	500.
New Jersey	452.3	Delaware	475.18

Ratio of defectives by disease.

	New York	New Jersey	Pennsylvania	Delaware
Tuberculosis	27.06	22.26	22.08	15.02
Venereal	29.77	34.99	36.48	77.21
Cardio-Vascular	41.05	30.88	32.83	24.82
Developmental	36.20	35.10	32.77	57.76
Nervous and Mental Disorders	14.8	10.87	14.62	9.75

◆ ◆ ◆ ◆ ◆

GROUP II.—Composed of states of Maine, New Hampshire, Vermont, Connecticut, Rhode Island and Massachusetts.

Percentage of nativity

Native White	42½%	German	4 %
Canadians	15 %	Italian	3 %
Irish	15 %	Scotch	2 %
Austrian and Russian	5 %	Scandinavian	2 %
Other Foreign White	5 %	Negro	2 %
English	4½%		100 %

Ratio defects per 1,000 men

Maine	563.61	Vermont	613.19
New Hampshire	505.28	Connecticut	507.89
		Rhode Island	640.48

Ratio of defectives by disease.

	Maine	N. H.	Ver.	Conn.	R. I.
Tuberculosis	31.47	17.36	27.72	27.63	40.18
Venereal	23.74	18.49	13.03	26.55	27.56
Cardio-Vascular	55.70	23.63	46.51	34.20	44.33
Developmental	72.10	59.16	63.33	39.32	112.51
Nervous and Mental Disorders	25.93	13.54	39.35	14.62	19.68

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GROUP III.—Composed of states of Wisconsin, Illinois, Indiana, Ohio and Michigan.

Percentage of nativity

Native White	52½%	Canadian	2½%
German	21 %	English	2½%
Other Foreign White	5 %	Negro	2½%
Austrian and Russian	5 %	Hungarian	2 %
Scandinavian	2½%	Italian	2 %
Irish	2½%		
			100 %

Ratio defects per 1,000 men

Wisconsin	465.03	Indiana	416.99
Illinois	471.25	Ohio	421.40
		Michigan	467.20

Ratio of defectives by disease.

	Wis.	Ill.	Ind.	Ohio	Mich.
Tuberculosis	22.76	23.06	24.15	21.46	22.09
Venereal	20.28	52.69	47.07	41.34	44.54
Cardio-Vascular	31.06	23.62	22.39	28.32	50.30
Developmental	28.85	28.65	29.27	25.46	22.52
Nervous and Mental Disorders	17.46	13.46	14.30	16.31	14.48

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GROUP IV.—Composed of states of Georgia, South Carolina, North Carolina, Virginia, West Virginia and Maryland.

Percentage of nativity

Native White	60 %	Italian	½%
Negro	35 %	English	½%
German	1½%	Irish	½%
Other Foreign White	1 %		
Austrian and Russian	1 %		100%

Ratio defects per 1,000 men

Georgia	455.78	North Carolina	453.89
South Carolina	422.60	West Virginia	507.38
		Virginia	604.21

Ratio of defectives by disease.

	Ga.	S. Car.	N. Car.	W. Va.	Va.	Md.
Tuberculosis	24.46	19.93	30.47	17.39	32.10	38.46
Venereal	135.64	131.32	69.56	52.67	71.21	66.73
Cardio-Vascular	34.81	25.80	27.41	18.13	31.51	46.58
Developmental	48.79	42.79	33.41	17.15	33.05	43.43
Nervous & Mental Disorders	16.72	24.24	25.91	12.97	24.13	26.07

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GROUP V.—Composed of states of Florida, Mississippi, Alabama, Tennessee and Kentucky.

Percentage of nativity

Native White	63 %	Italian	1 %
Negro	31 %	Irish	1 %
German	2 %		
Other Foreign White	2 %		100 %

Ratio defects per 1,000 men

Florida	541.60	Alabama	427.70
Mississippi	426.21	Tennessee	442.40
		Kentucky	382.10

Ratio of defectives by disease.

	Florida	Miss.	Ala.	Tenn.	Ky.
Tuberculosis	19.15	24.12	21.14	30.83	31.61
Venereal	163.32	132.46	114.67	65.16	39.53
Cardio-Vascular	24.42	21.75	22.07	31.10	18.34
Developmental	44.11	24.74	29.57	51.51	42.62
Nervous and Mental Disorders	13.57	20.01	19.48	24.55	17.81

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GROUP VI.—Composed of states of Texas, Oklahoma, Louisiana and Arkansas.

Percentage of nativity

Native White	60 %	Austrian and Russian	1½%
Negro	25 %	Irish	1½%
German	4 %	India, China and Japan	1 %
Mexican and West Indian	2½%	Canadian	1 %
Other Foreign White	1½%	English	½%
Italian	1½%		
			100 %

Ratio defects per 1,000 men

Texas	402.40	Louisiana	438.9
Oklahoma	432.70	Arkanssa	384.2

Ratio of defectives by disease.

	Texas	Oklahoma	Louisiana	Arkansas
Tuberculosis	23.03	19.31	27.61	21.47
Venereal	112.08	85.15	121.40	105.28
Cardio-Vascular	16.72	16.34	23.86	16.76
Developmental	28.74	23.31	37.22	26.16
Nervous and Mental Disorders	12.34	15.45	26.76	14.26

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GROUP VII.—Composed of states of North Dakota, South Dakota, Nebraska, Kansas, Missouri, Iowa and Minnesota.

Percentage of nativity

Native White	55 %	Negro	2½%
German	15 %	Canadian	2 %
Scandinavian	10 %	Mexican and West Indian	1½%
Other Foreign White	5 %	Scotch	1 %
Austrian and Russian	4 %	India, China and Japan	½%
Irish	3½%		
			100 %

Ratio defects per 1,000 men

North Dakota	438.	Kansas	354.35
South Dakota	373.2	Missouri	489.
Nebraska	386.99	Iowa	425.78

Ratio of defectives by disease.

	N. D.	S. D.	Nebr..	Kas.	Mo.	Iowa	Minn.
Tuberculosis	14.30	16.97	12.41	19.21	26.18	17.15	18.42
Venereal	18.64	15.60	30.97	30.07	65.24	29.87	24.20
Cardio-Vascular	24.46	27.30	18.52	18.74	30.71	27.37	27.10
Developmental	12.88	16.99	15.67	16.69	34.75	30.11	22.48
Nervous and Mental Disorders	13.68	17.90	11.21	16.27	17.76	19.59	14.48

GROUP VIII.—Composed states of Montana, Wyoming, Nevada, Idaho, Utah, Arizona, Colorado and New Mexico.

Percentage of nativity

Native White	52½%	Irish	3 %
Other Foreign White	10 %	Mexican and West Indian	3 %
English	6 %	Italian	2½%
Hungarian	5 %	Scotch	2 %
German	5 %	Austrian and Russian	2 %
India, China and Japan	3½%	Negro	2 %
Canadian	3½%		
			100 %

Ratio defects per 1,000 men

Montana	456.7	Utah	505.82
Wyoming	465.03	Arizona	410.01
Nevada	476.	Colorado	544.97
Idaho	479.26	New Mexico	458.22

Ratio of defectives by disease.

	Mont.	Wyo.	Nev.	Idaho	Utah	Ariz.	Colo.	N. M.
Tuberculosis	13.37	11.90	19.92	16.11	15.68	66.58	57.49	63.54
Venereal	34.49	23.37	32.96	22.45	19.28	48.20	24.60	67.43
Cardio-Vascular	26.34	16.29	28.08	29.87	54.60	24.79	26.92	18.51
Developmental	15.86	19.44	32.51	21.86	32.46	15.19	34.81	34.89
Nerv. & Mental Disorders	5.56	5.42	3.36	8.26	9.57	4.09	11.93	14.72

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GROUP IX.—Composed of states of Washington, Oregon and California.

Percentage of nativity

Native White	50 %	Scandinavian	5 %
Other Foreign White	12½%	Italian	5 %
German	8 %	Scotch	2½%
India, China and Japan	5 %	Austrian and Russian	1½%
Canadian	5 %	Negro	1 %
Irish	5 %		
			100 %

Ratio defects per 1,000 men

Washington	549.41	Oregon	579.59
		California	583.89

Ratio of defectives by disease.

	Washington	Oregon	California
Tuberculosis	28.19	24.49	47.14
Venereal	28.93	22.28	27.58
Cardio-Vascular	68.84	39.90	39.94
Developmental	29.31	27.18	45.91
Nervous and Mental Disorders	12.28	12.38	11.75

New Equipment

THE VICTOR-KEARSLEY STABILIZER

THIS device means much to the roentgenologist, for it eliminates a factor of inconsistency which is experienced in the operation of Coolidge tubes on practically every voltage supply circuit.

This inconsistency is not due to any shortcomings within the tube itself, but rather to the surrounding conditions, that is, fluctuations in the line supplying the filament circuit. As is well known, the passage of current through a Coolidge tube is dependent upon the heat of the filament, and the control of amount of current through the tube is by varying the heat of the filament. An increase of current through the filament circuit means an increase of current through the tube.

The operating range of the Coolidge tube is at filament temperatures of from 2050 C to approximately 2300 C. Because of these comparatively narrow limits, a slight change in line voltage in the filament circuit will bring about a very great change in tube circuit. This explains why two consecutive radiographs, using the same technique, are frequently so different in diagnostic qualities when line voltage fluctuates.

The Victor-Kearsley Stabilizer is an instrument designed to maintain a constant tube current over a line voltage variation at the filament transformer. By its means the heat of the filament is maintained at the required temperature to permit a desired amount of current through the tube Should a line voltage fluctuation occur, this stabilizer automatically causes a change of temperature in the tube filament, to equalize the fluctuation and thus hold the tube current constant.

The device is placed in the high tension circuit, therefore, adaptable for use regardless of the low tension voltage supply or frequency.

The range of control is from 2 ma. to 100 ma. tube current. The setting for the desired tube current is made

with the insulated handle at the lower end of the stabilizer.

This instrument can be used with any interrupterless x-ray apparatus and the Coolidge tube. It can be immediately cut out of the high tension system when it is desired to use the regular Coolidge filament control, as, for instance, in fluoroscopy.

Every roentgenologist will welcome this wonderful aid in his work. It insures uniformity in radiographic results and will save considerable in plate costs, also the time consumed in making additional exposures. For therapy it is of vital importance, in that it enables the operator to make his setting for the desired current and know that the stabilizer will maintain that current for any period of time. Its value for administering exact dosage is, therefore, obvious.

The main elements of the stabilizer consist of the following:

1. A vibrating relay, which tends to hold the filament current constant regardless of change in voltage.
2. A limiting relay, which prevents heavy current surges through the tube at the time of closing the x-ray switch.
3. A fixed resistance in each relay circuit.
4. A regulating mechanism which is adjustable by hand to obtain any desired tube current within the range of the stabilizer.
5. An on and off switch.

SWEETBRIAR SCREENS

A WORD or two concerning the history of Sweetbriar Screens may be interesting to the average radiologist, perhaps too much inclined to expect a great deal of manufacturers of various appliances and then not appreciate the rendition of indefatigable service in the perfection of an apparatus.

The Sweetbriar Screen was designed by a Mr. Smith, an English gentleman, who completed his college course in England just a few weeks after the x-ray was first discovered. Shortly thereafter, Mr. Smith came to the United States and has been actively identified with x-ray work ever since. He begun the manufacture of fluorescent screens of platinum-barium-cyanide in 1906, marketing them through dealers under such labels as they directed. About four years ago, Mr. Smith determined to market his own product.

At a meeting in Saratoga in 1919, Mr. Smith exhibited some screens having remarkable qualities, in that they could be put into developer or fixer and be washed and used again without the screen being in any way injured. They could also be put on the floor and jumped on without showing any marks. These screens are extremely difficult of manufacture, and the Sweetbriar Laboratories are not yet prepared to place them on the market as a regular product, though it is hoped they will accomplish this in the not too far distant future.

The Sweetbriar Laboratories divide screens into two classes—those which have the calcium tungstate mounted in such a way that it is porous, so that any drop of developer or fixer destroys the calcium tungstate completely through the screen where it touches, and those that are so mounted the mounting medium closes all pores in such a way that a drop of developer or fixer will destroy only such particles of calcium tungstate as are actually exposed where the drop falls. Screens of the latter class are not destroyed and are scarcely injured by developer or fixer if immediately cleaned off.

Sweetbriar screens are of the non-porous variety. They can be distinguished from the porous by their high gloss. The filling of the pores produces a screen which is more durable and of slightly slower speed Sweetbrite Screens are guaranteed to have absolutely no grain. They are usually shipped as folders. They are very flexible, and in this form are easier to handle and make better contact. They are also easier to clean, since they can be lifted from the cassette and opened flat on a table.

WAPPLER PORTABLE X-RAY UNIT

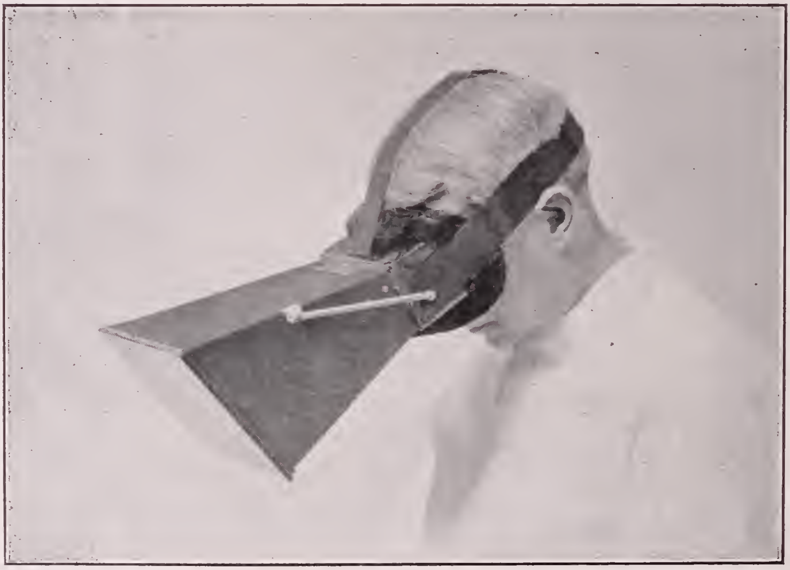
RADIOLOGISTS will be interested in the Wappler Portable X-Ray Unit, because frequently it is neither possible nor advisable to move the patient to plant for observation or treatment. With this unit, work can be done equally satisfactorily in the private home and hospital ward as in the laboratory. It is really a bedside unit. It is also so efficient as to serve as an auxiliary unit at the office when other units are busy. And for the physician or surgeon inaccessible to an x-ray laboratory, the Wappler Portable is an ideal unit for use in minor cases. The distinction minor is made, not because the unit under discussion is inefficient, but because in cases of major importance, the physician or surgeon prefers to refer his patients to an experienced radiologist for diagnosis and treatment.

The need for such a unit is great and it will add materially to the rendition of larger service by the profession.

PATTERSON OPERATING FLUOROSCOPE

ONE of the distinct accomplishments in x-ray science, from roentgenologist, and now manufactured and sold by The Patterson Screen Company.

The advantages of The Patterson Operating Fluoroscope for the busy



the equipment side, which may be accredited to the necessities of war, is the device developed by a French radiologist will occur without detailing them here. It is sufficient to direct attention to the two figures; and to say that the weight of this fluoroscope is but a few ounces. It is adjusted to any head by the elastic

bands—the eye piece is fitted with soft material, which conforms to the contour of the nose and forehead, closing out all external light, and is hinged so that it can be tilted back against the head, as shown in figure two when not in use. When tilted back, a piece of ruby glass automatically falls down in front of the eye piece protecting the accommodation of the eyes. It is equipped with a 5-inch by 7-inch Patterson Fluoroscopic Screen and protected by the best quality of polished and ground lead glass.

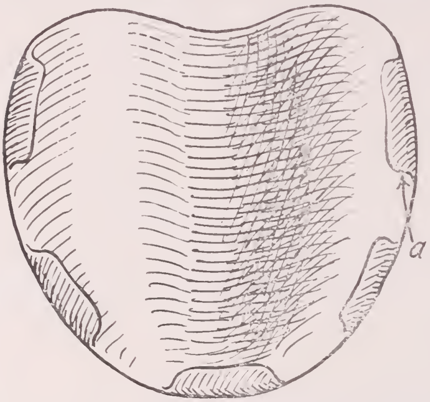
Department of Technique

A NEW METHOD OF HOLDING THE FILM IN THE MOUTH

J. De'Voine Guyot, M. D.
Bucklin, Mo.

I THINK that practically every device that has been put on the market for the purpose of holding the film in the mouth of the patient has been abandoned in favor of the old simple finger method. I have tried all I have ever heard of or have seen without any great degree of satisfaction, and I believe that has been the experience of everyone doing dental radiography.

Recently I developed a holder for use with the upper jaw that is giving me a great deal of satisfaction and has the advantage of being cheap,



a- Edge turned back to hold edge of Film. About ¼ inch fold is enough

simple and permits the film to be placed in the desired position before inserting in the mouth and it will stay where it is put.

From a heavy piece of sheet dental gutta percha make a plate to conform to the general contour of the roof of the mouth, allowing the margins to project slightly (¼-inch) beyond the teeth. This can be easily done if the material is immersed in warm water. Trim the plate on its posterior edge so that it will not impinge on the tissues at the back of the mouth and cause gagging. Turn back portions of the edge that was left to project beyond the teeth, and bend them sharply against the palatal surface of the plate. Two on each side and one in front are sufficient. The intervening material may then be cut away. These serve to hold the film in place when it's edge is slipped under them.

The film is placed with its edge under one of these turned back portions, the plate inserted in the mouth and the patient instructed to make pressure on the centre of the plate with the thumb or finger while the exposure is being made.

The film will not slip down or rotate and the next film can be easily placed in its proper relative position, overlapping is avoided and my patients insist that it is far more comfortable than using simply the finger.

I have several sizes of the plates and am getting better results with less effort than ever before. I am still using, for want of something better, the finger with the lower jaw, but am in hopes that eventually something better will show up.

With the hopes that others may find this method as useful as I have, I take pleasure in commending it to you for a trial.

DEVICE FOR MARKING PLATES

H. L. Bernheimer, M. D.,
Terra Haute, Indiana.

FOR some time I have been using a device for marking plates which has proven so simple and practical in my hands that a number of my colleagues have remarked about it. It does away with re-handling of numbers and there is no chance of losing the numbers, because they are used but once. The device is one of the old check perforators made by the

Fig. 1—Showing the check perforating machine fitted with a track which will take a strip of tin foil three quarters of an inch wide. On the left hand side the foil has already been perforated, while on the right hand side no perforation has been made.

B. F. Cummings Company of Chicago. No doubt, there are others on the market that will do similar work.

As you will see in Figure 1, I have added on the base of the check marker a track so that tin foil cut three-quarters of an inch wide is kept in a straight line while being perforated with the numbers. Any length of foil

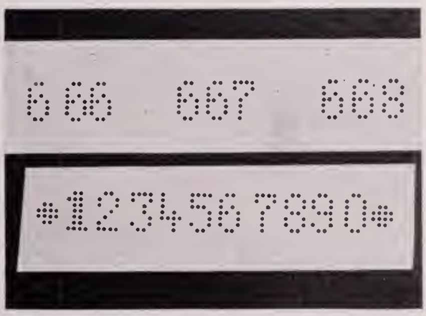


Fig. 2—Print showing the appearance of the numbers on the x-ray plate.

may be used, so that as many numbers as you wish may be perforated on it. After the perforation has been made, the foil is rolled up so as you use it all you need to do is to cut off the number, use it on the plate and then discard it.

A SIMPLE METHOD FOR KEEPING EFFICIENT RECORDS IN ROENTGENOTHERAPY

J. Thompson Stevens, M. D.,
Montclair, N. J.

IT IS, I believe, generally recognized that the records kept in most roentgenotherapeutic laboratories are totally inadequate where any great degree of accurate, scientific work is to be desired. I realize that the above statement is not true in all cases, for I have seen the records of a few of the men which meet the most exacting requirements. In my own case, however, I know that in the past my records were at times not of much value, particularly when several months had lapsed since the last visit of the patient. The record here offered, I think, will meet any and all requirements with entire satisfaction. At a glance the roentgenotherapeutist can tell exactly what was done at the last visit of his patient.

The chart is prepared upon a flexible cardboard, flexible enough so that it can be easily run through a typewriter. Cardboard was chosen as it is more resistent to repeated handling than paper. The size of the cardboard is 8½x11 inches. Only one side of the cardboard is ruled as shown, the other side is left plain upon which the history of the case can be typed, also the physical findings, etc., and the clinical course of the case.

Columns marked date and area need no explanation. Columns Tube and App. mean tube and apparatus. All who are doing much roentgenotherapeutic work well know that machines and tubes of the same make often vary within wide limits as to their output in spite of the fact that the treatment factors were always the same. Here tubes and machines are numbered and the apparatus used in

DATE	AREA	TUBE	APP	DISTANCE	M. A.	VOLTAGE	FILTER	TIME	REACTION	OPERATOR

a given treatment is recorded by number in the columns marked Tube and App.

Distance refers to focal distance, M. A. means milliamperage used, Voltage can be recorded either in terms of spark-gap or direct voltage whichever method seems most useful to the roentgenotherapeutist, Filter is recorded as kind and thickness of filter, Time means length of exposure, Reaction provides for a record of the effect the rays had on the skin, Operator provides for signature of the one who actually did the work.

Here in my laboratory the cards are filed in envelopes of proper size. Any roentgenograms or photographs taken before, during, and after treatment can be cut and filed in the same envelope. .The roentgenograms must be taken on films for use as just described. Letters and copies of letters regarding the case are filed in the same envelope along with laboratory and other reports that one may have.

In conclusion I wish to state that for the past few months I have never been in doubt as to exactly what the patient had done at his last visit, nor have I had to ask the patient a question or two to clarify my records. I presume that some of us have records even better than the one I have just described. I am offering this one hoping that it will help some one to better judgment for dosages in the future, and therefore to better results from the patient's standpoint as well as that of the roentgenotherapeutist. In my hands this record is easy to keep, as well as being the most efficient one I have ever seen.

TREATMENT SAFETY DEVICE

EVERY ONE who is doing x-ray therapy, and especially deep therapy, is very much impressed with the need of some sort of safety device so that the current can be quickly shut off in case of necessity. Although the patient is constantly under observation, there is frequent need for stopping the current and the patient may not be able to signal in a satisfactory manner, or if it is attempted the patient may come in contact with the high tension wires.

Dr. E. C. Ernst of St. Louis, Mo., has installed a simple device which appeals to us as not only accomplishing the desires of the radiologist, but as one which will inspire the confidence of the patient, since by the employment of this device the patient is the one who controls the shutting off of the current. This gives patients a degree of confidence which they do not otherwise have.

The device is a knife switch placed on the wall in the treatment room, and to the handle of this knife switch is attached a string which runs across the room to the patient, a loop being fastened about the patient's finger. The knife switch is set very delicately so the least movement on the part of the patient will open it and cut off the current. The switch is connected into the primary circuit of the transformer, a line being taken from the control board to the switch.

A SIMPLE METHOD FOR THE PREVENTION OF PUNCTURE OF THE COOLIDGE TUBE BY "STATIC" DURING DEEP THERAPY.

J. Thompson Stevens, Montclair, N. J.

I HAVE READ with interest and profit the article published in "The Journal of Radiology," June, 1921, by Dr. R. H. Stevens of Detroit, Mich., and was particularly interested in his expression of his reasons for using glass for filters. With his type of wooden tube stand, I believe that his method for protection of the Coolidge tube against puncture by means of glass filters cannot be improved upon, but for those of us who are using the ordinary stand, made of metal and glass, the method of Dr. Stevens would not probably be as satisfactory as it has been in his hands.

If glass in the common American made stand is placed in the usual filter slot, it will be found that there is a metal support upon which the lead glass bowl rests, which will be left uninsulated, between the tube and the layer of glass. In my own stand, this metal which came into the field was a frequent cause of puncture, and even before the tube broke down the glass of the tube was discolored, the discoloration taking the form of a ring the position of which was exactly above the metal upon which the lead glass bowl was supported. This is what I have done and the results have been one hundred per cent perfect to date. I have punctured no tubes in the last few months since using this method and none of the tubes are discolored.

I first removed the lead glass bowl from its support. A piece of pure glass one-sixteenth of an inch thick of proper diameter was cut so that when the lead glass bowl was replaced, the insulator glass was large enough so that it would extend to the outer edge of the outlet of the lead glass bowl. This gives us the following arrangement: metal support for lead glass bowl upon which is placed the layer of glass, the insulator; and finally the lead glass bowl is placed upon the layer of glass and clamped properly. Now the tube is entirely surrounded by glass, no metal enters into the field anywhere. One may now use in the usual filter slots either aluminum, copper, or glass to make up any desired filter in a given case with no danger of tube puncture when the metal filters are used. The layer of glass used as an insulator must be counted as a filter. Glass and one millimeter of aluminum I have found to be about equal in filter value. Glass for insulator should be one-sixteenth of an inch thick, and in my stand, five and a half inches in diameter was necessary.

Abstracts and Reviews

The purpose of this department is to furnish its readers a succinct epitome of current interesting articles and books. We will be glad to review articles which have been presented for publication or any manuscript or book sent us.

The Symptomatology and Diagnosis of Foreign Bodies in the Air and Food Passages. Chevalier Jackson. Am. Jour. Med. Sci., May, 1921; pages 625-661.

THIS article is a full and complete discussion of the subject, covering it in an exhaustive way. Coming as it does from Dr. Jackson, every one knows that about the last word has been said that is possible in the space given. The paper is based on a study of 789 cases. The following summary is transcribed, as it gives the subject in outline.

Summary of the Chief Points in the Symptomatology and Diagnosis of Foreign Body in the Air and Food Passages.

Larynx

1. Foreign bodies lodged in the larynx cause an initial laryngeal spasm which is followed by more or less laryngeal wheezing, croupy cough, and a variable degree of impairment of phonation.

2. Pain in the laryngeal region may be present and is sometimes referred to the ears.

3. The larynx may tolerate a thin, flat foreign body for a relatively long period of time, but the development of increasing dyspnea renders early removal imperative in the majority of cases.

Trachea

4. Tracheal foreign bodies are usually movable and their movements can usually be felt by the patient.

5. The vibrations may be palpated and heard with the stethoscope.

6. Cough is usually present at once, may disappear for a time and recur, or may be continuous, and may be so violent as to induce vomiting.

7. Sudden shutting off of the expiratory blast and phonation during paroxysmal cough is almost pathognomonic of a movable tracheal foreign body.

8. Dyspnea is usually present and is due to the bulk of the foreign body plus the subglottic swelling caused by the traumatism of the shiftings of the intruder.

9. The asthmatoid wheeze is usually present and is often louder and of lower pitch than the asthmatoid wheeze or bronchial foreign bodies. It is heard at the mouth, not at the chest wall.

10. Pain is not a common symptom but may occur and be accurately localized by the patient.

Early Symptoms of Irritating Foreign Body (such as a peanut-kernel) in the Bronchus.

Bronchi

11. Initial laryngeal spasm is almost invariably present with foreign bodies of organic nature, such as nut kernels, peas, beans, maize, etc.

12. A diffuse purulent laryngo-tracheo-bronchitis develops within twenty-four hours in children under two years.

13. Fever, toxemia, cyanosis, dyspnea and paroxysmal cough are promptly shown.

14. The child is unable to cough up the thick mucilaginous pus through the swollen larynx and may "drown in its own secretions" unless the offender be removed.

15. Lung abscess rapidly forms.

16. The older the child the less severe the reaction.

17. In the early stages an acute obstructive emphysema is present, manifested by: (a) limited expansion, (b) muffled tympanitic percussion note, (c) markedly diminished or absent breath sounds on the obstructed side, (d) many rales and harsh breathing on the free side.

18. The radiograph confirms these signs by showing (a) greater transparency on the obstructed side, (b) displacement of the heart toward the free side, (c) depression and limitation of the diaphragmatic movement on the obstructed side.

Symptoms of Prolonged Foreign Body Sojourn.

Bronchi

19. The time of inhalation of a foreign body may be unknown or forgotten.

20. Cough and purulent expectoration ultimately result, although there may be a protracted delusive symptomless interval.

21. Periodic attacks of fever, with chills and sweats and followed by increased coughing and the expulsion of a large amount of purulent, usually more or less foul material, are so nearly diagnostic of foreign body as to call for exclusion of this probability with the utmost care.

22. Emaciation, clubbing of the fingers and toes, night-sweats, hemoptysis, in fact, all of the symptoms of tuberculosis are in most cases simulated with exactitude, even to the gain in weight by an outdoor regimen.

23. Tubercle bacilli have never been found in the Bronchoscopic Clinic associated with foreign body in the bronchus. It was the only element lacking in a complete clinical picture of advanced tuberculosis. A point of difference was the rapid recovery after removal of the foreign body.

24. The erroneous statement in all of the text books that foreign body is followed by phthisis pulmonalis is an heirloom of the days when the bacillary origin of true tuberculosis was unknown, hence the foreign body phthisis pulmonalis or pseudotuberculosis was confused with the true pulmonary tuberculosis of bacillary origin.

25. The subjective sensation of pain may allow the patient to localize a foreign body accurately.

26. Foreign bodies of metallic or organic nature may cause their peculier taste in the sputum.

27. Offensive odored sputum should always suggest bronchial foreign body:. but absence of sputum, odorus or not, should not exclude foreign body.

28. Sudden complete obstruction of one main bronchus does not cause noticeable dyspnea provided its fellow is functionating.

29. Complete obstruction of a bronchus is followed by rapid onset of symptoms.

30. The pleura is rarely involved. Rib resection done for supposed empyema have with one exception shown no pus.

31. The physical signs usually show limitation of expansion on the affected side, impairment of percussion, and lessened transmission or absence of breath sounds distal to the foreign body.

32. The "asthmatoid wheeze" may, if present, be of great diagnostic value. Its absence, however, does not negative the presence of foreign body.

33. All cases of chest disease should have the benefit of a radiographic study to exclude bronchial foreign body as an etiological factor, and negative opinions should never be based upon any plates except those of the utmost perfection, that the wonderful modern development of the art and science of roentgenology can produce. In doubtful cases, the negative opinion should not be conclusive until a roentgenologist of long and special experience in chest work has been called in consultation. Even then there will be an occasional case calling for diagnostic bronchoscopy.

34. Symptoms of pulmonary abscess, or other lung disease, even cough, following within a few weeks of the extraction of teeth, call for the exclusion of foreign body in the lung.

Esophagus

35. There are no absolutely diagnostic symptoms of esophageal foreign body.

36. Dysphagia, however, is the most constant complaint, varying in degree with the size of the foreign body and the degree of inflammatory or spasmodic reaction produced.

37. Pain may be caused by the penetration of a sharp foreign body, by inflammation secondary thereto, by impaction of a large object or by spasmodic closure of the hiatal sphincter.

38. The objective sensation of foreign body is usually present but cannot be relied upon as assuring the presence of a foreign body, for it is present for a time after the passage of the intruder.

39. All of these symptoms may exist, oftener in most intense degree, from previous violent attempts at removal and the foreign body may or may not be present.

40. Fluoroscopic study of the swallowing function with barium mixture or capsule will give the location of a foreign body which may not be radiopaque.

41. Anteroposterior and lateral roentgenograms should always be made.

42. The value of a radiograph after the removal of the foreign body cannot be too strongly emphasized.

Stomach

Foreign body in the stomach ordinarily produces no symptoms. The roentgenogram and the fluoroscopic study with an opaque mixture are the chief means of diagnosis.

E. W. ROWE.

Treatment of Carcinoma of the Tongue. Douglas Quick, New York City. Annals of Surgery, June, 1921, page 716.

CARCINOMA of the tongue is the most difficult type of malignant disease to treat. Clinical courses are various. The rich vascular supply explains the rapid growth and metastases. Average duration of life is two years. Fatal termination varies from 75 to 90 per cent. The cases are coming for treatment earlier, but 25 per cent only are operable when they are first seen. The nearer the initial lesion to the base, the more hopeless it is. Various surgical reports are given to show the mortality of operation and the expectancy of life and cures.

Treatment of the Primary Lesion

This field belongs entirelv to radium. Later developments in the application of radium by buried emanations have greatly improved the results. Surface radiation has been abandoned except in a few selected cases. Buried emanations are given to the bulk of the cases. The capillary tube used contains one millicurie. These are buried throughout the growth by means of a fine trocar needle. The amount varies with the size and the shape. It is most necessary to place these adequatelv. This method gives prolonged exposures of beta and gamma rays filtered only through the glass. The radium element gives mostly gamma rays, which are less efficient. The tissue reaction and trauma is less with emanations; also the distribution is more even. The effects last for a long period. In eight days there is still present about one-fourth of the activity.

Treatment of the Cervical Nodes

Metastases as a rule is late in the lymphatics of the neck. Unless it is definitely present, surgery should not be applied. Removal of the glands, even by block dissection, does not remove all involved glands and it does remove one of nature's barriers which it is important to conserve. Extension to the lymph glands is embolic. If no glands are present, the treatment of the neck is by radiation. If they are present a dissection is made and emanations are introduced in the wound, as well as in all suspicious points. Where the cancer has burst the gland capsule, the glands are not removed, but are treated by radium emanations; thus the natural barriers are preserved.

Statistics

Number of cases treated, 148 cancers of tongue.

Number in men, 90.5 per cent.

Number in women, 9.5 per cent.

History of syphilis or Wasserman positive, 35.1 per cent.

Average duration, 6.72 months.

Primary growths without nodes, 45.8 per cent.

Of these there are now free, after two months to three years, 85 per cent.

Of these, five developed cervical metastases.

Of these, verified by microscope, the number is 88.2 per cent.

The total number of cases treated in the hospital give a somewhat different report to this selected group. But in both groups there are now clinically free sixty-one cases, or 41 per cent of all the local lesions showing retrogression. There are nineteen cases showing improvement, but not yet free from disease.

Conclusions

1. The primary lesion in cancer of the tongue should be handled entirely by radium.

2. Buried emanations is the method of choice.

3. Cervical nodes should be treated conservatively:

(a) External radiation if there is no gland involvement.

(b) If there is involvement, external radiation followed by surgery, and again treatment by buried emanations.

4. While time is too short to compare with surgery, yet it is believed that this form of treatment in unselected cases will yield a higher percentage of clinical cures than will surgery alone in selected operable groups.

E. W. ROWE.

The Present Position of Radium in the Study and Treatment of Uterine Cancer. William S. Stone, New York. Surgery, Gynecology and Obstetrics, June, 1921, page 509.

SO MUCH evidence is arising as to the value of radium in the treatment of uterine cancer that the question arises whether it is not more effective than operation. Radium has assumed an importance in cancer research. The histological studies made have added a great deal to our knowledge. The action of radium in the uterus is the same as in other parts of the body. That is, the tissues respond according to the type. Embryonal and rapidly growing kinds are the most responsive; the glandular more so than the epithelial. Disappearance of cells or lymphocytic invasion and fibrosis take place. This destruction may, if the dose is too great, extend to normal tissue, causing necrosis. Clinically, reparation after the use of radium takes place so regularly that its action is looked upon as specific.

Palliation in advanced cases is marked. Occasionally retrogression is complete. The writer quotes from 400 cases of uterine cancer which he has observed.

Radium in all recurrences produces much greater benefit than surgery, provided they are not too closely related to the bladder and rectum. The earlier the cases the better the results. Pain and hemorrhage may be relieved even if there is no idea of cure, or if there is considerable retrogression. The x-ray may be substituted for treatment over the abdomen. The embedding of emanation needles is giving encouraging results.

Operation has been performed by eminent surgeons with a degree of success, but this success has been low in ordinary hands. Operation has been performed to an unjustifiable extent, producing suffering and mortality and bringing discredit both to operators and all other sincere efforts to cure the disease. When a competent diagnostician receives a case, palliation is usually the only procedure justified. For all cases of primary uterine cancer, therefore, with few exceptions, radium should be the method of choice. Of thirty-four cases treated in the Memorial Hospital coming within three months after the beginning of symptoms, a primary and complete regression was obtained in sixteen, or 47 per cent; and a partial but substantial regression in all the remainder. Of the sixteen cases in which regression was complete, the growth was limited apparently to the uterine tissues in three, and in the remainder the extrauterine involvement was not extensive.

Of another thirty-four cases coming in from four to six months, the advancement was greater. In three a regression was obtained with the growth limited to the uterine tissues. In eighteen cases, or 50 per cent, the regression was not complete. The restoration to normal health for a time, however, showed its value. There was no improvement in a few. Two were made worse. Time only can tell the ultimate result. Numerous cases in this series are apparently well two or more years after treatment.

The question of radium in borderline cases is decided strongly in its favor. Properly applied, radium will destroy all cancer cells in the uterus, and as far around as surgery can reach. Cases outside operability are frequently made to be within the range of operation after radiation.

It is a mistake to use radium as an adjunct to surgery in advanced cases. It should be a substitute, because cutting through uterine cancer cells causes them to scatter and increases the rapidity of growth.

Radium should be used as a prophylactic measure. There are numerous cases where first bulky and necrotic growths may be removed by cautery and then the radium applied. The subsequent application of radium to the tumor base may increase the permanency of the result, as often the parametrial invasion is not commensurate with the apparent extent of the original lesion.

Two unfortunate cases in which recurrence followed in what seemed to be curable cases cause the writer to hesitate to say that those patients with involvement in the uterus only should be treated by radium alone. In these cases radium, one to two weeks prior to operation, will improve the results.

Because we cannot control by radium or x-ray the lymph node involvement in early cancer, it is not best to supplant surgery by radium. But radium prior to operation is advisable. Seven such cases have been treated by radium alone without signs of recurrence. Three of these have gone for more than three years.

In regard to the work of those having small amounts of radium, it may be said that it is better to use large amounts for short periods than small amounts for longer periods. The value of applying x-ray or radium to the abdominal wall has not been determined. Beta radiation must be avoided. Gamma rays are by far the most active and beneficial.

In general, the chief error in the use of radium is over-dose.

A strong plea is made to avoid treating those cases too far advanced. Such methods bring discredit in the eyes of the public.

E. W. ROWE.

Splinters of Glass in the Face and Skull Revealed by the Roentgen Ray. Report by Charles G. Sutherland, M. B., Rochester, Minnesota.

CASE 1. This was a male patient who noticed, thirteen months after his accident, a discharge from a point near the temple and also he could feel a sharp foreign body. The x-ray demonstrated plainly a triangular piece of glass under the skin, which was successfully removed. The foreign body had caused great suffering and several mistaken diagnoses.

Case 2. This patient was more seriously injured, and aside from an evident injury to the brain there was the roentgen evidence of a splinter of bone in the posterior portion of the brain. The patient's condition was poor. He had been operated once. No further operation was advised. He died two weeks later.

The literature does not contain any reference to glass in tissues. Roentgenological search for glass is never hopeless.

E. W. ROWE.

Present Status of the Treatment of Operable Cancer of the Cervix. By William P. Graves, Boston. Surgery, Gynecology and Obstetrics, June, 1921, page 504.

THE Wertheim operation for cancer of the uterus was much in vogue a few years ago and is still used, somewhat modified by surgeons who have been persistent in removing uterine cancer by surgery. Radium has had a recent boom in popularity. Its use has been partly limited by the scarcity of the element. Many excellent gynecologists have had to work without it. Undoubted cures have been recorded from radium. Radicals are proclaiming the "death knell" of the operation. The immense value as a palliative was early established. The question now under consideration is whether we are justified in resorting to the simple application of radium in cases that are frankly operable, and in which an ultimate cure by surgical means is reasonably possible.

The first experience was obtained in the Huntington Hospital and the Free Hospital for Women. The results, summarized, are:

1. Of the inoperable and border-line cases sent, none was permanently cured, though many were very much benefited.

2. Several inoperable cases were made operable and lived in comfort many months.

3. A number of recurrence cases treated were benefitted very much.

4. Prophylactic treatment following operation after several trials was given up on account of the danger of burns, and later, fistula.

In 1916 the hospital purchased 100 m.g. of radium, and since then they have learned better technique and have had less trouble with the disagreeable sequellae. The latest experience may be given thus:

1. So far they have not a single radium cure of inoperable cancer of the cervix.

2. Evidence is obtainable that cancer of the cervix is curable by the use of radium.

3. Some of their cases now clinically cured may prove to be definitely cured.

4. In view of the uncertain and sometimes treacherous behavior of radium in the treatment of inoperable

cases, they have not felt justified in substituting it for radical surgery in cases favorable for operation.

Surgical Aspect of Cervical Cancer

Sixty-four per cent of the cases applying for relief are granted operation.

The mortality resulting from operation is five per cent.

The five-year curability is 27.6 to 34.2 per cent.

The absolute curability is 16.8 to 18.5 per cent.

In 101 out of 119 operations the Wertheim technique was carried out more or less completely.

The percentage of postoperative fistula is one and seven-tenths.

These statistics are not spectacular, but are offered because they represent a fair index of the present status of the surgical treatment of operable cancer of the cervix.

The operability of their cases is high because the institution naturally draws a large number of patients that are operable, since their clinic is devoted entirely to gynecological cases. He admits there may be a judicial shirking in the selection of cases for operation. There is a denial that the majority of operations for cervical cancer are followed by distressing and desperate sequelae. Burns occur when radium is used. When such burns follow treatment the results are desperate: large holes are made into the vagina and rectum, and usually remain hopeless. If fistulous openings follow surgery they are small and generally can be repaired.

The radical operation is not too difficult for practical use. The reckless, extensive surgery attempted by some is not necessary.

Conservation in surgical treatment of cervical cancer has been made more rational by the advent of radium, for the surgeon no longer feels able to attack the desperately difficult cases. Cases found too desperate for surgery on operation may be abandoned for radium. Postoperative radiation prolongs life.

Education of the public is bringing cancer of the cervix for earlier operation. The number of permanent cures is increasing. Cancer of the cervix is amenable to curative treatment in the early stages. Earlier detection is the measure of hope.

E. W. ROWE.

Chronic Pulmonary Tuberculosis, Primary in the Lower Lobe. Joseph Rosenblatt, Bedford Hills, N. Y. Jour. A. M. A., June 11, 1921.

"CHRONIC pulmonary tuberculosis primarily in the lower lobe is rather a rare occurrence—so rare, indeed, that many good clinicians assert that such a condition never occurs."

A brief discussion follows these opening remarks of authorities who confirm this view. Three case histories of patients are given which are chosen from a thousand consecutive cases of pulmonary tuberculosis which have entered the Bedford Sanatorium. Only the three were definitely proven to be primarily lower-lobe cases. The history, physical findings, sputum and roentgen findings were all positive. In one there was extensive cavitation. Repeated search failed to find anything in the upper lobes in this one. In the other two the extension upward was observed. It is not wise to wait for a positive sputum, for in one of these cases it was a year before tubercle bacilli were found.

Paramount importance is given to the value of the roentgen evidence. Lower-lobe lesions are clinically hard to distinguish from non-tuberculous lesions. Roentgenologically the differential diagnosis is easy. Often the roentgen findings are pathonomonic. Tuberculous lesions of the extent found to cause consideration of bronchiectasis are never difficult with the roentgen ray. The same is true of pulmonary abscess or neoplasm. Roentgen examination is absolutely indicated.

E. W. ROWE.

Radium. C. J. Broeman, Cincinnati, Ohio. Kentucky State Medical Journal, June, 1921.

RADIUM was discovered in 1898 by Madame Curie. It is extracted from a number of radio-active ores, and there are now in existence about three ounces. The radium used therapeutically is not the element itself, but one of its bulkier salts or a gaseous emanation. There are three kinds of radium rays, but the Gamma having a selective action upon the diseased cells, is the most important in medical work.

Plaques, tubes and needles are used to convey the element to the point of application. The application is painless, and is usually followed by a reaction, sometimes severe and very painful. Much skill and judgment on the part of the operator are necessary to make this reaction as mild as possible.

1. The author calls attention to the fact that the popular impression that radium treatments are very expensive is far from the truth. The patient saves considerable time and money because no extended sojourn to the hospital is necessary. There is very little interruption to his or her regular duties. Treatments are painless and there is no period of convalescence.

2. Radium is the ideal treatment for all forms of basal-celled epithelioma and for prickle-celled epithelioma, if seen early enough, and no glandular involvement is present.

3. In carcinoma of the lip it is the treatment of choice when the case is seen early.

4. Radium is to be preferred in certain uncomplicated cases of uterine fibroid and bleeding.

5. Radium should be universally used in cancer of the cervix and inoperable cancer of the body of the uterus.

6. In all forms of inoperable cancer it relieves pain and hemorrhage and lessens discharge.

7. Radium is to be preferred to the x-ray in cases of goiter because of its exact dosage, deeper penetration and ease of application.

8. It is the preferred treatment in tuberculous adenitis and vernal or spring catarrh, while certain systemic diseases, such as splenomedullary-leukemia, pernicious anemia, and Hodgkin's disease, radium therapy has proven beneficial.

9. In dermatology radium improves and eradicates many heretofore stubborn and incurable dermatological conditions, among which may be mentioned agioma, lymphangioma, keloids, lupus erythematosis and vulgairs, intractable pruritis, chronic eczema of the mucous membrane of the lips, warts, sycosis vulgaris, localized eczema, leucoplakia, extensive hypertrichosis and other skin affections.

10. From my own experience I feel justified in affirming that radium is here to stay, and that the physician who is not willing to recognize its value to medical science is simply refusing to read the handwriting upon the wall.

Cancer of the Uterus. John B. Deaver, Philadelphia. Am. Jr. Med. Sci., May, 1921, page 661.

THE problem of cancer is unsolved, but there is hope. There are some indications that the surgeon may have to "lay down his knife" so far as cancer is concerned and "make room for radiotherapy, either roentgen ray or radium, or a combination of the two." He agrees with the English point of view expressed thus: "When the pen has superseded the sword, the scalpel will still be needed for myoma." And this he believes is true with cancer of the uterus.

The early symptoms of carcinoma of the uterus and the pathological changes are succinctly stated.

In the presence of undoubted cancer, hysterectomy is as sure a way as any to cure the disease. He disagrees with the radiologists that early cases without metastases should be treated by radium. His experience is that the disease recurs. But since radiotherapy is new, he has hope for improvement in technique and greater success in cures.

He thinks that the surgeon sees so many failures in the use of radium that he is liable to be prejudiced against its use. He reports twenty-seven cases of cancer of the uterus operated by him since January, 1916, without a mortality. Nothing whatever is given on the outcome of these cases.

E. W. ROWE.

X-Ray Treatment of Tonsils and Adenoids Associated with Exopthalmic Goiter and Tubercular Glands. W. D. Witherbee, New York. X-Ray Bulletin, Treasury Department, Washington; June 15, 1921, page 83.

THE technique used in the treatment of tonsils is as follows:

Factors: One-inch spark gap, 5 m. a., 10″ distance: 4′ time, filtered 3 mm. of aluminum, two weeks' intervals until results are obtained. The dosage for children is reduced accordingly. The patient is placed prone, with the head first to one side and then to the other.

The effect of the x-ray is beneficial on the accessory tonsils and lmyphoid tissue in the pharynx.

In the treatment of goiter the tonsils are included in the technique. In tuberculosis glands the tonsils are also included. In thirty out of thirty-six cases, haemolytic streptococci and staphlococci were eliminated from the crypts four weeks after one massive dose of x-ray.

In the treatment of tonsils and tuberculous glands the thyroid has never been injured. If the technic is followed carefully the skin is never burned.

E. W. ROWE.

X-Ray Treatment of Basedow's Disease. I. S. Trostler, M. D., F A. C. P. The American Physician, April, 1921.

THE thyroid gland has been called the balance wheel of metabolism and if deranged, so as to be running too fast or too slow causes a too rapid or too slow oxidation of the fuel, with the resultant upset of the balance of the economy of the body. We have too much activity on the part of some thyroid glands, producing hyperthyroidism or the thyrodoxicoses with its well-known syndrome, and with which we are more particularly interested at this time.

In this paper we are more concerned with what is the best means of slowing down the action of this over-active, over-working gland than with any other one thing.

Some cases may show improvement with the use of drugs, but decidedly less than 20 per cent can be considered curable by drug treatment, and many of these have relapses.

The patient is not a good surgical risk. Records show less than 50 per cent cured by surgery and an operative mortality of three to six per cent.

Fully 90 per cent of all cases are cured by x-ray therapy and this in about half the time surgery requires. It lessens the activity of the glandular epithelium and causes an obliterative endarteritis in the gland. We have found that it required from four to eight full dosage treatments to effect a sure. If the patient is very toxic, a full dosage treatment cannot be administered, but if not very toxic, the treatments are administered in full dosage about every twenty-one days.

In a small series of cases the thyroid area only was treated, and failure to secure the full effect resulted until the thymic region was treated, after which cures were effected in all cases experimented upon.

The damage done the heart cannot be repaired, but the process will stop where it is and medicine, hygiene and other necessary measures may be used to repair the damage as much as is possible. The nervous and gastric disturbances disappear early in the treatment, the increase in size of the thyroid gland is usually decidedly reduced in a few treatments and the exophthalmos is usually gone in a few months.

The technique will vary with the findings in each case. The x-ray therapist should be one who has had the experience and training to properly administer treatment. The possession of apparatus does not any more make a competent radio-therapist than the possession of a lot of glittering knives, retractors, etc., make a surgeon

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Primary Tumors of Bone

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A Report of Cases from the Surgical Service of Walter Reed General Hospital, Washington, D. C.

THE recent publication by Bloodgood of a series of bone tumors came at a time when we had the opportunity of seeing and studying a group of similar cases which appeared at this hospital and at his suggestion we are putting them on record.

Realizing the difficulty in reaching an agreement as to the exact type of tumor or even in determining at times the malignanacy or benignity in a given case, we feel that complete and accurate reports of individual cases can be of inestimable value. Primary tumors of bone frequently do not conform to type and as yet we have no criterion in establishing the diagnosis of malignancy. Therefore, exhaustive study of single cases must be made before sufficient data is accumulated to formulate any rules which will be of adequate value in diagnosis. With a sufficient number of these on hand for study and comparison the percentage of correct diagnoses before reaching the pathologist will be considerably raised. For this reason we are presenting these cases completely and in detail, with the exception of the second case (in which operation was refused). Although the roentgenological appearance is not always pathognomonic, it is conceded to be the most efficient aid to diagnosis, and furnishes the most reliable information prior to operation. Perhaps the most frequent errors in roentgenological interpretation are in reporting syphilitic periostitis as periosteal sarcoma, and a central destructive lesion as osteomyelitis. In this connection it is of interest to record the fact that of these seven cases we are reporting, three were carried as osteomyelitis and two of them were curetted.

The number of cases is too small to permit any deductions or didactic statements to be made and the time since operation is too short to report them cured cases. A further report will be made of the end results after a sufficient length of time has passed to justify such a report.

CASE 1—(X-ray No. 13163)

White male; age, 39; major, air service; complaint, lump on finger; (see Figure 1).

Fig. 1.—Case I. Photograph of hand, showing small tumor on middle phalanx, ring finger.

History

Duration of swelling, five months, no pain. No disability. This same finger was infected four years ago (1916), at which time incision and drainage was done, with uneventful healing. Patient cannot accurately locate incision, no scar can be seen. No other history of trauma.

Examination

Tumor is smooth, rounded, firmly fixed to bone, but not to skin. Is tender on firm pressure. Feels quite hard, non-fluctuant. Three Wassermanns were negative. Urine shows faint trace of albumen; later clear. X-ray examination was made one month before admission and the roentgenologist interpreted the condition as a periostitis probably with the history of the previous infection in mind. The finger was re-rayed just before admis-

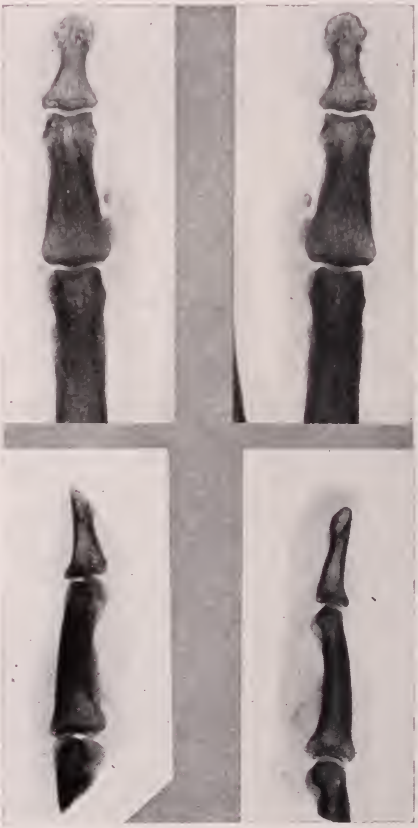

Fig. 2.—Case I. X-ray of finger showing a pedicle of bone (exostosis) with new bone formation in body of tumor.

sion, and as there was thought to be a definite increase in bone destruction and production, the diagnosis was changed to sarcoma, the patient being sent to us for amputation of the finger. Our examination (Fig. 2), showed a small bone producing tumor arising from the periosteum of the second phalanx of the ring finger, with questionable destruction of the cortex at its base. Dr. Bloodgood saw the case at this time, with both present and past x-rays and diagnosed it an osteochondroma.

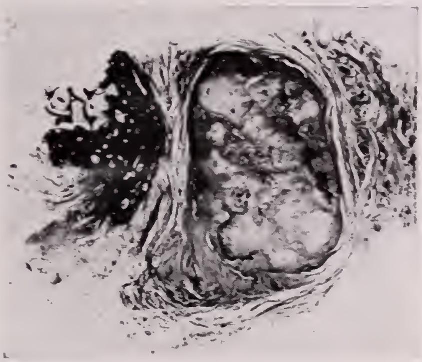

Fig. 3.—Case I. Section through tumor X 10, showing encapsulated cartilage with bone formation.

Operation

At operation (Major Parce), the tumor was removed in toto, with a margin of healthy bone; tumor tissue not being seen (Fig. 3). Part of the flexor tendon was in the tumor and was removed with it. The excision of bone was carried into the proxi-

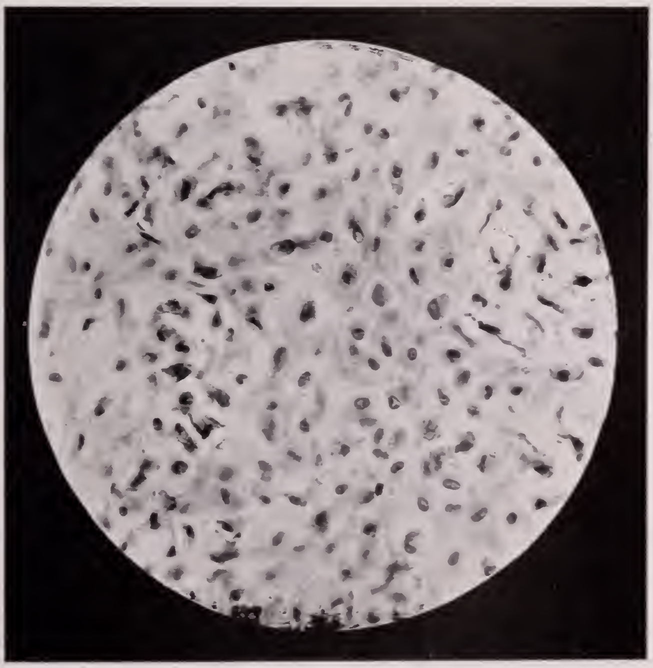

Fig. 4.—Case I. High-power microphotograph showing cartilage cells with loose fibrous tissue.

mal joint. On *microscopical examination* (Fig. 4), Major Schule, Dr. Bloodgood), the diagnosis of osteo-chandroma was confirmed No cellular areas suggesting sarcoma, nor any areas suggesting myxoma. The result has been excellent. Primary union followed, and except for voluntary flexion of the terminal phalanx, patient has full use of his finger.

Discussion

From the x-ray alone the differentiation was difficult. We had a bone producing tumor, periosteal in origin, probably slight cortical destruction at its base, new bone formation perpendicular to the shaft, and a negative syphilitic history and findings. Against this picture of periosteal sarcoma there stood the law of probabilities, as we have not as yet seen or heard of a proven case of periosteal sarcoma of a phalanx. No doubt they can and do occur, but their extreme rarity is a definite aid to diagnosis. As far as the complete removal of the tumor is concerned, Bloodgood has shown that the osteo-chandromata must be treated as potentially malignant, due to the comparative frequency of associated myxoma.

CASE 2—(X-ray No. 11150)

White male; age, 20; soldier; complaint, swelling of wrist.

History

Family and personal history negative. Eight years ago (age 12) this wrist was broken, but it healed normally except for some deformity. Two months ago the radius was refractured during a boxing bout. There was no pain after the third day.

Examination

The interesting part of this case was that an x-ray at that time in a camp hospital was diagnosed as a "fracture with excessive callus." A month later a diagnosis of sarcoma was made at a base hospital and the patient was sent to us for amputation. On being told that the tumor was probably benign, he refused the exploratory operation which

Fig. 5.—Case II. X-ray showing tumor lower end of left radius with pathological fracture through upper portion.

was advised, and as there was no disability or pain, he was discharged shortly afterward to duty.

Discussion

This x-ray (Fig. 5) was interpreted as a healing bone cyst, with an old pathological fracture. There is undoubted evidence of healing, which with the fracture as the first symptom, the age of the patient, and the duration of symptoms give a fairly typical clinical picture. The location, however, is more suggestive of giant cell tumor, which cannot be ruled out except by an exploratory operation. Of late the tendency has been not to operate on the bone cysts, but to allow them to heal spontaneously while keeping them under observation. But this puts us in a peculiar position, as we cannot be positive that they are bone cysts unless we have a section from the wall for misroscopic examination. For this reason exploratory operation was advised, to rule out giant cell tumor and myxoma, in which case curettement or resection and transplant, respectively, would probably have been done.

CASE 3—(X-ray No. 10501)

Colored male; age, 27; soldier. Complaint, pain and swelling in right knee.

History

Family and personal history negative. Onset sudden with pain in right knee, followed shortly by swelling. No history of trauma. History otherwise negative. This swelling was incised, no pus being found, but the wound did not heal. Three months later the knee was explored for tuberculosis and a piece of tissue was removed which was stained for tuberculosis bacilli with negative findings. While being transferred back to the states, the wound became infected, and on admission he was discharging pus from a small sinus.

Fig. 6.—Case III. X-ray of right knee showing area of destruction in lateral condyle of Femur with perforation of the cortex.

Fig. 7.—Case III. Section through gross specimen showing typical mottled appearance and extension of tumor through soft tissues to skin surface, probably due to previous operation. Note that tumor reaches cartilage but does not invade it.

Examination

X-ray examination at this time resulted in a diagnosis of osteomyelitis. The wound was Dakinized, and it healed slowly from the bottom. Pain and disability remained, and knee was partly ankylosed. Five months later a second x-ray showed, instead of a healing osteomyelitis, a picture of further destruction (see Fig. 6). About the same time a small swelling in the scar was tapped and found to contain blood. Recognizing this then as a tumor, we were at a loss to determine definitely the type, due to the previous operation and the subsequent infection. Dr. Bloodgood's opinion was that the tumor was malignant, and the patient preferred amputation with quick results, rather than a resection with graft and a long hospitalization.

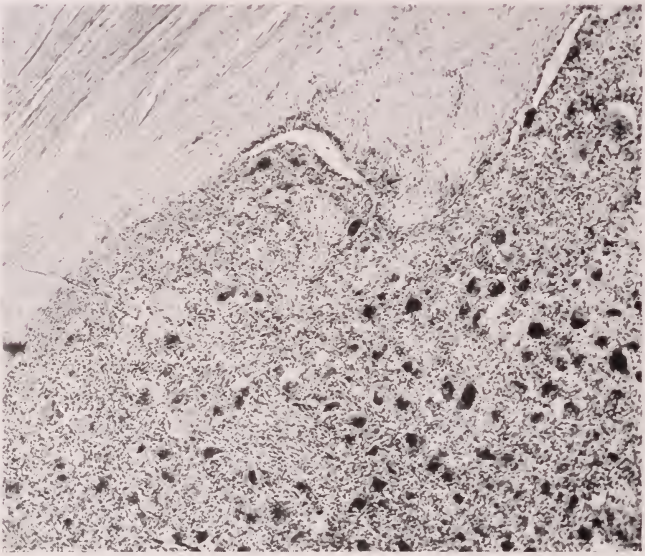

Fig. 8.—Case III. Low-power microphotgraph showing benign giant cell tumor and scar from previous exploratory operation, demonstrating that tumor cells have not infiltrated the scar.

Operation

Operation (Major Kirk). Amputation through thigh at junction of upper and middle thirds of femur. Bone and marrow normal at this point (Fig. 7). Microscopical examination (Bloodgood) showed an escapulated giant cell tumor of epulis type. Does not invade cartilage, nor the scar of operation (Figs 8 and 9). The result was excellent. Operative scar healed in ten days. Three months after operation the patient was discharged with his permanent artificial leg.

Discussion

This case presents a not unusual history of being treated as osteomyelitis for a number of months. If an exploratory operation had been done and a piece of tissue removed for resection, the character of the tumor would have been recognized immediately. A complete curettement with saving of the leg, but probably ankylosis of the knee, would have followed. This case also illustrates the fact that, from x-ray, perforation of the cortex does not always mean malignancy. This condition has also been noted in bone cysts, pure myxoma and chondroma.

CASE 4—(X-ray No. 13454)

White male; age, 30; medical officer.

History

Complained of pain and disability in right shoulder. Duration of pain, nine years; swelling and disability, five years. This right shoulder in 1909 and 1910.

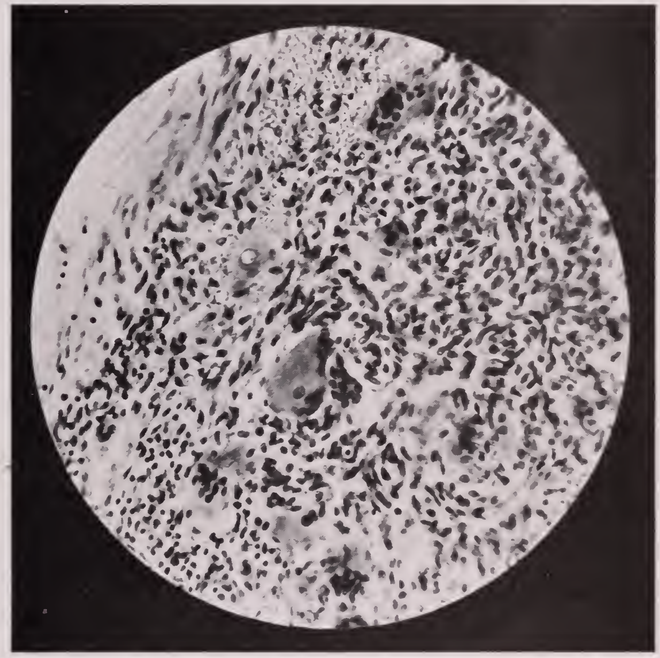

Fig. 9.—Case III. High-power microphotograph showing giant cells of epulis type in typical giant cell tumor tissue.

case has been previously reported rather completely and we show it as a case of unusual interest and for suggestions as to treatment rather than a question of differential diagnosis. A short extract of his history might be of interest. Three dislocations of Pain in shoulder 1911, x-rays said to be negative at that time. In 1912 a severe typhoid, with phlebitis, pulmonary infarcts and thrombosis of both axillary veins. In 1916 the pain recurred with swelling for the first time and marked disability.

Examination

X-ray then showed "bone shell with marked expansion in region of greater tuberosity with markings suggesting a multicystic tumor."

Operation

Operation was done January, 1916, and the greater tuberosity, a piece of the shaft, the bicipital groove and a part of the lesser tuberosity removed. The gross appearance was that of a multicystic tumor containing blood. The pre-operative diagnosis and the diagnosis at operation was probably typhoid osteomyelitis, but the microscopical report was "haemangioma cavernosum." Pain recurred and re-operation was performed three months later for recurrence, but none was found. Specimens removed were reported "inflammatory tissue." The patient was relieved, however, of all symptoms, entered the army and did full duty until April, 1920, when all his symptoms returned following a strenuous game of tennis. At this time Dr. Garre' of Bonn University, Germany, saw the patient, x-rayed his shoulder and diagnosed it sarcoma, advising amputation. Instead of this being done he was returned to New York, where a third operation was done in July, 1920. At this time there was removal of cartilage and a bony spur the size of end of finger near the joint, and some tissue resembling a blood clot imbedded in bone and old scar tissue. The surgeon's opinion was again granulation tissue, but the pathologist reported angio-cavernoma of bone. Ten days later 30 cc. of clear fluid was aspirated from the shoulder joint evidently due to a chronic synovitis. The Wassermann was consistently negative, and the urine has shown nothing abnormal. (We can find no record of a Widal test).

On admission to the hospital he stated that his symptoms had not been abated by the last operation. There was marked pain on motion, causing disability, but no marked point tenderness. All the symptoms could be attributed to the joint. X-ray examination at this time (Fig. 10), without a history of the case, yielded a report of bone destruction and removal, slight bone proliferation,

Fig. 10.—Case IV. X-ray of right shoulder. (See text) For previous x-ray and microphotographs see reference.

periosteal and osteogenetic, with several small sequestra, suggesting a low grade chronic osteomyelitis. Monthly examinations showed no change.

Discussion

Our belief is that this condition is benign. It is most improbable that a sarcoma situated in the center of the humerus of a haemorrhagic cystic type present at least five years and operated on five years ago and twice since then could give the x-ray findings of September, 1920 (Fig. 10). Dr. Bloodgood who saw the x-ray, states that it suggests "a healing process of a central lesion, with periosteal bone formation of the type found in osteoarthritis." Also, at the second operation, some of the inflammatory tissue removed was found to be within a new bone shell. This apparent reformation of a bone shell, is against sarcoma. Whether or not there is any relation of the lesion to the typhoid in 1912 is under discussion. Certainly as far as our studies go, this is a possibility—a typhoid osteomyelitis with a mass of peculiar granulation tissue. As for the treatment, Dr. Hitzrot in a private communication, states "the patient is bound to have some pain, owing to a chronic arthritis and thickening of capsule, as a result of the operation. Use, with baking and massage, is indicated; resection would not help." This opinion as to further treatment was concurred in, and at this hospital physio-therapy was given, but to no avail. The only relief was given by fixation and traction, which, however, left more disability after removal. The final disposition was retirement from the service, as it was evident he could not do full duty.

CASE 5—(X-ray No. 13563)

White male; age, 25; soldier. Complaint, pain, swelling and disability in knee.

History

Family and personal history

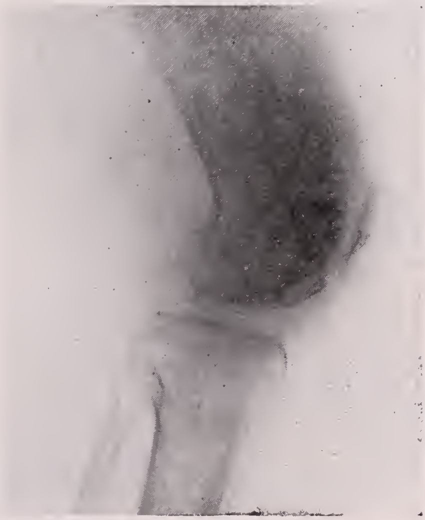

Fig. 11.—Case V. X-ray of left knee, lateral view, showing spotty areas of destruction through lower end of left femur.

negative. Indefinite history of trauma. Duration of pain, ten months; swelling and disability, eight months. Gradual increase of all three symptoms, with loss of weight. Aspiration of knee joint, six months before admission, sterile fluid found. The pain was relieved by support and extension with traction.

Examination

Large, smooth, rounded swelling of left knee, which is fairly firm, not boggy, and rather ten-

Fig. 12.—Case V. Antero-posterior view, showing huge soft-tissue tumor almost obliterating bone detail.

der. Knee shows very little if any motion. Marked atrophy of thigh and calf muscles. Inguinal glands not palpable. Patient is poorly nourished and anaemic. Blood Wassermann and urine negative. X-ray examination of chest shows an old fibrosed apical lesion. X-rays of knee (Figs. 11 and 12), show very poor bone detail, due to huge, soft tissue swelling. Multiple small areas of bone destruction with very slight new bone formation. Apparent perforation of the cortex at several points. Articular surface of medial condyle destroyed. This was first reported as tuberculosis, but on consultation the diagnosis was changed to sarcoma.

Operation

(Major Kirk). Amputation through thigh at the junction of the upper and middle thirds. The bone and marrow at this point were normal (Fig. 13). Microscopical examination (Major Callender), showed a typical small round cell sarcoma, periosteal in type (Figs. 14 and 15). Primary union. The result has been immediate gain in weight of twenty pounds in five weeks and a marked improvement in general health.

Fig. 13.—Case V. Section through gross specimen showing huge periosteal growth with destruction of cortical bone greater than shown in x-ray, involvment of shaft without periosteal bone formation, and little or no fibrous reaction.

Discussion

There is nothing unusual about this case, as bone tumors go. The important point, as far as our examination was concerned, was that, although the articular surface of the femur was destroyed in part, the tibia opposite this showed no involvement, which is strongly against tuberculosis.

CASE 6—(X-ray No. 13247)

White male; age, 43; soldier. Complaint, pain and swelling in right shoulder. Duration of pain, one year, six months. Swelling, one year, three months. Limitation, one year.

History

In March, 1919, patient noticed a small area on the point of the right shoulder, which was painful to touch and in which there were occasional aching pains. This was brought to his attention when lying on his right side, and was attributed to the use of a hard mattress. The pain has been more or less continuous since that time, disappearing completely for periods of from two to six days. The severity of the symptoms gradually increased up to the present time. Three months after the pain was noticed a small swelling was found occupying the same area. There has been

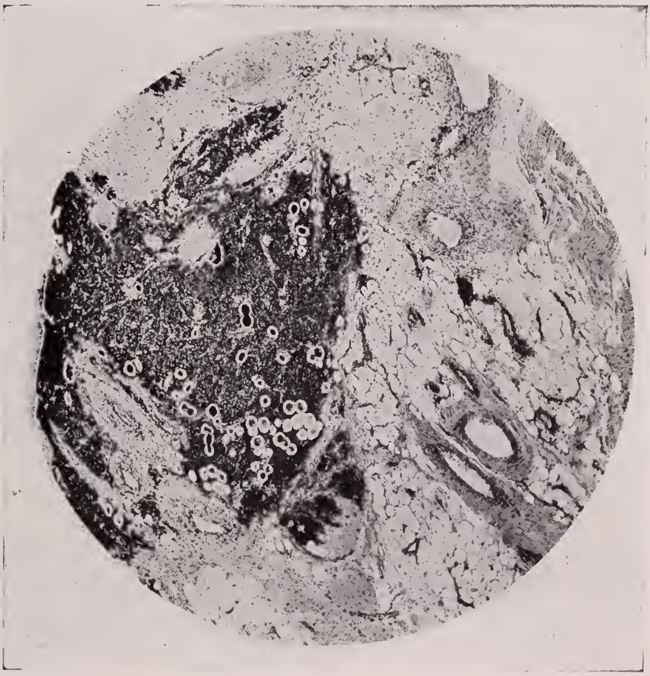

Fig. 14.—Case V. Low-power microphotograph showing tumor cells invading fat and fibrous tissue. Type of small round cell sarcoma.

no history of trauma preceding the first symptoms. No loss of weight, patient feels well except for the pain, which is worse at night, sometimes requiring the use of opiates. *Past History*: Patient has had an iritis in one eye and a cataract extraction in the other eye. Has had a bilateral inguinal adenectomy. Patient's wife has had one miscarriage, eighteen months after marriage, and has not been pregnant since.

Examination

Eye conditions as noted above. Scars of bilateral inguinal adenectomy. Scar on glands. Shoulder: There is a small swelling over the greater tuberosity of

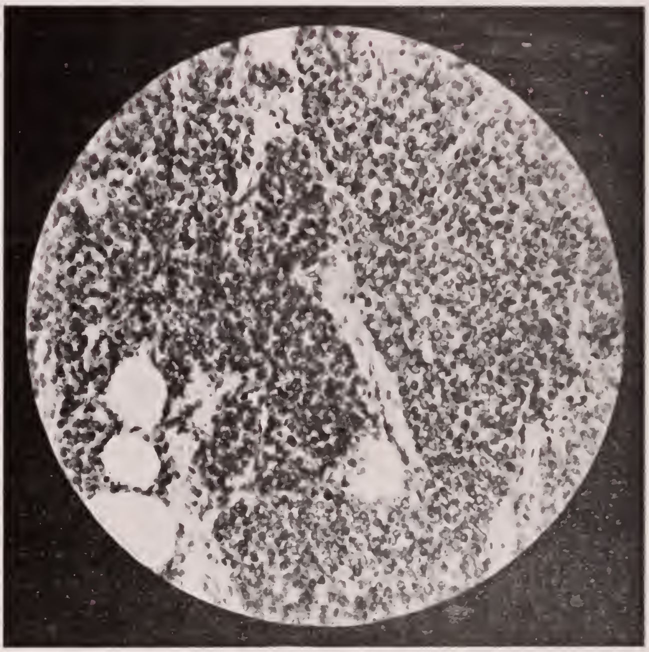

Fig. 15.—Case V. High-power microphotograph. Small round cell sarcoma, cells of nearly uniform type, size, and morphology, resembling Ewing's "endothelial myeloma."

the right humerus, which is tender to pressure. No movable mass can be felt and no involvement of the soft parts or of axillary and cervical glands can be made out. There is definite limitation of the shoulder joint apparently due to the pain and most marked on abduction. *X-ray Examination*: (See Fig. 16). Shows expansion of the upper end of the humerus in the region of the greater tuberosity and apparently extending through the epiphyseal line into the head of the bone. The expansion is rather symmetrical, but the involved area is cloudy and appears lobulated, not smooth, as seen in bone cysts, nor mottled, as seen in older bone cysts or in giant cell tumors. The cortex appears to be almost destroyed in places and there are fine perpendicular lines of periosteal new bone formation. Laboratory ex-

Fig. 16.—Case VI. X-ray of right shoulder. For description see text.

amination shows a negative urine and a plus minus Wassermann reaction. The x-rays of this case, with an abstract of the clinical history and laboratory findings, were presented to a group of prominent roentgenologists and surgeons with a request for an expression of opinion. The majority favored a low grade inflammatory process. The most plausible was the suggestion that it was due to syphilis, as the patient presented a very suggestive history. Several, among them Dr. Bloodgood, insisted that the condition was malignant, but all agreed that a course of salvarsan should be tried as an aid to diagnosis, as well as for therapeutic purposes. Accordingly, the patient received six doses of salvarsan between September 11 and October 2, without the slightest benefit. In addition, the disease was attacked from another angle and radium was tried. On September 15, five and five-sixths mc. of radium emanation was implanted in a small glass capillary tube, 2mm. long and ½ mm. in diameter into the center of the head of the humerus through a hollow needle. On October 2, 1920, seven and four-fifths mc. radium emanation was implanted in tubes into the head of the humerus. Neither gave any relief from symptoms. A second x-ray, five weeks after the first one showed a slight but definite

Fig. 17.—Case VI. Photograph of gross specimen, showing at X the area where crepitation could be felt.

increase in the size of the tumor, and the cortical destruction. Operation was performed at once and based on these findings, a positive diagnosis of sarcoma was made.

Operation

On the morning of the operation, palpation revealed an area of distinct parchment-like crepitation (Fig. 17), near the head of humerus, and for this reason resection was advised without exploratory incision. The operation (Major Kirk) was a disarticulation of the right shoulder, with resection of the humerus at the junction of the upper and middle third. Tumor tissue was not exposed during disarticulation, but when the biceps tendon was dislocated from its groove, clear serum exuded, suggesting perforation of the cortex. The wound was thoroughly sponged with alcohol. When the humerus was resected a small particle of tumor tissue was seen in the marrow cavity, and frozen section showed definite evidence of malignancy. Immediately this was sponged with alcohol and the humerus resected above the condyles. Here the bone and marrow appeared normal. This condition of expansion down the shaft was explained on section of the tumor (Fig. 18), when it was found to be under quite a bit of pressure and the marrow cavity was the point of least resistance. The upper eleven inches of the left fibula was grafted into place (Fig. 19), the lower end being inserted into the marrow cavity and the head of the fibula being placed against the glenoid and sutured. The wound closed without drainage, and although the patient was somewhat shocked, he made an uneventful recovery. The result has been all that could be expected.

Fig. 18.—Case VI. Longitudinal section through gross specimen showing expansion of tumor down shaft, central area of destruction in tumor and perforation of cortex. Tissue in gross was white, opaque and gelatinous, suggesting myxoma.

Fig. 19.—Case VI. X-ray showing fibular graft in position, supported by modified airplane splint.

Seven weeks after operation he was free from all pain, had gained in weight, and had a fair amount of motion in the shoulder. The microscope showed (Figs. 20, 21, 22), a cellular tumor, small round cells and spindle cells with several myxomatous areas and several central areas of degeneration which may have been due to the radium or to the lack of blood supply which frequently causes central degenerative changes, especially in rapidly growing tumors.

Discussion

Our experience in this case illustrated the futility of attempting to make a diagnosis from the x-ray plate alone, even if combined with the ordinary clinical and laboratory findings. The line of treatment followed in this case is believed to be the most reasonable with our present knowledge, and is based on the fact that the percentage of cures in true sarcoma of bone is quite small, even with amputation. This accounts for the choice of resection and graft rather than amputation, thereby saving the limb and offering as much hope for a cure in the former procedure as in the latter. Unfortunately, tumor tissue was met unexpectedly in the bone marrow, well below the lesion, and although immediate steps were taken to destroy any transplanted

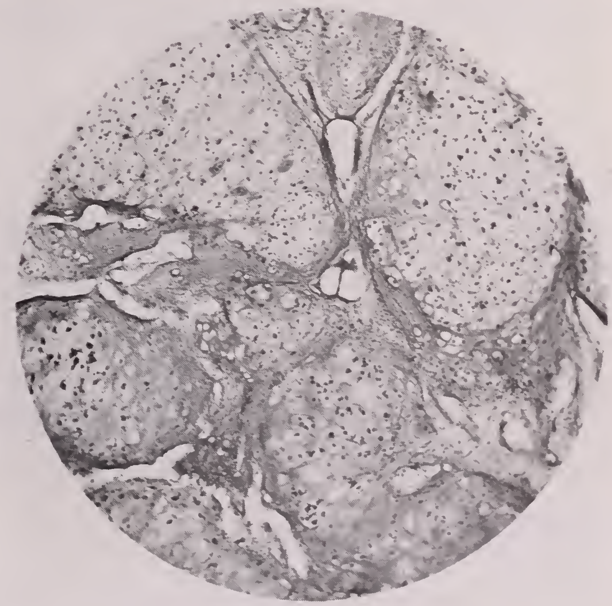

Fig. 20.—Case VI. Low-power microphotograph showing myxomatous and fibrous areas.

cells, the prognosis as regards recurrence is distinctly less favorable. In regard to the radiotherapy, which may be criticised as insufficient, it is fairly well established that tumors which will react favorably to x-rays or radium, do so at once with symptomatic relief, while the others are better off with immediate surgery, without the delay incident to a really complete "course" of radio-therapy. The delay of five weeks in establishing the diagnosis is considered short, as compared with the duration of the lesion, which was at least eighteen months. There was time for "therapeutic" roentgen radiation, but as the radium showed no appreciable results, x-rays would in all probability

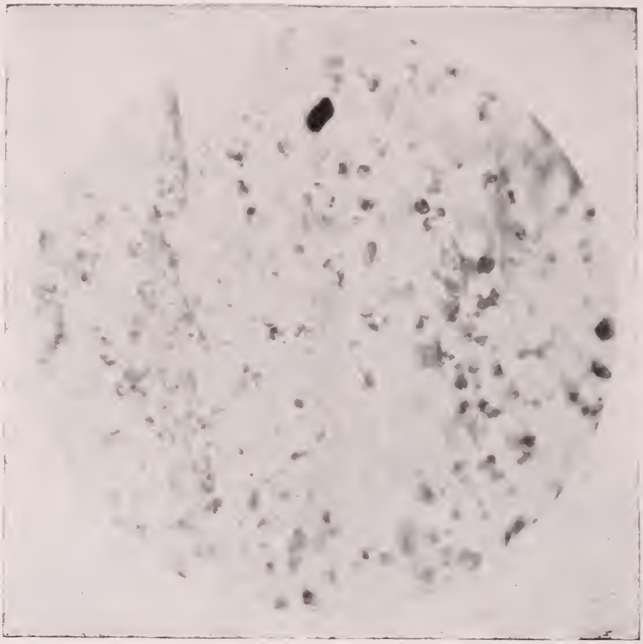

Fig. 21.—Case VI. High-power microphotograph showing necrosis of cells in a myxomatous area.

have been no more helpful. Again, in view of the small percentage of cures, a radical operation should not be done unless the diagnosis of malignancy is firmly established, and an exploratory operation with a frozen section, may be necessary before this can be done, as in the next case.

(For a case quite similar to this one, see Reference 1, Fig. 1, and page 175).

CASE 7—(X-ray No. 11138)

White male; age, 25; lieutenant of infantry.

History

Complained of swelling of stump of left thigh, said by patient to be torn muscles. Condition dated from injury to stump. Duration of pain, swelling and disability, all three months. *Past History*: While in a hospital for treatment of pulmonary tuberculosis in March, 1918, the patient noted a painful swelling of the first phalanx of his left great toe ,which disappeared and reappeared four times until it finally became constant in December, 1918. As he was in bed it caused him no inconvenience and it was not until August, 1919, that it troubled him, 17 months after the first symptom. At this time a diagnosis of osteomyelitis was made (see Fig. 23) and the toe curetted. A blood filled cyst was found in the bone, and as the wound did not heal, the toe was amputated about two

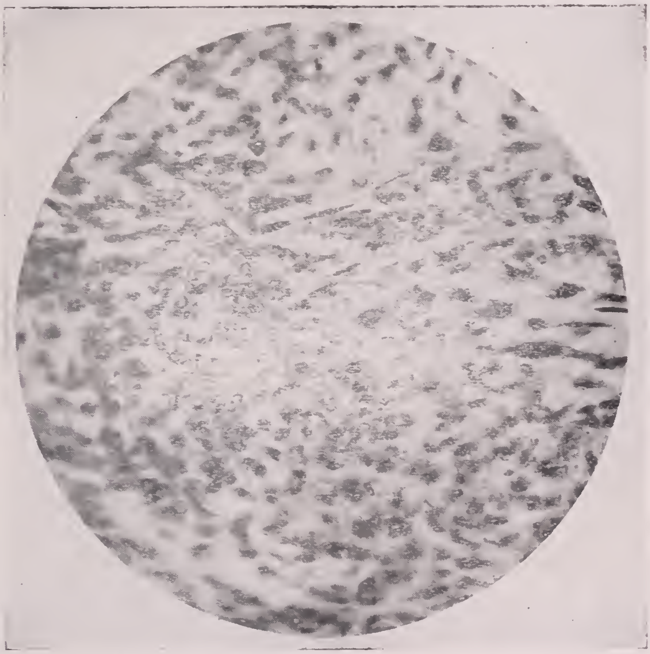

Fig. 22.—Case VI. High-power microphotograph showing large round and spindle cells which should be looked upon as sarcoma, in typical myxomatous tissue.

months later. From this a section was made which was diagnosed sarcoma. Seven weeks later (Nov., 1919), the entire foot became swollen, and on x-ray examination metastases to tarsus and condyle of femur were found. On account of these, amputation was performed through the middle third of the thigh, and the patient was then sent to our hospital for a prosthesis. At this time, December, 1919, a lump appeared in the left groin, swollen, red and painful, which disappeared entirely under radium therapy and has not returned. The x-ray examination of the stump, pelvis, spine and chest were negative for metastases and again negative after a three months period. In May, 1920, he was returned to his

Fig. 23.—Case VII. X-ray showing original lesion in toe.

original hospital wearing a permanent artificial limb. In July, 1920, he "twisted" his stump in a minor accident, and a few days later found that he was unable to wear his leg comfortably, due to a lump on the arterior aspect of the stump, which was tender and quite painful on motion. On second admission a large, firm, smooth swelling was found on the antero-lateral aspect of the middle third of his thigh stump firmly fixed to the bone, but not to the skin, and apparently involving the soft parts. Tender on pressure and painful on motion. No evidence of glandular involvement.

Examination

X-rays showed (Fig. 24), a large cystic defect in the femur just below the lesser trochanter, with almost explosive destruction of the cortex, the latter apparently in part due to a pathological fracture through the involved area. Examination of the chest showed several small nodules in the base of the right lung, not seen when the plates of the previous spring were compared with the present ones, and a diagnosis of metastatic sarcoma involving femur and lung was made. Unfortunately, we did not at that time have his previous x-rays or section of the tumors, and on consultation the possibility of tuberculosis was suggested. As the prognosis, in the case the lesions were sarcomatous, was poor,

Fig. 24.—Case VII. X-ray of stump of left femur. See text.

an exploratory operation was done, October, 1920. (Major Kirk). A large blood filled cyst was found (Fig. 25), with the "velvety" lining of tumor tissue, a section of which was reported as sarcoma. Amputation was then done three days later, with no attempt at chemical or electrical cauterization of the original

Fig. 25.—Case VII. Longitudinal section through tumor showing large hemorrhagic cyst with marked bone destruction. Tumor tissue was friable, soft and hemorrhagic. Type of malignant hemorrhagic bone cyst.

wound. Further microscopic study (Figs. 26 and 27), confirmed the diagnosis of sarcoma, of the endothelial type, which not infrequently metastasizes to bone. (Bloodgood). On comparison of the tissue from the toe and from the stump, the latter is more cellular, more vascular, the cells stain more deeply and appear younger, indicating some increase in malignancy.

Treatment

In spite of the poor prognosis, deep roentgen therapy was begun on the chest (the stump having had one "course" prior to operation), and the entire lung field thoroughly and heavily radiated. The small nodules in the base can now hardly be found, appearing fibrosed, and, although quite sick after the intensive treatment, the patient is now in gairly good condition, with no signs of recurrences. There was an immediate gain in weight and a general improvement, so that the prognosis at present is much better than before operation.

Discussion

This case is somewhat unusual in that it began as a central tumor of a phalanx (these tumors forming only a small portion of bone), and is one of the few malignant tumors originating in a phalanx to be put on record. It also shows an unusual spread, by metastisizing primarily to bone and to the bones of the same limb in an ascending sequence. The only other involvements noted were the inguinal glands on the same side and the base of the lung, neither of which has been proven to be tumor tissue. In addition it demonstrates the rapid response to radio-therapy found in some tumors not belonging to the lymphomatous group, which, of course, respond best of all to this form of treatment. In view of this it is possible that a thorough treatment of the original lesion with x-rays or radium would have prevented the subsequent metastases, especially if curettement had not been done. This in turn shows the necessity of recognizing the type of tissue which is met, even in such a minor operation. The finding of a blood-filled cyst in the bone should have suggested the possibility of malignancy, and a resection of the tissue should have been made at once.

In conclusion we wish to thank Dr. Bloodgood for his extremely valuable assistance in the study of these cases, and the officers of the surgical and laboratory services of this hospital for their hearty coöperation. We are indebted to Mr. Herman Shapiro, of Baltimore, for the excellent reproductions of the x-rays and gross and microscopic sections.

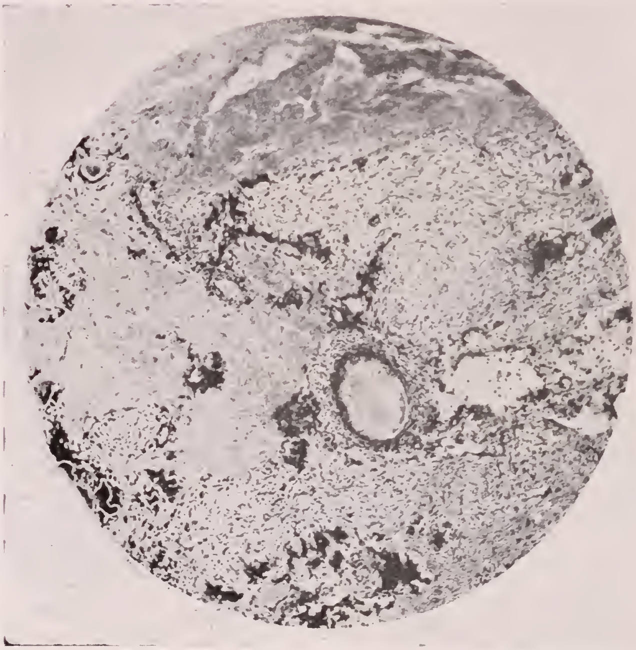

Fig. 26.—Case VII. Low-power microphotograph showing small nests of medium-sized round sarcoma cells with much blood. Blood vessels with tumor cells in lumen and outside.

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Fig. 27.—Case VII. High-power microphotograph showing many small blood vessels. Tumor cells uniform in morphology. Suggests angio-sarcoma.

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**—Authority to publish granted by the Surgeon General, U. S. Army.

The Treatment of Tuberculous Cervical Adenitis — Results From Use of Fractional X-ray Dosage in One Hundred Cases

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THERE are two laws which should govern the physician in his treatment of disease—First, he should do no harm; Second, he should work in harmony with Nature's modus operandi.

The application of the first law to the treatment of Tuberculous Cervical Adenitis rules out, we believe, their surgical extirpation. For it is inconceivable that the opening up of blood and lymphatic channels resulting from an extensive dissection should not do harm by giving opportunity for the extension of the infection to other organs, particularly the lungs. The x-ray can cure any glands that surgery can remove, with less discomfort to the patient and less danger of spreading the infection. Further, we have cured by the x-ray many cases that have come to us as surgical failures. The only indication for surgery is where a caseous gland has broken down through having become secondarily infected, or through liquefaction necrosis, and is pointing at the skin. Then the detritus or the pus should be evacuated by the smallest kind of skin incision.

The consideration of Nature's second law—that the physician should imitate Nature's methods, together with the study of the pathology of tuberculous glands, has led us to depart from the commonly taught method of using x-ray in the treatment of tuberculous glands of the neck, viz., intensive treatment by hard filtered rays. The U. S. army x-ray manual (1) recommends for the treatment of tuberculous adenitis "intensive or semi-intensive filtered treatments." The kind of ray recommended for filtered treatments is (2) a "9-inch gap." Pancoast (3) says of tuberculous adenitis, "deep penetration and filtration are to be employed." These expressions are representative of the American literature on this form of x-ray treatment.

Now, we do not believe that the hard x-ray, represented by the 9-inch gap, produces results as much in harmony with Nature's method of healing tuberculous glands as does the milder ray, with shorter spark gap. The hard ray accomplishes its results by the destruction of rapidly proliferating tissue, especially of embryonal type. It has made its great achievements in the malignancies and in the pathological hyperplasias, notably those of the thyroid gland and the fibroids of the uterus. In tuberculous glands, however, the destructive process and the process of repair are of quite a different order from that of the neoplastic type of disease. The hyperplasia here is not a destructive process, but is a part of the process of repair, and should be stimulated rather than inhibited.

Further, in the proliferating embryonic type of tumor the indications are to cut off the blood supply, and this the hard ray does by destroying the intima of the arterioles, with resulting thrombosis. On the other hand, in tuberculous glands the indications are to increase the blood supply, to supplement the hyperemia, which nature produces, by the stimulating effect of the milder forms of x-ray.

Adami and McRae (4) thus describe the destruction process and mode of repair of tuberculous glands "as a result of the invasion of the gland by the tubercle bacillus, a mild protective inflammatory process is set up." This process consists of:

1. Simple cellular hyperplasia.
2. Tubercle formation; agglomeration; caseation resulting from the tubercle bacillus toxins; and possible liquefaction necrosis, or breaking down as a result of secondary infection.
3. Thickening of the capillary walls, the fibrous stroma of the gland, and the fibrous capsule of the gland, which may be so extreme as to cause atrophy of the lymphoid elements.
4. Deposit of calcium salts in the caseous gland.

The hyperplasia of lymphocytes is nature's primary defensive mechanism in the acute stage; the hyperplasia of fibrous tissue elements is the subsequent method of defense. Both these are essentially defensive measures and should not be interfered with. We believe they are retarded by the destructive tendency of the hard ray, and stimulated by the ray of medium softness.

Erskine (5) says: "With a short spark gap only soft rays are produced, with a medium spark gap more soft rays and some medium rays, while by using a long spark gap we get many more soft rays, more medium rays, and some hard rays." And from the premises he draws the conclusion: "By using a long spark gap we obtain a beam of light with the widest possible range of penetrative power, especially rich in soft and medium rays, and adaptable by means of filters to every therapeutic requirement." Now, it is generally conceded that the heavy filtration, required when the long spark gap is used, cuts out larger relative proportions of soft and medium rays, and lets through proportionately more hard rays. So that the characteristic effect of the ray produced by the long spark gap seems to be, not that of the mixed rays, but that of the hard ray. We think it is more in harmony with nature's method of healing tuberculous glands not to use this hard destructive ray, produced by the 9-inch spark gap, but to use the medium stimulating ray produced by the 5 or 6-inch spark gap. The fibrous chains of glands which are the results of infection extending over years, and in which the tuberculous process is arrested, may be the proper field for the hard rays. But we are convinced that the acute or subacute inflammations which form the bulk of our cases, should receive only the medium rays, especially since no one attributes to the x-ray the power to destroy the tubercle bacillus.

This conviction is confirmed by several other considerations:

1. Certain unfortunate experiences. Recently a medical confrere from an adjoining town desired a heavy treatment of an acutely infected gland, as he could not report again in less than a month. Contrary to our best judgment we gave him a highly filtered intensive treatment. The result was that we set up a terrific reaction, which nearly prostrated our doctor patient for a period of two ensuing months. Again, a patient in whom the large acute swelling had subsided under twelve mild treatments, was given a course of intensive treatments to absorb the hard gland remaining. The result was a prompt recrudescence of the acute inflammation.

2. A second consideration, suggestive of the value of medium rays in this condition, is the good results obtained in many sanatoria through the treatment of surgical tuberculosis, including tuberculous glands by heliotherapy. Now heliotherapy is a much less stimulating form of treatment than even the mildest forms of x-ray. And yet I am told by the superintendent of one of these sanatoria that they must be careful even in the use of heliotherapy, because of the dangers of overstimulation and the flaring up of acute symptoms.

3. The third consideration, confirming our conviction of the value of medium rays, is the uniformly good results which we have personally obtained by their use in the treatment of the one hundred cases which we now report.

If we would summarize our idea of the kind of x-rays to use in tuberculous cervical glands, we would say—The rays should be as soft as consistent with thorough penetration and safety to overlying tissues. Our problem then is, what is the lowest spark gap which will enable the rays to overcome the two-fold resistance—first, that of the tissues overlying the cervical glands; second, that of the filters necessary to protect the overlying skin.

The tissues overlying the cervical lymphatic glands and interposing resistance are, the skin—when the glands are post sternomastoid—and the skin and sternomastoid muscle, when the deeper glands underlying that muscle are involved.

Warner (6) has demonstrated by the ionization method, using a 5.5 inch spark gap, that a thick skin will absorb rays equivalent to that absorbed by .70 mm. of aluminum, while beef-steak 20 mm. thick is equal in absorbing power to 1 mm. aluminum. On this basis the resistance of the sterno-mastoid, which will average about 6 mm. in thickness, would be the equivalent of .30 mm. aluminum. The total overlying structures of the cervical lymphatic glands would represent the filtration effected by .70 plus .30 equals 1 mm. aluminum.

In addition to this resistance by the overlying tissues, we must take into consideration the resistance offered by the filtration necessary to protect the skin. This factor, which we estimate at 2 mm. aluminum for the 5 or 6-inch spark gap ray, can readily be determined by experimentation along the lines mapped out by McKee (7). Remer and Witherbee (8) who have worked out what they term "the arithmetical method of computing x-ray dosage."

They find that the law for filtered dosage differs from that for unfiltered dosage. The formula for unfiltered dosage is—spark gap times milliamperage multiplied by time, equals square of focal distance. The formula for filtered dosage is—spark gap times milliamperage multiplied by time, focal distance. While the unfiltered dose varies inversely as the square of the focal distance, the filtered dose varies inversely as the focal distance. On this basis they find by actual experimentation the formula for a skin dose when a 2 mm. aluminum filter is used to be $\frac{21}{2}$; while the formula when a 3 mm. filter is used is $\frac{231}{20}$.

It is interesting to see how the technique we have adopted. for treatment of tuberculous cervical glands measures up with these formulae. As stated above, we use 2 mm. aluminum filter. Our formula is as follows: 5-inch spark gap times milliamperage, 4 multiplied by 5 minutes time, equals 10-inch focal distance, or $\frac{100}{10}$.

It will be seen that this formula represents a skin dose underneath the 2 mm. filter, $\frac{100}{10}$ being almost the same as $\frac{21}{2}$; but it represents only $\frac{7}{8}$ of a skin dose in the glands, underneath the 3 mm. filter—the overlying tissues forming the additional mm., since $\frac{100}{10}$ is about $\frac{7}{8}$ of $\frac{231}{20}$. The difference in focal distance between the skin and the gland is so small as to be negligible for practical purposes.

This technique, while using the spark gap distance that we consider the best to apply in treating tuberculous glands, furnishes as nearly a skin dose to the glands themselves as it is possible to give and not overstep the bounds of safety for the overlying skin. That the technique will be criticised, by those who use and teach deep therapy for everything, we quite expect. But there is one thing which is beyond criticism, and that is the statistics which we furnish of nearly one hundred per cent cures in a long series of cases, going back over a period of about ten years.

Before treating an enlarged inflamed cervical gland with x-ray, one must know that he is dealing not with a secondary infection from some pus forming organism, but with a tuberculous process. It is our practice to determine this in every case by using the tuberculin test, giving from three to fifteen milligrams of old tuberculin subcutaneously.

There are certain general measures, common to the treatment of all forms of tuberculosis, that should be carried out in dealing with tuberculous glands, such as the open air life, good feeding, and plenty of rest.

It is a matter of first importance to locate and remove any foci of infection. These will usually be either the tonsils or the teeth. The tonsils may be the site of entrance of the tubercle bacillus, or the seat of a pus infection which is secondarily involving the glands through lymphatic drainage. In either case, the tonsils, if showing any evidence of disease, should be removed. Infected teeth may be furnishing the pyogenic organisms which are secondarily invading the tuberculous gland, and interfering with the healing effects of your therapeutic measures. A very vivid realization of this fact was experienced by us when a patient, who had received seven treatments with no improvement in the gland, removed to another city, and was promptly relieved of her enlarged gland following the extraction of a diseased tooth. We are forcibly impressed, in tabulating this series we are now reporting, with the large number of cases that did not respond to treatment until tonsils or other foci were removed.

Another measure which we regard as of cardinal importance is the hypodermic use of tuberculin. Various members of our clinic have had long experience in the use of tuberculin, having employed it continuously for the last fifteen years with almost unvaryingly good results. It is one of the lines of treatment which we would not like to do without. We are quite aware that there has been a great deal of criticism offered concerning the therapeutic use of tuberculin. We believe that criticism is largely based upon incorrect methods of administration. There are two ways of using tuberculin, just as there are two ways of using the x-ray. The one way is to stimulate reactions, and the other way is to stimulate metabolism and the process of immunization. We believe that in the therapeutic use of tuberculin, especially in the early stages, the dose should be kept below the point where it gives systemic reactions to the patient. Failure to observe this is responsible for much of the unsatisfactory experience some have had with this agent. We use the bacillen emulsion, beginning with two minims of the lowest dilution, and increasing according to the degree of immunity of the patient as evidenced by the presence or absence of reaction.

Coming now to our x-ray technique, we use the formula described above. giving one treatment every five to seven days until there is marked decrease in the size and inflammatory condition in the glands. Then the period between the treatments is extended to two weeks, and they are continued thus for a period of six to nine months. This continuation of the treatment after the glands have subsided is the crux of the whole situation. If you let your patient go after you have given eight or ten treatments, which we find is the average number required to reduce the glands to normal size, you may look for recurrence. We tell our patients that any one who is healed of a tuberculous process of any kind in from one to two years is a very fortunate individual. The healing of tuberculous glands goes through the same stages as the healing of a tuberculous process in the lungs. There is the period of quiescent symptoms, followed by the period of arrested progress, followed by the period of apparent cure. These periods extend not over weeks. but months, and you can no more heal a tuberculous gland in a day than you can a tuberculous lung. The patients in this series, who continued the treatment until they were discharged as cured, received an average of twenty-four treatments each, extending over an average period of ten months.

We have seen telangictasis in only one case, and that was produced in the early days when the gas tube was used, and we did not understand the necessity of never producing an erythema of the skin.

During the course of the treatments about ten of the glands broke down and required evacuation. This was done through a very small skin incision, which promptly healed. We have had no case of an unhealed tuberculous sinus.

We have records of recurrence in only two cases, where the patients had been discharged as cured. These cleared up on further treatment, and remain so at this date. That this is conclusive as to the glands remaining healed, is evident, when it is noted that in about thirty of the cases the cure dates back over five years.

In only two cases was there anything to indicate that our treatment might possibly have any relation to a spreading tuberculous infection.

In one case a boy of four received three treatments, one week apart, over a large softened caseous gland. In a few days after the last treatment he developed a tuberculous meningitis and died.

A young lady received eighteen treatments over a course of six months, contracted "the flu," developed acute miliary tuberculosis of the lungs, and died in a sanatorium.

We do not believe there is any causal relation between the x-ray treatment and the spreading infection in these two cases.

Five patients changed their residence and transferred their treatment to other radiotherapists. Six patients failed to follow up the treatments after they had made but a beginning. Eleven patients are continuing the treatment, progressing favorably, but not yet ready to be discharged as cured. The balance of the hundred have been discharged by us as apparently cured. The glands have been reduced to the merest kernels, and the general condition of the patients has been restored to one of well-being.

In conclusion we wish to make it clear that we do not in any sense disparage deep therapy. In certain forms of malignancy, in hyperplastic thyroids, in the hemorrhages of the menopause dependent upon fibroid changes in the uterus, we have achieved through deep therapy results so brilliant that we have come to regard it as almost a specific. But we should not let our enthusiasm for deep therapy prevent us recognizing the good results obtained by milder types of x-ray treatment. The advent of the Coolidge tube, which has done so much for deep therapy, has also standardized our technique for the milder therapy. And this report is simply a statement of our experience with that standardized milder therapy in the treatment of tuberculous cervical adenitis, where we have demonstrated its ability to achieve such uniformly good results.

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History and Development of Radium-Therapy

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RADIUM was discovered by the Curies in 1898, and an action by the radium rays on the skin was first recorded by Walkhoff in 1900 (Photogr. Rundschau, Oct.) Giesel a little later (Ber. d. d. Chem. Ger. 33, 3570, 1901) described an experiment wherein, after a two-hour action by 0.27 gm. of a radium preparation, enclosed in a double celluloid capsule, and applied to the inner surface of the forearm, there was a very intense reaction with pigmentation after two to three weeks, followed by vesiculation and scabbing as in case of a burn. Following the healing, the hair did not grow on the rayed spot. Becquerel in 1901, while using a very active radium preparation, carried the tube in his vest pocket for several hours. Several weeks later a severe inflammation of the skin appeared, which was attributed to the action of the radium. Prof. Curie then made an experiment on himself, and as a result of the discovery of this new property of radium, loaned a specimen of radium to Dr. Danlos, of the St. Louis Hospital, Paris, for medical purposes. In 1901 Danlos reported on the treatment of lupus erythematosus by radium chloride (Soc. franc. de dermat. et de syph. Nov. 7).

As rapidly as the amounts of radium available permitted, the experiments in the use of radium were taken up by other workers in Europe, and America, and in the years up to 1910, radium treatment was favorably suggested for many conditions, including many malignant and benign growths. During this early period the main contributors were the French and German schools, the English and American contributions being much fewer in number. In this country we may mention the pioneer work of R. Abbe (Radium in Therapeutics, Boston Med. and Surg. Jour., 53, 1904); Wm. J. Morton (Treatment of Cancer and Lupus with Radium, Med. Record, Nov. 9, 1907); Williams, of Boston, (Early Treatment of Some Superficial Cancers, especially

Epitheliomas, by Pure Radium Bromide rather than Operation or x-rays, J. A. M. A. 51, 894. 1908) and H. Robarts (Practical Radium, The Causation of Cancer and Its Curability by Radium. The Practical Uses of Radium in the Treatment of the Obstinate Forms of Disease. St. Louis, Mo., 1908). The writer has not had an opportunity to go into the work of the pioneer radium therapists in the country and simply mentions the names of men whose work has come to his attention.

During the first ten years of its development radium therapy struggled with two great difficulties which made advances in the work very slow. These were the small amounts of radium which were available for the work and the lack of a suitably accurate method for standardizing radium preparations for therapeutic use.

In order that there might be greater accuracy in the standardization of radium preparations, the Congress of Radiology and Electricity, meeting in Brussels in 1910, appointed a committee to make arrangements for the preparation of an International Radium Standard, and Mme. Curie was asked to prepare the standard. This, as made, consisted of 21.99 mgm. of pure radium chloride, sealed in a thin glass tube. In March, 1912, this standard was compared by the committee, meeting in Paris, with similar standards made by Hoenigschmid from pure radium in the possession of the Institute for Radium Research of the Vienna Academy of Sciences, the material for the Vienna prototypes having been purified for atomic weight determinations, the three tubes containing 10.11, 31.70 and 40.43 mgm. of radium chloride, respectively. Comparison of the Curie tube with the Vienna tubes showed that the preparations agreed within the limits of the errors of measurement, and certainly within one part in three hundred. The standard prepared by Mme Curie was accepted as the International Radium Standard and is preserved at the International Bureau of Weights and Measures at Sevres, near Paris. Duplicates of the International Standard have been prepared for use by the governments of the world, that for the United States being in the possession of the U. S. Bureau of Standards, at Washington.

Along with the new radium standard came the more general use of the gamma ray method of comparing quantities of radium, and this advance has been of the greatest importance in permitting physicians to know exactly with what they are working, and so make it more readily possible for the accurate description of their methods, and for the duplication of their work by others. This was not possible with the older method of standardization (the so-called activity units) where each radium applicator had to be physiologically standardized.

The radium production from Bohemian pitchblende was maintained as a government monopoly by the Austrian government, and the independent production of radium in France and Germany up to 1914 was mainly from ores which were imported, high grade carnotite from Colorado being, in the several years prior to the outbreak of the European war, the main source of radium. Even this ore, according to the statistics, could not in the aggregate have yielded any very large amount of radium. (Less than 25 grams probably). (See U. S. Geol. Survey Report for 1914, Report on Uranium, Vanadium and Radium, by F. L. Hess). In the United States, Lockwood, of Buffalo, N. Y., had worked from 1903, in a vain effort to produce high purity radium salts, and it was not until 1913, that the first high grade radium was prepared in this country in the laboratory of the Standard Chemical Company, at Pittsburgh. Since 1914 the production of radium has been carried on mainly in this country, carnotite being the source, and it is conservatively estimated that to date (June, 1920), the total aggregate production in the world of high grade radium salts probably does not exceed one hundred and thirty grams of radium element contained, and of this amount between eighty and eighty-five grams have been produced in the United States. While the figure for the world's total production is in the nature of a guess—the figures for the production in this country are reasonably accurate, since for example it is known that the Standard Chemical Company, of Pittsburgh, has produced over 55 grams to date.

Prior to 1912 the most extensive work in radium therapy was that of the French School, of whom we mention Drs. Danlos, Beclere, Darier, Dominici, Wickham, Degrais, Barcat, Chevrier, Cheron, Rubens-Duval, Fabre, Oudin and Verchere, Faure-Beaulieu, Bavet, and de Beurmaun. Other pioneers worthy of special mention are Abbe, Williams, Davidson, Lassar and Blaschko.

The indications for radium in various conditions, as given by Dr. Barcat in his Precis de Radiumtherapie (Paris, Maloine, 1912) are noted here, together with the name or names of those who first reported the treatment.

Cutaneous cancer, lupus vulgaris, lupus erythematosus, port wine stains, psoriasis, Danlos, 1902. Leucoplakia, Rehns and Salmon, 1904. Keloids, Williams, Werner and Hirschel, 1904. Wickham and Degrais, 1908. Sycosis, acne rosacea, lichen ruber, Blacshko, 1905. Eczema, Lassar, 1904, Blaschko, 1906, Wickham and Degrais, 1906. Warts, Abbe and Boikoff, 1904.

Pigmented nevi, Hartigan, 1904. Epithelioma of the Mucous Surface of the Lips, Dominici, 1908. Epithelioma of the Buccal Mucosa, Gussembauer, (1 case); Abbe, (2 cases); Dominici, (6 cases). Epithelioma of Tongue, Dominici. Angiomas, Wickham and Degrais, 1906. Mycosis, de Beurmann, Dominici and Rubens-Duval, 1907. Vanthoma, Barcat and Bord. Rhynophyma, Wickham and Degrais, 1909. Breast cancer, Lassar, 1904, Abbe, 1905. Hartigan, 1905, Morton, 1907. Sarcoma, Morton, 1905, Dominici, Haret. Cancer of Cervix, Fibroids, Abbe, 1905. Fibromas and Metrorrhagia due to Fibroids and Metritis, Oudin and Verchere. Later works by Dominici, Cheron, Rubens-Duval, Wickham and Lacapere, Fabre and Bender. Cicatrization of wounds, Chevrier. Exophthalmic Goitre, Abbe, 1905.

Following the experiments of Danlos, the crude applicators were modified by later workers, many of the forms employed being still in use today. The varnish surface plaques were introduced by Danne, and the metal tubes, filled with radium salt are credited to Dominici. These tubes with a sharpened point served for introduction into tumors. For lighter treatment over large areas the flexible linen, or "toile" applicators were made. Dominici first showed the importance of metal filters or screen to absorb the undesirable irritating soft rays, when treating growths requiring considerable irradiation, this method being called that of the "surpenetrant" or ultra-penetrating radiations.

In 1912 there were already a number of radium institutes where therapeutic treatments with radium were being carried on extensively. The most important at that time, in point of experience, was probably the Laboratorie Biologique du Radium, in Paris, under the direction of Dr. Louis Wickham, assisted by Dr. Degrais. Second to this ranks the work at the Hospital St. Louis, Paris, of Dr. Dominici. At Heidelberg, under the direction of V. Czerny, a radium department carried on work, and at the General Hospital in Vienna, in 1912, a radium department was established with half a gram of radium element available. In London, in August, 1911, there was opened the Radium Institute, under the direction of a committee of leading surgeons. A. E. Haywood Pinch being the medical superintendent. This institution was credited with owning two grams of radium bromide, the largest amount then available at any one clinic in the world.

In 1913, the medical world was thrilled by the reports given at the Gynecologic Congress at Halle, when Kroenig and Gauss, Bumm, and Doederlein reported their astonishing results obtained by the use of massive doses of gamma rays from heavily screened mesothorium preparations in the treatment of carcinoma of the cervix uteri. A "radium fever," as it was called, came over Europe, particularly in England, Germany, Austria and Italy. The production of radium on a larger scale, which began about this time, could not begin to meet the demand. Funds were raised by public subscriptions to endow hospitals with sufficient radium, and many of the governments of states and cities provided funds for the same purpose. In Manchester, England, public subscriptions secured a gram of radium element for the Radium Institute, and in a like manner, a half gram of pure bromide was secured in Sheffield, England. The Prussian government purchased a gram of radium element, the Bavarian government a half gram, and a great many of the German cities likewise purchased quantities of radium for use in the local hospitals.

In the United States radium therapy was not received very cordially at this time. A few men, like Abbe, Kelly, Simpson, Aikins, and Dieffenbach, were working in the field, but few would believe their statements. Then came the war in 1914, with its upsetting of communications. During 1915, and in spite of the adverse propaganda of the Bureau of Mines, more and more the American physicians came to realize the importance of radium therapy, and backed their belief by securing the precious material for use in their own practice. The poor communication with Europe, due to the war, the fact that the literature of radium therapy was largely in German and French journals, not accessible to very many, resulted in an American School of Radium Therapy, which rediscovered, and improved on many of the results of the pioneers. It would go beyond allowable limits were the writer to try to indicate these points in detail as it has been his privilege to observe the development of radium therapy in the United States since 1913. Intelligent understanding of the limitations of radium therapy, coöperation between the surgeon, the roentgenologist and the radium therapist have gone far to work for improved results, and combined methods rather than reliance of a single means, give hope that radium therapy will go far in the combatting of cancer.

The writer would like to mention the splendid research work which is being carried out at the Memorial Hospital, in New York, and where Dr. Janeway is developing the method of employing radium emanation tubes inserted directly into the tumor growths. This promises to be one of the most important advances made in radium therapy, and if later observations confirm the earlier ones, this work will materially influence the trend of radium therapy in this country. Radium emanation is only readily available where rather considerable quantities of radium are employed, and a demand for radium emanation will force the physicians to coöperate to pool their supplies for the more economical production of radium emanation.

There are in this country two institutions which each possess for regular work over four grams of radium. There are to the writer's knowledge four with a gram or more in use and seven with over a half gram. A conservative estimate at this time places the number of physicians, hospitals and institutions in this country who are employing radium at four to five hundred, and the total quantity of radium employed at between thirty-five and forty grams. Based on present production, which, of course, can be greatly increased if necessary, additional radium is available at the rate of from twenty to thirty grams per year.

An estimate of the amount of radium necessary for all likely therapeutic uses, for the whole world, would probably be a large figure in terms of the present day's stock and rate of production of radium. There have been recently a number of disquieting statements by Dr. R. B. Moore, of the Bureau of Mines, indicating that the radium supply of the world and particularly that which will come from the Colorado carnotite is painfully small. The writer has been arguing this matter with Dr. Moore since 1914. at which time Dr. Moore's predecessor, Dr. Parsons, said in a hearing before a Congressional Committee that "we cannot estimate as much as 200 grams of radium metal available in any known deposits at the present time." Without in any wise exhausting the Colorado carnotite field, or barely touching the Utah deposits, over eighty grams of radium have since been produced. In spite of Dr. Moore's pessimistic view, there is other better evidence that several thousand grams of radium will be obtained from the carnotite deposits. It is, therefore, unlikely that radium therapy will languish for lack of sufficient radium.

This country now leads the world in all fields, with the largest known radium deposits, the largest manufacture of radium, the greatest institutes for radium therapy, and far and away the largest amount of radium thus employed.

*—Read at meeting of Iowa Roentgen Club, Iowa City, April 15, 1921.

Atrophy of Lymphatic and Tonsilar Tissue by Radium and X-Ray

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FOR some years it has been known that lymphatic tissue is very much more susceptible to x-ray and radium than connective tissue or bone.

The thymus gland may be taken as a typical example of a lymphatic organ. Another example is the tonsil. Both glands are composed almost entirely of pure lymphatic tissue, the fundamental pathology being essentially the same.

In 1915 I did some experimental work on half grown guinea pigs and rabbits to see what the effects of x-ray would be on the thymus gland of these animals. The controls were pigs and rabbits of the same litter, approximately the same size and weight and living under the same conditions.

The technique employed was to give 3 points Hampson radiometer each day for eight days through 1 M.M. aluminum, pastile on the skin. My apparatus consisted of a 16-inch coil using 9-inch spark gap, 5 millamperes current Coolidge tube target 10 inches from the animal.

One week after the completion of treatments the control and treated animals were killed, the thymus gland removed and sectioned by Dr. Hunter, of George Washington Medical School.

Microscopically the treated glands could be divided into a capsular and an interstitial hyperplasia, both increased to a marked degree leading to a distinct sclerosis and enormous reduction in the amount of thymic tissue. The capsule was in places increased to six times the thickness of the capsule in the untreated gland.

The veins, arteries and capillaries were widely engorged with thrombi and organized blood clot and the walls of the vessels were much thickened, all pointing to future organization of the vessel contents.

In addition to this, there was a decided thickening of the trabeculae and a great increase in the reticulae all taking place at the expense of the thymic cells, in other words, a rapid and unmistakable atrophy of the lymphatic tissue associated with an increasing amount of connective tissue and sclerosis of the entire gland.

Satenstein and Remer have recently studied the varying sensitiveness of the different tissues of the body to x-ray, the degree of sensitiveness being most marked in the lymphocytes and less marked in the fibroblasts and connective tissue cells, both being more resistant to the ray than neoplastic elements (epithelium) (as cancer) which in turn was much less resistant and more sensitive to x-ray than normal tissue.

In saying it is less resistant to the ray I mean that the tissues are unable to withstand the heavy doses of ray so that involution, absorption and atrophy in this case of lymphoid tissue results without permanent damage to the surrounding and very much more resistant connective tissue.

From the Rockefeller Institute and Journal A. M. A., January 22, 1921, a report has recently been made that will prove a land mark in the treatment of hypertrophied tonsils. This article, coming from such an ultra-scientific and ethical institution and men, is not to be questioned or doubted. Briefly, it told of the treatment of forty-six patients ranging in age from 3½ to 45 years by exposing the area of the tonsils to a massive dose of x-ray. Two weeks later distinct shrinkage of the hypertrophied tonsil was noted. This continued from one to two months, at which time the tonsillar crypts had opened and drained, and in all but a few the exudate had disappeared from the troat, leaving the tonsil smooth, pale and of a healthy appearance.

Cultures were made from the crypts in forty of the forty-six patients before and at intervals after the treatment began. The common organisms of the throat were not affected. Thirty-six of the forty patients showed hemolytic streptococci, and of this number the tonsil of thirty were free of this organism four weeks after treatment began.

As the atrophy of the tonsil progressed the crypts became more shallow and drained better, the streptococci disappeared and the lymphatic tissue became displaced by connective tissue. The hypertrophied tonisls had undergone a shrinkage comparable to the atrophy of old age when the gland is composed of little more than a small collection of fibrous tissue.

Viewing the treatment from the point of a roentgen therapeutist the entire technique is most simple and easily accomplished in one or two treatments

The measured amount of ray over the tonsillar area is less than that given for a skin cancer and averages the quantity used in the treatment of ring-worm of the scalp, or in other words, a perfectly safe amount of x-ray.

The one thing, and to my mind the only part of the technique that detracts from the treatment is the fact that the target or tonsil being at least an inch or more below the surface of the skin, especially in adults, and not in a very accessible or exposed location may not receive the full amount of ray intended for it. This would entail more visits, treatments, expense, and the loss of time of at least one month or more, as such large doses of x-ray cannot be safely repeated under four weeks.

In order to overcome this difficulty and to be able to concentrate the rays accurately and directly on the tonsil, obviating the use of large doses of x-rays over the structures of the neck, to save time and to make doubly sure of the results, I am using a flat dermatological 30 mg. double strength radium applicator, covered only with a single layer of sterile rubber tissue. Swabbing the throat and tonsil with a two per cent novocain solution will usually eliminate any gagging.

A convenient handle is supplied with the applicator which enables the patient to hold the unscreened radium directly on the tonsil for an hour. With this original technique it is perfectly remarkable how quickly the tonsil begins to shrink and show other atrophic changes. A mild reaction which turns white is to be seen where the radium has been held. This slight irritation of the tonsil disappears in two or three days.

In one patient with a temperature of a hundred and one degrees, exudate in the crypts of the enlarged protruding and inflamed tonsils, cervical glands of the neck the size of half an orange associated with malaise loss of appetite the picture was changed in one week and after a single treatment. After two weeks the tonsil was the only part of the entire naso-pharyngeal field that did not share in the very acute red, inflamed condition that involved every other part of the posterior-nares and pharynx. The enlarged glands had disappeared in three weeks, and only a small part of the tonsil was to be seen when the anterior pillar was pulled to one side. On the opposite side, not complicated by enlarged cervical glands, the enlarged protruding tonsil had entirely disappeared after a single exposure of x-ray and radium.

By using the unscreened radium applicator on the surface of the tonsil combined with three points Hampson x-ray through three M.M. aluminum pastile on skin and covered with two layers of shamois skin externally, I get a cross-fire of radium and x-rays which is concentrated and centered on the tonsil itself.

This technique to me seems a much more scientific and accurate, a sure and quicker way of reaching and atrophying the tonsil.

The dermatological flat radium applicator without filters is not only the practical applicator to use, but its advantages are apparent with the most superficial knowledge of radio-therapy. The radium is on the surface of the metal capsule, having no aluminum to cover it and filter out the valuable beta ray and being of double strength, the strongest made, the effects are immediate and both superficial and deep All of the more valuable beta rays are available, which is impossible when using, say the popular metal capsules or needles such as are employed in uterine and deep cancer work. This metal capsule employed by gynecologists and surgeons is most frequently made of one-half to one M. M. of silver, which equals in density and filtration power two to four M.M. of aluminum. Such a filter eliminates and absorbs from fifty to ninety per cent of the very type of rays that one seeks to employ in this work. Not only does it waste from half to ninety per cent of the beta ray that is useful and needed, but it prolongs and multiplies the duration of treatment from four to eight times.

(1) From the cases upon which I have tested this technique and the reports from the Rockefeller Institute combined with the rather large experience of six years in producing atrophy of the thymus gland with x-ray, I am positive that I can cause complete atrophy and disappearance of any but a fibrous tonsil in one to three treatments. If the tonsil is very fibrous the change in size will not be so marked.

(2) Eliminating, as it does, any suffering, operation, anaesthetic, hemorrhage and pain, it most certainly will be a popular method of removing the tonsils from patients who have circulatory and kidney lesions, who are unable to give their time for an operation or who prefer a slower, safer and painless destruction of the tonsils. Needless to say that the physician who undertakes this work must be thoroughly familiar with modern, measured x-ray therapy and very well versed with the particular specimen of radium he is using.

*—Read at Mid-Summer Meeting of the Radiological Society of North America at Boston, June 3. 1921.

The Present Status of Roentgen and Radium Treatment of Cancer of the Breast

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BEFORE proceeding to the subject of our paper we would like to bring to your attention some considerations that seem to us of great importance in the evaluation of any method of treatment of mammary cancer. Some of these are mentioned by Ewing in his book on Neoplastic Diseases.

1. In stating the end results of any method of treatment, if the statistics are to be of real value, the results must be tabulated according to the structural types of carcinoma which are present. For instance, it is of very little value to state that of 210 cases of breast carcinoma 42 per cent were cured by radical surgical operation, since a number of the 210 cases might be circumscribed adeno-carcinoma, all of which might have been cured by simple excision. If, on the other hand, we know that of these 210 cases there were 75 per cent of cures in adeno-carcinoma, 48 per cent in medullary carcinoma, 46 per cent in circumscribed scirrhus, 35.5 per cent in small infiltrating scirrhus, and 20 per cent in large infiltrating scirrhus, the statistics become much more valuable to us as a basis for determining approximately what chance we have of obtaining a cure in any individual case by a radical surgical operation.

2. The tabulation must also be based upon the extent of the disease. If one surgeon, for instance, considers only those cases operable in which the axillary nodes are not palpable and another operates even if the supraclavicular glands are enlarged, certainly their results are not comparable. With equal surgical skill the former's percentage of cures must be immensely higher than the latter's.

3. Statistics of cure are sophistical unless in addition to the percentage of cures in the cases treated a statement is also made of the number refused as hopeless. For instance, 100 patients may apply for treatment and eighty of them be considered hopeless and sent away without treatment. The other twenty are treated and at the end of five years ten of them are alive. Whatever method of treatment was used is then credited with 50 per cent of cures, although only 10 per cent of the total number who applied for treatment are then alive.

4. The position of the cancer should also be known, since cancers localized about the nipple are relatively less malignant than those close to or adherent to the chest wall or located in an aberrant portion of the breast.

As a further consideration, in order that we may give this relatively new method of treatment—that is, radiation—its proper place, it is necessary to have in mind a general idea of the value of surgery in breast cancer, because it has been the established treatment for many years. Moore, in 1867, recommended removal of breast, skin, fat, axillary nodes, and pectoral muscle. The operation has been gradually extended by the contributions of surgeons in all parts of the world until there seems little room for further improvement. Statistics show that as the operative field has widened the results have steadily improved.

Formerly it was the custom to report cases cured if they lived for three years after operation without recurrence, but Bloodgood and others showed that a considerable percentage of recurrences take place between three and five years, and a smaller percentage recurs even after five years. At the present time it is the custom to report cases as cured if they live for five years without recurrence of the disease. Figures taken from a tabulation by Deaver, covering approximately the years 1895 to 1912, show the percentage of three-year cures varying between 29 per cent and 44 per cent with different surgeons, while the percentage of five-year cures varies from 21 per cent to 29 per cent. It is seen from these figures that somewhere between 20 per cent and 30 per cent of cures have been obtained in all forms of breast cancer by the radical surgical operation. It must be remembered, however, that these figures represent only the percentage of cures in the cases that were considered operable, and also that these are the results obtained by the leading surgeons of the world. It is probable that the average success obtained by surgical treatment is far below these percentages. Several conditions greatly modify the result of surgical treatment. The most important of these is the extent of the disease. Finsterer reports 275 cases in which the axillary glands were palpable with only 4.3 per cent of cures. Ewing believes that this represents about the average surgical success under these conditions. That is, a woman has about one chance in twenty-five of being cured by operation if she has a mammary cancer with palpable involvement of the axillary nodes. If the supra-clavicular glands are involved the chance is greatly reduced. The Massachusetts General Hospital statistics show 0.5 per cent of cures in such cases, or one in two hundred. Statistics from the same source show 16 per cent successes when the tumor is adherent to the skin, against 32 per cent when it is not adherent; 11 per cent successful when it is adherent to chest wall, against 21 per cent when not adherent; 6.5 per cent successful when ulceration is present, against 21 per cent in non-ulcerative cases.

A fair statement of the case would seem to be that in an almost invariably fatal disease radical surgical treatment is able to save the lives of about one in every four operated upon. The probability of success from operation is greatly lessened when the axillary or supraclavicular nodes are involved, when the tumor is adherent to the skin or to the chest wall, when there is ulceration, and when the patient is below 30 years of age. On the debit side of the account must be placed the deplorable results, following local recurrence, the unbearable pain, edema of the arm, etc., that make the patient's condition so much worse than before operation. There seems to be no doubt that operation not only increases the suffering, but it also shortens the life of the majority of recurrent cases.

The limitations of surgical treatment have led to the wide use of radiotherapy as an adjuvant in the treatment of breast carcinoma, and what we shall have to say in regard to its proper place and value in this disease is based very largely on personal experience and observation. We have generally followed the prevailing changes in technique which have come into vogue during the past twenty years. This alone, without regard to other equally important considerations, would render such statistical data as we have entirely valueless.

So far as we know, practically nothing has ever been attempted in the treatment of cancer of the breast by radio-therapy alone other than in inoperable cases. It is in the latter group that our own results have been most gratifying. We do not claim to have cured a single inoperable cancer of the breast, but do know that some have been restored from a state of misery to a condition of comparative comfort, and that at least two are alive and apparently in good health after a lapse of ten years.

It is interesting in this connection to speculate as to what might be accomplished in a series of more favorable cases by radiotherapy alone. It is reasonable to suppose that its greatest good would be accomplished in the same group of cases (amounting to about 30 per cent) that are most amenable to surgery. It is not probable that a considerable number in this group could be cured? If so, what about the remaining 70 per cent? Would not the average period of longevity and well being be materially increased? These are problems which sooner or later will have to be solved.

A second group of cases generally referred for radio-therapy are the recurrences, or perhaps a better term would be the recrudesences, following operation. Our personal experience in this group has on the whole been discouraging. We do not know that we have ever caused the permanent disappearance of recurrent cancer of the breast. In some cases, we have caused a temporary disappearance, but with possibly one exception our hopes for a permanent cure have been shattered. The one exception to which I refer was an extensive adenopathy of the neck and axilla following a double breast amputation for carcinoma, which has now been apparently well for a period of three years. The result in this case was so exceptional that we are doubtful as to the actual pathology of the adenopathy.

While we are exceedingly skeptical as to the curative value of radiation in these cases, we are convinced that it is useful as a palliative measure. By its judicious use the resort to narcotics can often be entirely obviated.

In general it may be stated as our experience that cancer recurrences and metastases do not respond nearly so well to radiotherapy as do the primary growths. This can in part be explained on the assumption that recurrence is simply an evidence of unusual malignancy, but it is highly probable that the real reason is much more complex. It is known that a biopsy is capable of transforming a relatively innocent lesion into one of extreme malignancy, and it is not improbable that the same cause operates with respect to the resistance of cancer recurrences and metastases, not only to radiotherapy, but to surgical and other treatment as well.

It has been quite a general practice for the past several years to refer all operated cases of breast cancer for post operative radio-therapy, and this constitutes by far the largest group with which we have had to deal. Surgeons generally have been eager to have others share their responsibility and disappointments in a disease where their independent efforts have not been altogether a shining success.

Many surgeons refer all of their breast cases for post-operative treatment regardless of the extent or character of the growth. They do so on the assumption that some cancer elements may have been left in the patient's body. In about three-fourths of the cases this assumption is entirely correct. It may reasonably be assumed that the remaining one-fourth have already been cured when they are sent for treatment, and further treatment by radio-therapy would be entirely superfluous. Our concern, therefore, is with the 75 per cent who still have cancer. Personally we are of the opinion that this large group of patients are in a worse condition than before operation. To state the case more succinctly, we believe that for every cancer of the breast cured by surgery alone four have been made definitely worse. We are rather strongly convinced that they are worse, not only from the standpoint of the patient's actual condition, but also from the standpoint of any anticipated benefit from radio-therapy. It has already been intimated that it has been our experience that recurrences of breast cancer respond much less favorably to radiotherapy than do primary growths. This is true of cancers in general and is particularly notable in cancers of the uterine cervix. In cases referred for post-operative radiotherapy, while it is true that we are not called upon to treat a recurrence, we are called upon to treat a traumatized cancer, and the analogy is not as far fetched as might appear at first thought.

It is manifestly impossible to prove what, if any, good has been accomplished by post-operative treatment. Certain statistics from foreign sources have tended to show that such treatment has actually increased the incidence of recurrence. We doubt if this is true, but we also doubt exceedingly if we have ever prevented a recurrence of mammary cancer by post-operative radiotherapy. We know this much that we have seen a great many recurrences and metastases occur in spite of vigorous treatment. We have particularly noted that these recurrences are by no means all deep seated, but have repeatedly seen lenticular metastases occur in skin that has been consistently bombarded by the roentgen ray over a prolonged period. This, of course, does not prove anything, but is at least suggestive.

Pre-operative radiotherapy of cancer of the breast has been championed by some radiotherapists, but has not, so far as we know, ever become generally popularized. The surgeon has always looked askance at any procedure that tends to delay operative interference. We do not believe that such an attitude harmonizes with certain known facts concerning the effects of radiotherapy on cancer. Practically every primary cancer will show definite obvious improvement under efficient radiotherapy. This is evidenced by a diminution in the size of the primary tumor, and also a decrease in the size of adjacent lymph nodes when these have become involved. This improvement varies in degree, but in our experience is well nigh universal. It reaches its maximum, as a rule, in from one to three months after beginning treatment, and it is usually within this period that the tide of enthusiasm, both of the patient and of the radiotherapist reaches its height. As is well known, a great many basal cell cancers, and some of the more malignant types eventuate in a complete cure, but unfortunately, a great majority of the latter group, after a variable period of betterment, again begin to grow, and when this occurs further treatment seems to be of little avail in arresting the progress of the disease.

We believe, therefore, that the most favorable time for operative interference in cancer of the breast is about six or eight weeks after instituting roentgen treatment. This, of course, presupposes that the treatment is efficiently administered.

We realize that it is little short of sacrilege to propose such a course, but we do so with the conviction that the following advantages will accrue:

(1) In practically all cases the surgeon will actually have less cancer tissue to remove. In many cases this will amount to more than 50 per cent.

(2) The danger of local operative implants will be lessened.

(3) The danger of cancer dissemination incident to the handling of the tumor and traumatization of the tissues will be restricted.

(4) A considerable number of inoperable and border line cases will become definitely operable.

(5) The axillary region can be treated efficiently before operation, whereas this is seldom practical after operation, because of the restricted mobility of the arm.

The principal objection to the method is the fact that it will be found difficult to persuade many patients to submit to operation after experiencing the initial benefits of radiotherapy. This can be obviated in large measure by clearly outlining a tentative course to be persued before beginning treatment.

Another circumstance, although not a valid objection, which will tend to discredit the procedure, is the fact that failures will be attributed to operative delay rather than to the inherent nature of the disease.

The question of radiotherapy in cancer can not be dismissed without brief reference to recent developments in roentgen technique.

It must be admitted that the question of what constitutes efficient treatment in more or less deep seated cancer, is at present in an unsettled state.

For several months we have used the following technique:

Milliamperes, 5; spark gap, 9 to 10 inches; filtration, ½ millimeter copper and 1 millimeter aluminum; skin focus distance, 12 inches; time for each area, 3 hours.

Breast cases have been treated over from two to four areas, depending on circumstances. This makes an exposure time of from six to twelve hours. We believe that one such treatment, followed by operation in from four to eight weeks, if the case is operable, probably affords the best chance of cure. Possibly another such treatment given two or three weeks after operation would be of some value, but we believe that practically all of the benefit to be derived in the cure of cancer by radiotherapy is accomplished by one or two treatments, and that the initial blow should be as hard as possible. Certainly treatments repeated month after month over an indefinite period are potential for considerable harm, and are of very doubtful benefit.

We have observed no skin effects from our present technique other than an intense bronzing.

Roentgen sickness is often distressing. It is hardly practical to give all of the treatment on one day, and when divided over several days it often requires considerable persuasion to induce the patient to complete the series.

We believe that with such dosage there is in some cases a potential danger of a profound or possibly fatal toxemia, but in an otherwise hopeless malady we do not hesitate to assume that risk.

In conclusion it may be stated as our belief that results are superior to those obtained by the older methods and that radicalism in the radiotherapy of cancer is no less essential than it is in its surgical management.

NOTE—Since the above paper was prepared, in the early spring, we have had a few cases, treated in accordance with the technique outlined, in which there has been some vesication of the skin. In every instance this has healed within two or three weeks. The reaction has not been of such a character as to induce us to modify the technique, but we feel that attention should be called to the possibility of such an occurrence.

The advent of hot weather is considered a possible factor in its production.

We believe that the beneficial effects of the amount of radiation received by the patient more than compensates for the temporary discomfort occasioned by the dermatitis.

*—Read at Mid-Summer Meeting of Radiological Society of North America, Boston, June 3rd and 4th, 1921.

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Annual Meeting

IT is not a moment too early to begin thinking seriously about the annual meeting, and the plan of society activity for the ensuing year, which must be threshed out at that time.

There is every desire on the part of the outgoing as well as the incoming officers to do all they can toward the fulfillment of those responsibilities which The Radiological Society of North America enjoys.

But the officers must have the assistance of the rank and file of the membership, otherwise the society becomes so autocratic as to fall from sheer single-mindedness.

For these and many other reasons which might be cited in support of the proposition, it is hoped that every member will come to the annual meeting next December with definite ideas concerning the constructive and the creative work to be undertaken by the society during the coming year; and with those ideas boiled down, also, to some practical working plan.

On behalf of those officers charged with the responsibility of working out the program and all necessary arrangements, the thoughtful consideration and coöperation of every member is solicited because in that fact, and in that fact alone, is the source of inspiration like which there is nothing else existent.

Cancer

A RECENT news despatch from Geneva, Switzerland, where The League of Red Cross Societies was then in session, is to the effect that, during the four years, 1908 to 1912, cancer caused more than 1,500,000 deaths in civilized countries. Switzerland headed the list with a ratio of 125 for every 100,000 inhabitants. Holland and England came next; and the United States third, with Italy last. The disturbing fact is that, in the United States, the statistics compiled show cancer to be on the increase.

Probably no other disease offers such disheartening response to any method of treatment yet devised as cancer. X-rays and radium, however, seem at the present time to contain more latent possibilities than any other branch of medicine.

From the curative side, the main difficulty seems to be to obtain sufficiently early recognition of cancerous growths. While on the preventive side, comparatively little is known concerning incipience.

All which suggests that here is a very fertile field for exhaustive research by radiologists especially, because they just now more than all other members of the medical profession seem to be specifically impounded in the interests of suffering humanity. That is the obligation which rests with this particular specialty.

A Research Program

FOR the purpose of lending proper emphasis to the importance of the work which can without question be done by a properly constituted committee or bureau of research laboring under the auspices of The Radiological Society of North America, and for the purpose, also, of recording and commending the zeal and thoughtfulness with which the British Association of Radiology and Physiotherapy has already undertaken the job of laying out a specific research program in its broad relation to the practice of radiology, and then setting it up in sufficient detail to make certain all the diverse ramifications of that program will be encompassed and considered, the following statement of known factors and the desiderata which it is hoped will be their happy sequelae are taken from the preliminary report of the X-Ray and Radium Protection Committee of the British Association. The purpose of this committee is to discover ways and means for preventing the debilitating and destructive effects from continuous contact with these valuable and indispensable adjuncts to the practice of medicine.

INTRODUCTION

The danger of over-exposure to x-rays and radium can be avoided by the provision of efficient protection and suitable working conditions.

The known effects on the operator to be guarded against are:

1. Visible injuries to the superficial tissues, which may result in permanent damage.

2. Derangements of internal organs and changes in the blood. These are especially important, as their earlier manifestation is often unrecognized.

GENERAL RECOMMENDATIONS

It is the duty of those in charge of x-ray and radium departments to ensure efficient protection and suitable working conditions for the personnel.

The following precautions are recommended:

1. Not more than seven working hours a day.

2. Sundays and two half-days off duty each week to be spent as much as possible out of doors.

3. An annual holiday of one month or two separate fortnights.

Sisters and nurses, employed as whole-time workers in x-ray and radium departments, should not be called upon for any other hospital service.

PROTECTIVE MEASURES

It cannot be insisted upon too strongly that a primary precaution in all x-ray work is to surround the x-ray bulb itself as completely as possible with adequate protective material, except for an aperture as small as possible for the work in hand.

The protective measures recommended are dealt with under the following sections:

I.—X-rays for diagnostic purposes.

II.—X-rays for superficial therapy.

III.—X-rays for deep therapy.

IV.—X-rays for industrial and research purposes.

V.—Electrical precautions in x-ray departments.

VI.—Ventilation of x-ray departments.

VII.—Radium therapy.

It must be clearly understood that the protective measures recommended for these various purposes are not necessarily interchangeable; for instance, to use for deep therapy the measures intended for superficial therapy would probably subject the worker to serious injury.

I.—X-RAYS FOR DIAGNOSTIC PURPOSES

1—Screen Examinations.

(a) The x-ray bulb to be enclosed as completely as possible with protective material equivalent to not less than 2 mm. of lead. The material of the diaphragm to be equivalent to not less than 2 mm. of lead.

(b) The fluorescent screen to be fitted with lead glass equivalent to not less than 1 mm. of lead, and to be large enough to cover the area irradiated when the diaphragm is opened to its widest. (Practical difficulties militate at present against the recommendation of a greater degree of protection).

(c) A traveling protective screen, of material equivalent to not less than 2 mm. of lead, should be employed between the operator and the x-ray box.

(d) Protective gloves to be of lead rubber (or the like) equivalent to not less than ½ mm. of lead, and to be lined with leather or other suitable material. (As practical difficulties militate at present against the recommendation of a greater degree of protection, all manipulations during screen examination should be reduced to a minimum).

(e) A minimum output of radiation should be used with the bulb as far from the screen as is consistent with the efficiency of the work in hand. Screen work to be as expeditious as possible.

2—Radiographic Examinations ("overhead" equipment)

(a) The x-ray bulb to be enclosed as completely as possible with protective material equivalent to not less than 2 mm. of lead.

(b) The operator to stand behind a protective screen of material equivalent to not less than 2 mm. of lead.

II.—X-RAYS FOR SUPERFICIAL THERAPY

It is difficult to define the line of demarcation between superficial and deep therapy.

For this reason it is recommend that in the reorganization of existing, or the equipment of new, x-ray departments, small cubicles should not be adopted, but that the precautionary measures suggested for deep therapy should be followed.

The definition of superficial therapy is considered to cover sets of apparatus giving a maximum of 100,000 volts (15 cm. spark gap between points; 5 cm. spark gap between spheres of diameter, 5 cm).

CUBICLE SYSTEM

Where the cubicle system is already in existence it is recommended that:

1. The cubicle should be well lighted and ventilated, preferably provided with an exhaust electric fan in an outside wall or ventilation shaft. The controls of the x-ray apparatus to be outside the cubicle.

2. The walls of the cubicle to be of material equivalent to not less than 2 mm. of lead. Windows to be of lead glass of equivalent thickness.

3. The x-ray bulb to be enclosed as completely as possible with protective material equivalent to not less than 2 mm. of lead.

III.—X-RAYS FOR DEEP THERAPY

This section refers to sets of apparatus giving voltages above 100,000.

1. Small cubicles are not recommended.

2. A large, lofty, well ventilated and lighted room to be provided.

3. The x-ray bulb to be enclosed as completely as possible with protective material equivalent to not less than 3 mm. of lead.

4. A separate enclosure to be provided for the operator, situated as far

as possible from the x-ray bulb. All controls to be within this enclosure, the walls and windows of which to be of material equivalent to not less than 3 mm. of lead.

IV.—X-RAYS FOR INDUSTRIAL AND RESEARCH PURPOSES

The preceding recommendations for voltages above and below 100,000 will probably apply to the majority of conditions under which x-rays are used for industrial and research purposes.

V.—ELECTRICAL PRECAUTIONS IN X-RAY DEPARTMENTS

The following recommendations are made:

1. Wooden, cork, or rubber floors should be provided; existing concrete floors should be covered with one of the above materials.

2. Stout metal tubes or rods should wherever possible, be used instead of wires for conductors. Thickly insulated wire is preferable to bare wire. Slack or looped wires are to be avoided.

3. All metal parts of the apparatus and room to be efficiently earthed.

4. All main and supply switches should be very distinctly indicated.

Wherever possible, double-pole switches should be used in pereference to single-pole. Fuses no heavier than necessary for the purpose in hand should be used. Unemployed leads to the high tension generator should not be permitted.

VI.—VENTILATION OF X-RAY DEPARTMENTS

1. It is strongly recommended that the x-ray department should not be below the ground level.

2. The importance of adequate ventilation in both operating and dark rooms is supreme. Artificial ventilation is recommended in most cases. With very high potentials coronal discharges are difficult to avoid, and these produce ozone and nitrous fumes, both of which are prejudicial to the operator. Dark rooms should be capable of being readily opened up to sunshine and fresh air when not in use. The walls and ceilings of dark rooms are best painted some more cheerful hue than black.

VII.—RADIUM THERAPY

The following protective measures are recommended for the handling of quantities of radium up to one gram:

1. In order to avoid injury to the fingers the radium, whether in the form of applicators of radium salt, or in the form of emanation tubes, should always be manipulated with forceps or similar instruments, and it should be carried from place to place in long-handled boxes lined on all sides with 1 cm. of lead.

2. In order to avoid the pentrating rays of radium all manipulations should be carried out as rapidly as possible, and the operator should not remain in the vicinity of radium for longer than is necessary.

The radium when not in use should be stored in an enclosure, the wall thickness of which should be equivalent to not less than 8 cm. of lead.

3. The handling of emanation should, as far as possible, be carried out during its relatively inactive state. In manipulations where emanation is likely to come into direct contact with the fingers, thin rubber gloves should be worn. The escape of emanation should be very carefully guarded against, and the room in which it is prepared should be provided with an exhaust electric fan.

EXISTING FACILITIES FOR INSURING SAFETY FOR OPERATORS

The governing bodies of many institutions where radiological work is carried on may wish to have further guarantees of the general safety of the conditions under which their personnel work.

1. Although the committee believe that an adequate degree of safety would result if the recommendations now put forward were acted upon, they would point out that this is entirely dependent upon the loyal coöperation of the personnel in following the precautionary measures outlined for their benefit.

2. The committee would also point out that the National Physical Laboratory, Teddington, is prepared to carry out exact measurements upon x-ray protective materials and to arrange for periodic inspection of existing installations on the lines of the present recommendations.

3. Further, in view of the varying susceptibilities of workers to radiation, the committee recommends that wherever possible periodic tests, that is, every three months, be made upon the blood of the personnel, so that any changes which occur may be recognized at an early stage. In the present state of our knowledge it is difficult to decide when small variations from the normal blood-count become significant.

Probably a good deal has already been done by many radiologists to overcome the difficulties pointed out by the British Association Committee, though familiarity so often breeds contempt that a recapitulation of the whole problem with its incident dangers will incline those working with x-rays and radium to more exact care in the protection of their persons.

There is, however, this outstanding fact: it at once becomes apparent, from a reading of the detailed statement made by the British Committee, that a research committee or bureau in permanent form can, by close coöperation with manufacturers of x-ray equipment, accomplish a great deal to protect operators and to standardize equipment so that an operator desiring to instal protective measures will know exactly what he is up against. More than this, the field for sincere collaboration between scientists, physicists and electrical engineers employed by manufacturers and a permanent bureau representing radiologists is so large no time should be dawdled away in argument about whether such a bureau should be created, but rather the question of ways and means should be taken up immediately and seriously.

State Medicine

THE sweeping reorganization which has taken place in business in the past thirty years is carrying over into professional life. That reorganization has developed a social code built upon the impersonal relationships of specilization, standardization, and quantity production. Business has broadened in proportion to international markets, but the medical profession, like most every other profession which is a part of our complex existence, is still trying to stretch an individualistic concept of its obligations and responsibilities to cover the ubiquities of a modern business world.

Most of us hesitate when it comes to organizing such an intimate part of our lives as the old family physician into a scientific machine for quantity production. There linger tender memories of the kindly doctor who was omnipresent if not omnipotent, who brought people into the world in the morning, ministered to all the community ills at midday, and then sat up with Grannie Everybody the night she died—that gentle old soul who never grew too old, whose kindly ministrations were the frankincense and myrrh of a humdrum existence—the one man in the whole circle of our acquaintance who somehow seemed to have contact with the beginning and ending of all things and give us assurance of Divinity.

Of course, to contrast the impersonal relationships of specialized medicine, necessitating the introduction of a score of doctors and an army of laboratory men and specialists into the holy of holies of our private lives, does not make a pretty picture.

When viewed in the abstract men rebel at such a proposal. But the virus of specialization is in the blood. When the man of business suffers the slightest ailment he calls a specialist. So the memory of that type of medical man who was all things to all men is about all there is left. Economic laws and the demands of a modern world have scotched the romance of the general practitioner; the science of medicine is now being called on to safeguard the ability of men and women everywhere to do a day's work.

Quite naturally many of the older members of the profession find it extremely difficult to adjust themselves; they are bewildered at the mass of knowledge and scientific fact presented and demanded at every turn; they are not able to see clear through when they look at younger men, without the long years of gruelling experience, confining their studies to a single item of medical science.

These older members of the profession are not the only persons who wonder how organization can be introduced into the intimate affairs of human life. Most everybody else either refuses to think about the matter at all or is perfectly willing to shift the whole problem to that political worker of magic, the state, which they try to make themselves believe accomplishes utopias by some mysterious legerdemain beyond the ken of man.

But there is nothing in that. There is no mind for the solution of human problems except the human mind.

That is why it is hoped this frank discussion will stimulate professional thought on the subject. That is why, at the risk of seeming presumptuous, we hope to have some part in developing a comprehensive program of preventive medicine which can and will be accomplished by the medical profession.

Professedly such a program must be predicated on the public interest as reflected by the public health. Nothing less than that will answer that profound obligation which is the habiliment of every honest medical man. No other ultimate purpose of the medical profession as a social unit is defensible.

That is why the statement of Dr. J. Whitridge Williams, Dean of Johns Hopkins Medical School, that the time has come when a halt will have to be called on many members of the medical profession who charge all the traffic will bear, may be accepted as evidence of the fact that at bottom the instances of which he complains are but sporadic attempts on the part of medical men to equalize their charges with costs so as to provide a decent return.

No brief is held for the medical mountebank. There can be no question that the medical profession suffers constantly from the operations of self-appointed healers, unconscionable quacks, near-doctors, constitutional manipulators, and a score of other miracle perverts. But in the main these are not recognized as members of the medical profession. They are the jackals which infest every business, every profession. And so long as a lot of people who are sick in the head and not in the feet insist upon spending their money even though they cannot find a reputable physician who will take it, there will always be a clientele willing to take the part of accessory before the fact in the prostitution of the best science yet devised for ministering to the ills which the human family suffers—suffers many, many times needlessly, but nevertheless suffers, and will continue so to do until men and women have learned to correctly value health while they still have it.

Undoubtedly, there are some members of the medical profession who "get the money." It would not be a human profession if it did not here and there develop a scoundrel. But speaking by and large, the ratio of wealth found in the medical fraternity is far smaller than in any commercial line, notwithstanding the fact that even a reasonable degree of medical skill requires years of laborious study, and anything like a decent livable practice calls for unconscionable hours devoted to serving men and women who have gone down from a myriad host of causes all along the highways where men and women congregate, or the secluded byways where the fearless set themselves up in the rugged privacy of Nature's imponderables.

At base, the present failure of the medical profession arises out of the fact that it has not progressed in the science of organization as have most of our economic institutions. It hasn't learned to figure costs or developed those facts which justify the charges it exacts. Yet that is what it must do. It cannot attract the necessary capital to purchase and maintain the expensive laboratories of specialized medicine unless it does that. The first law of economics is that capital is entitled to a reasonable return. The second law is that labor, or professional skill, is also entitled to a reasonable return. And without fear of contradiction, the statement is made that there are many specialists, perfectly honorable, skillful, and above all things else, professionally without reproach, with capital investments in laboratory ranging anywhere from $5,000 to $100,000, who, after charging off a fair return on the investment do not earn as much as an office manager or the superintendent of a contracting outfit.

For evidence of the fact that the medical profession will have very soon to stand scrutiny before a public imbued with the idea of setting up a medical machine after its own pattern with no regard for the sources of human infirmity or the painstaking and sacrificial labor incident to their obliteration, one needs go no further than The Saturday Evening Post of July 16th.

Discussing Dr. William's statement, the editor of The Post goes on to say:

> "It is unfortunately true that occasionally a medical or surgical man in a large city, together with the laboratory men and specialists who assist him in making his diagnoses, charges whatever he dares; but it should be taken into account that the great majority of family physicians regard such men with contempt and do everything in their power to prevent guileless patients who appraise the skill of service solely by its cost, from falling into the clutches of these dollar doctors."

Again:

> "No action charging rapacity can lie against the great mass of family practitioners. As a rule they are overworked and underpaid, and in most cases they would be far richer men if their fees were in closer accord with the services they render."

Again:

> "For many years the overhead costs of medical service have been steadily rising. The patient pays more and gets more. The whole tendency of modern medicine is to lean more and more heavily upon collateral sciences, and to invoke their aid in substituting moral certainties for the exercise of unassisted judgment, which, though frequently highly skilled, was often unsatisfactory. The common use of the x-ray is the best known illustration of this tendency, though dozens of others might be named."

Was there ever a better demonstration of the conflict between the heart and the head which has been pointed out? Could there be a stronger plea for the sovereignty of the old family physician, whose place in the sun of human life is now assailed by the merciless exactions of economic law?

What could be more subtle than the effort to make the transition easy by interpolating these words:

> "Most physicians are quite ready to acknowledge that they charge their rich patients more than their poor ones. It is stated on high medical authority that the wealthiest fifth of the average community indirectly pays most of the doctors' bills of the poorest two-fifths. Persons in the intermediate layer pay just about what they should. Until the practice of medicine is taken over by the state there are only two other methods that can be employed: First, to charge neither rich nor poor more than a nominal fee; and second, to serve only the rich and well-to-do and let the poor shift for themselves. The former course is closed to the doctors by the first law of nature; the second by the dictates of humanity."

Was ever the wish better father of the thought? "Until the practice of medicine is taken over by the state there are only two other methods that can be employed," and neither is practical or possible. Is it possible that the trend toward specialism, whose high purpose is to "substitute moral certainties for the exercise of unassisted judgment," would disappear under state medicine, or that those economic laws which admittedly are forcing the medical practitioner to specialize would become one whit more benign under governmental operation? Would capital invested in plant, laboratory, and library be any the less entitled to earn a reasonable return under state medicine than under private ownership? Would professional skill be less costly or less valuable if compensated by taxation?

Believing that the editor of The Post will, without hesitation, answer all these questions negatively, the sole issue remaining is whether specialism can best be accomplished under some form of state medicine through taxation, or by the medical profession itself. That is something worth thinking about. It involves the reconstruction of every phase of human life. It is an attempt to measure and chart the reactions of the delicate texture of human passions. And at the outset it will be a choice between individual initiative on the part of men whose attainments are in exact proportion to intensity of devotion to the job, and the practice of medicine by rote according to governmental prescription. That may sound like a subtle distinction. But it is just that extreme subtlety of impulse which determines individual response to a wide range of incentives. Whether those incentives can be maintained or whether other incentives can be substituted which will spur men on to more sacrificial service under state medicine—that is one of the very real problems which confronts the man who would make the practice of medicine a paternalistic matter. Perhaps the medical profession as a whole is less responsive to the profit motive, speaking purely of the money side, than is any other class; but the fact remains, as the editor of The Post indicates, the first law of nature is self-preservation; and not many men or women in this sunny land of ours but are susceptible to that law. That sounds a good deal like begging the question at issue. Perhaps in a sense it is; because the public may be perfectly willing to insure the medical profession a comfortable living without regard to labor performed just to satisfy its whim about divesting the practice of medicine of the profit motive. That was the ultimate objective behind the muckraking in politics so vigorously prosecuted a few years ago. And how well it succeeded every man can judge for himself without assistance from the medical profession.

DEPARTMENT OF TECHNIQUE

Stereoscopic Radiography

THE advent of stereoscopic radiography is one of the most important steps in the development of this specialty in medicine. Much is due to the untiring enthusiasm of Dr. Emil G. Beck for bringing this method of examination to the forefront. Even though it has been in use for so many years we feel that it is not used as generally as it deserves. Its chief value, of course, is in the fact that it gives us the third dimension of depth as well as heighth and width, enabling us to see around the corner, if you will allow this expression.

It is especially applicable to parts of the body when making plates in two planes is either difficult or impossible. But aside from use in this type of cases, it has tremendous advantages, especially in the examination of the wrist and the foot. We do not hesitate to say that many cases of fracture of the carpal-scaphoid have been overlooked because the examining physician used only the flat plate in two planes. We might even go further and say that practically every Colle's fracture which has been well reduced and in which motion has followed early and in which considerable disability still exists, especially in the extension of the hand on the forearm, is complicated by fracture of the carpal-scaphoid. This fact is mentioned merely to emphasize the necessity of following the routine of making stereoscopic plates of the wrist in the dorso-ventral position as well as a flat plate in the lateral position.

Of course, stereoscopic vision is not possible for a person with only one eye. It is also difficult or impossible in persons suffering from near-sightedness.

Stereoscopic examination of the chest has been especially employed by Dr. W. Walter Wasson of Denver, and to him we owe much in refinement of technique in this kind of examination.

Dr. Jas. T. Case has called to our attention the value of stereoscopy in examination of the colon.

Aside from these special fields, we feel that it should be used as a routine in examination of the head, shoulders, hips, sacro-iliac joint, ankle and foot, wrist, foreign bodies and any other region where it will be of value.

A case recently came under our observation which was suffering from both gallstones and renal stones on the same side. Stereoscopic plates enabled us to differentiate between the two. One who has adopted the stereoscopic method of examination will certainly become most enthusiastic about it.

NEW EQUIPMENT

The Victor Sphere Gap

THE Victor Sphere Gap, announced in the August issue of Victor Service Suggestions, presages one of the most stabilizing influences injected into the science of x-rays on the mechanical side for a long time. Indeed, it would seem that in this appliance is to be found the foundation on which to erect a standardized technique in both therapeutic and radiographic work that will bear incalculable benefit for both the medical profession and the lay public.

At no time during the development of the science of x-rays, but more especially since the advent of deep therapy with its requisite high voltage, have radiologists been able to satisfactorily measure peak voltage—an extremity whose inherent possibilities as well as dangers they have had to direct and control at their peril.

But beyond the mere thought of safeguarding against the consequences of over or under-exposure in therapeutic work and the embarrassment of flunking in radiographic work because of uncertain voltage, there has always existed on the part of conscientious radiologists a desire to measure peak voltages accurately that thereby therapeutic and radiographic exposures might be reduced to specific formulae. The importance of this measurement is at once apparent, because in it will be found an exact medium for expressing results obtained or failures encountered.

To overcome this mechanical problem much time and effort has been expended on experimentation with spark gap. Voltages have been measured in inches "back up," with a resulting variation running as high as 30% in the actual dosage delivered to the patient.

From what has been said, it is hardly necessary to add that this method of measurement has proven very unsatisfactory. There were a lot of things whose exact effect could neither be calculated nor prevented in the ordinary laboratory, and many failures registered which can now be obviated by the use of The Victor Sphere Gap. The whimsicalities of polarity, the mechanical idiosyncrasies of appliances and apparatus designed with the utmost care for the conversion of electrical energy into x-rays of the right wave consistency when those appliances were subjected to actual field service, altitude, atmospheric conditions, line fluctuations, and so on, have constantly harassed x-ray operators, and added no small burden to their task of discovering the causes for and computing the effects of the thousand and one human factors met up with in the actual application of x-rays to diagnosis and treatment.

For these, and many other reasons, the radiological profession will welcome the commercial appearance of The Victor Sphere Gap. It will be heralded as the medium of control which will abate many of the fundamental failures in the practical application of x-rays for the purpose of substituting moral certainty for the exercise of unassisted judgment in the practice of medicine.

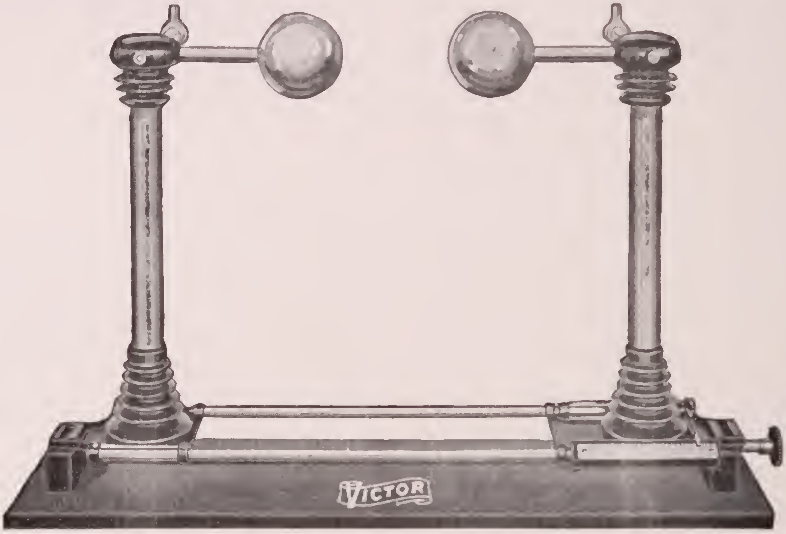
The Victor Sphere Gap is manufactured according to specifications promulgated by the American Institute of Electrical Engineers after exhaustive research and experiment. Mechanically, it is, of course, very delicate in its functions; it must be machined to the point of absolute perfection, and per se, it must be sturdily constructed to withstand the heat of voltages ranging anywhere from 50,000 to 150,000 under continuous usage.

The advantages of the sphere gap over the point gap are indicated by Mr. Carl Darnell, Commercial Engineer of The Victor Corporation, as:

1. The sphere gap measures peak voltage, while the point gap measures average voltage.

2. The point gap relieves the air pressure between the points by a corona discharge of variable duration and intensity, and then sparks over instead of reaching its real spark over points and then breaking over sharply. The amount of this corona discharge is affected by the shape and size of the points, by the manner in which the points are brought into juxtaposition, and possibly by the physical contour and content as well as proximity of surrounding objects. Even when the most painstaking effort is made to avoid the difficulties just enumerated, the break-down point is so much affected by atmospheric conditions, readings from a point gap are unreliable.

3. There is no corona discharge between the spheres of a sphere gap if the spheres are of proper size. It seems to make little, if any difference, also, from what angle or in what method the spheres approach each other, because at given distances specific voltage pressures will break down air resistance and arc over. Numerous experiments prove that the given voltage for a specific sphere distance will not arc over if that distance be increased even so slightly as a couple of millimeters. In other words, when the voltage pressure is reached which will break down the air gap between spheres, the arc will occur, and not until then. The absence of corona discharge with its attendant destruction of air resistance seems to be the explanation of this apparent mechanical anomaly.



Consequently, it would seem that in The Victor Sphere Gap will be found the means of obliterating the single greatest obstacle which has prevented thus far the standardization of technique according to specific formulae. By cutting it into the high tension circuit absolute measurement of peak voltages is assured. At this juncture it is perhaps well to say that each sphere gap sold by The Victor Company will be calibrated to meet the altitude and mean atmospheric conditions in which it is to be used before it leaves the factory. This means, that there will be such accuracy of voltage measurement radiologists can exchange results accomplished in such specific terms as to make possible exact duplication of dosage and exposure.

Somewhat apart from the consideration of the appliance proper though so palpably associated with its use as to justify discussion here, is the fact that since specific formulae of dosage and exposure are conceded of primary concern in the standardization of therapeutic and radiographic technique, the suggestion is made that through the employment of The Victor Sphere Gap in a series of experiments leading Radiologists can set up elemental tables of voltage, time of exposure, kind and thickness of filter, port of exposure, number of ports, etc., covering various parts of the human body both for specific disease and for diagnostic and radiographic purposes. Such a compilation issued in permanent form would prove invaluable to technicians and go a long way toward making the results obtained by less experienced operators of more universal value.

These thoughts are inspired by the fact that in the same number of Victor Service Suggestions as contains the announcement of The Victor Sphere Gap appear a number of tables for calculating x-ray absorption. For the Radiologist sufficiently versed in higher physics to be able to work out computations quickly and accurately these tables contain valuable information. But they are so complicated their practical benefit for the average operator is extremely doubtful.

The Fischer Transformer

While not exactly new in the sense that it is unknown to the profession, still the Fischer Universal Interrupterless X-ray Transformer, Type 2-B, embodies some features which distinguish it.

This transformer is of the closed core, oil immersed type. It is equipped with a Spark Meter instead of

Spark Gap; large easily read milliampere meter; auto-transformer control; exceptionally quiet motor and rectifying wheel; large disc insulating device between the rectifying wheel proper and the motor frame preventing kick-back or break-down, and all switches are concealed. This transformer is guaranteed to deliver 60 M A at a 6-inch gap.

For the person desiring to buy a moderately priced transformer with many of the refinements of some of the more costly ones the Fischer Universal Unit will merit investigation.

Magnuson Plate Tunnel

A particularly serviceable device in the dental as well as the medical x-ray laboratory is the Magnuson Plate Tunnel, lately put on the market by the Magnuson X-ray Company with headquarters at Omaha and with branches at Denver, Des Moines and Kansas City.

The Tunnel in question is constructed with a veneer top with space for a cassette, and is mounted on adjustable legs which can be removed entirely if the operator cares to use the Tunnel for flat body work.

Chief among the advantages which commend this Tunnel to the consideration of the technician and the more critical type of medical radiologist, are:

1. The fact that in sinus work the standard 23 degree angle can be obtained in all cases by merely lowering the Tunnel on the short legs. Beside this the whole Tunnel can be raised or lowered to suit the comfort of every patient.

2. In radiographing the head, knee or foot laterally, especially if the patient be rotund, the adjustable features of the Tunnel enable the operator to accommodate it to the physical facts, assuring correct angle of exposure and proper plate position for good photographic results.

3. The Tunnel can also be used for stereoscopic radiographs.

4. It displaces the inelastic wooden block so familiar to all x-ray laboratories and which so frequently was not of exactly the right height or cut at the particular angle to answer the exigencies of the case in hand.

Without doubt this device should find a place in every laboratory because it has a wide range of utility and because the principle it involves can probably not be incorporated into table construction for anything near the universal service the separate tunnel will render.

Syphilis of the Lung. Wile and Marshall. Archives of Dermatology and Syphilology. July, 1921.

FREQUENCY

ACQUIRED pulmonary syphilis is exceedingly rare pathologically, and even more so clinically.

In congenital syphilis it is comparatively frequent in the form of the well-known white pneumonia.

An exhaustive review of the literature shows that pulmonary disease associated with syphilis, and possibly due to syphilis, was reported as early as the sixteenth century.

More accurate reports were made in the latter part of the eighteenth and early part of the nineteenth centuries. The first clear-cut anatomic description of pulmonary syphilis was made by Depaul in 1850. Virchow's description in 1858, under the name of white pneumonia, still stands as a classic monograph on the subject.

Shortly after the appearance of these early papers a large number of cases of pulmonary syphilis were reported, but it seems probable that they were for the most part those in which syphilis was merely coincident with tuberculosis, or that many were actual cases of tuberculosis wrongly diagnosed as syphilis. Carlier in 1882 was able to collect but twenty cases of undoubted lung syphilis studied at necropsy. Hiller could find but eight more cases in the following two years. Pancritius, however, in 1881, thought that it was a common condition and that many people died of it each year. Osler found twelve cases in 2,500 necropsies at Johns Hopkins Hospital. Downing found no cases in 3,000 post mortems at the Massachusetts General Hospital. Massia found only two cases in 6,000 necropsies in Copenhagen. The differences in the percentages of these men may be due to a difference of opinion as to the criteria of syphilitic involvement. Carrera reports changes in the lungs in twelve cases out of 152 necropsies in known syphilitics. Many other writers are mentioned as having found post mortem evidence of pulmonary syphilis.

DIFFICULTY OF RECOGNITION

The clinical picture of pulmonary syphilis is so difficult of recognition that no case can be absolutely accepted without a pathologic examination. It is an accepted fact that syphilis and tuberculosis do frequently occur in the same patient. The presence of either disease in the lung offers an admirable site for the implantation of the other. The pathological results of both diseases—fibrosis and cavitation in the lungs—give local and general symptoms indistinguishable one from the other.

There are, however, cases in which tuberculosis can be eliminated, and which recover completely under antisyphilitic treatment. About fifty such cases have been reported by competent observers, and must be accepted as most probably true pulmonary syphilis.

TYPES OF LUNG SYPHILIS

1. Isolated gumma.
2. Diffuse fibrosis.
3. Diffuse bronchopneumonia.

1. Syphilitic gummata of the lung are exceedingly rare. When found, are more frequently in middle or lower lobe of right lung. Clinical picture depends upon location and stage of process. The symptoms may be nil, or may be those of an advanced ulcerative phthisis, bronchiectasis, or resolving pneumonia.

2. The chronic fibroid changes are the most frequent. These may be due to the breaking down and absorption of small gummata. Thus the findings may depend upon the time the patient is studied, the fibroid condition being a late manifestation, as is the interstitial hepatitis found as a terminal picture in syphilis of the liver.

3. Syphilitic bronchopneumonia is a much disputed topic, and it is not yet agreed whether the symptoms are due to syphilis or to a secondary pneumonic process superimposed on a lung weakened by syphilis.

Chronic interstitial pneumonitis due to syphilis is the most common form of lung syphilis. This is, in fact, the end result of all syphilitic processes in the lung. It is in this form that symptoms are most frequently encountered. The pathology of the condition is a radiating fibrosis extending out from the hilum through the bronchi, and bands extending from the pleura into the lung substance. Associated with this are isolated fibroid masses throughout the lung substance. The fibrosis causes a lessening of the air capacity of the lung and a narrowing of the bronchi, thus giving rise to symptoms of dyspnea, to coughing and to vascular changes, leading to occasional hemoptysis. Milne reports two patients who showed no lung symptoms during life, but at autopsy extensive syphilitic fibrosis was found in both lower lobes.

PROGNOSIS

If seen early, prompt antisyphilitic treatment offers a fair prognosis. If extensive fibrosis and destruction have taken place, a marked improvement in the patient's general condition may be expected to follow intensive treatment, but little change can be expected in the signs or symptoms of the pulmonary condition.

Three case reports are given. The following is a typical review of an interesting case of chronic interstitial syphilitic pulmonitis.

History—A man, aged 37, entered the university hospital November 5, 1920, having been referred from the department of internal medicine for tabes dorsalis. His complaint was weakness and difficulty in walking. The family history had no bearing on his present illness. There was no family history of tuberculosis or other lung trouble. The patient had had a primary syphilitic sore eighteen years before, which he says was not followed by any secondary manifestations. He had not received any treatment for the condition. He had been married for eight years and had three living children. His wife had had one miscarriage three months ago at the end of the second month of pregnancy. One year previous to admission he had noticed that if he walked in the dark he staggered and had great difficulty in keeping his balance. This condition had been getting gradually worse during the last year. He had had occasional sharp shooting pains in the legs, also dating back one year. Ten days previous to admission he developed a cough and expectoration, some of which had been tinged with blood. There was no history of a definite hemophthisis. The patient had not lost weight noticeably, had not been short of breath, nor had he had night sweats.

Examination—He was poorly nourished and emaciated. He showed many of the classical signs of tabes dorsalis, having Argyll Robertson pupils, marked swaying in the Rhomberg position, absent knee and Achilles reflexes, and a typical ataxic gait. The chest, which particularly interests us, presented considerable retraction of the interspaces. On respiratory excursion there was a slight lagging of the right side. On percussion, there was marked dullness over the right apex and base in the back. The percussion note throughout the remaining part of the lungs was normal. On auscultation, the breath sounds, spoken and whispered voice were exaggerated over the right apex and upper lobe. The breath sounds, spoken and whispered voice, were of normal intensity throughout the remaining part of the lungs. There were a few scattered crackling and bubbling rales at both apexes, which were more marked in the right.

Roentgen Examination—The left lung shows nothing unusual. On the right side the apex is obscured by a rather thick, smoky shadow. From the third to the sixth rib, inclusive, there is a very heavy shadow of thickened pleura in which there are definite localized areas of pronounced fibrosis. From the fifth to the eighth rib, posteriorly, the lung is comparatively free. Below this there is a curious elevation superimposed upon the outline of the diaphragm with a conical shape which probably represents a consolidation. The lateral view shows this mass to lie anteriorly in the pleural angle. Its anterior end is of a high degree of density and cannot be distinguished from the upper surface of the diaphragm. Posteriorly and superiorly, it gradually fades into the surrounding lung substance and there appears to be a space of at least one inch between it and the anterior surface of the nearest vertebra behind.

A subsequent roentgen report is as follows: The density in the right side of the chest is unusually uniform and free from the irregularities in density and cavity formation and the dense localized sclerosis of tuberculosis. The impression is rather that of a diffuse interstitial thickening, with a wedge-shaped distribution. There is undoubtedly considerable cicatricial tissue in the pleura, as is shown by its thickening and by the reduction of the width of the interspaces. The pleura is also involved over the extreme apex. The mass in the lower lung is an exceedingly unusual picture in tuberculosis. It has a density almost uniform, not so great as that of the liver and not sharply circumscribed, but with a rather fringed border. There is comparatively little retraction of the mediastinum toward that side. The distinction between tuberculosis and syphilis cannot be sharply drawn on these findings. While the first impression is that of tuberculosis, syphilis might easily produce the same type of lesion and might so modify tuberculosis as to produce the unusual picture of this plate. The total absence of any suggestive sign in the left lung is also puzzling, since it is scarcely conceivable that so extensive a tuberculosis could occur without bilateral involvement.

Treatment and Results—Repeated examinations of this patient's sputum during his stay in the hospital were negative for tubercle bacilli. He received during his stay in the hospital five intravenous and four intraspinal injections. During this time he gained weight and showed continuous improvement. In addition to the increase in weight his cough diminished, and his general health was better than it had been for months past. A letter written to the patient four months after his discharge elicited the response from him that he is able to do light work, that he feels exceptionally well and is in every way improved.

Resume—In a patient with a well developed tabes there occurs the fairly acute onset of pulmonary disease associated with a rather massive infiltrate occupying the lower portion of the left lung. The afebrile nature of the condition, the extensive process and the absence of general reaction, the total absence of tubercle bacilli in repeated examinations of an abundant sputum, and the prompt amelioration under anti-syphilitic treatment, make this case a presumptive one of pulmonary syphilis.

J. J. SNIPES.

Tumors of the Bony Chest Wall. C. A. Hedblom, Rochester, Minnesota. Archives of Surgery, July, 1921, p. 56.

THE first recorded thoracotomy for tumor was reported by Osias in 1778. The literature since then contains comparatively few cases. This review, containing those in the literature and those found at the Mayo Clinic, numbers 213 cases. The pathologic classification shows—

Chondroma	40
Sarcoma	131
Carcinoma	24
Fibroma	5
Exostoses	3
Gumma	1
Uncertain	9
Total	213

Pain is the most characteristic symptom, present in 50 per cent of the cases. Loss of weight and dyspnoea were also noted.

Early diagnosis is more difficult than late. Cold abscess, exostosis, gumma, aneurysm and dermoid cyst must be differentiated.

The treatment is early radical extirpation. Roentgen examination to determine metastases is important. Inflammatory changes found at operation instead of supposed malignancy make the indication for operation more definite. In operating the pleura may be opened and pneumothorax produced. This causes shock in a few cases.

SUMMARY

1. Tumors of the bony chest are relatively common. In 213 cases the ribs were primarily involved in 78.7 per cent, and the sternum in 21.3 per cent.

2. Trauma seems to be etiologic in some cases, both with regard to incidence and to malignant degeneration of the benign forms.

3. Pain is the most characteristic symptom, and may be present in the case of a benign as well as a malignant tumor. Pain may be present before the tumor is recognized.

4. Early differential diagnosis of neoplasm and cold abscess, exostosis, aneurysm and dermoid cyst may be difficult. Pre-operative differentiation of a benign or a malignant neoplasm may be impossible.

5. Early, radical extirpation offers the best prospect of prolonging life and care. Late radical or palliative extirpation, even in the presence of extensive involvement, may result in a relatively long period of freedom from recurrence.

6. Early exploratory thoracotomy is indicated in any doubtful case.

7. Differential pressure anesthesia, while not essential to the successful removal of tumors involving wide opening of the chest, obviates the risk incident to sudden open pneumothorax, and by preventing a closed pneumothorax may lessen materially the occurrence of postoperative shock, pneumonia, and empyema.

8. Intrabronchial or intrapharyngeal insufflation anesthesia affords an effective means of preventing operative pneumothorax.

9. Shock, pneumonia and empyema are the common causes of postoperative deaths.

10. Recurrence has been the rule in most cases of malignant tumor, but there may be freedom from recurrence for many years, and life may be further prolonged by repeated extirpation of the growth.

E. W. ROWE.

Radical Surgery as an Aid to Efficient Radiotherapy in the Apparently Hopeless Cases of Carcinoma. By Emil G. Beck, Chicago. International Clinics, Vol. II, 31st Series, page 46.

SURGERY and radiotherapy, or a combination of both, have outlived all other methods of treating cancer, and stand today as the most efficacious measure for helping cancer. This discussion will be confined to those cases in which surgery is inadvisable or in which recurrence has taken place after one or more operations. Even in apparently hopeless cases something can often be done.

In the study of literature, clinical reports and observation one can clearly see that something can be done by radium and x-ray, applied scientifically. The use of radium is in its infancy, and some workers are more competent in its use than others. Distance and the presence of normal intermediary tissue are barriers to the effective use of radium and x-rays. Also filters screen out the most effective rays. "If skin, muscle and fat, and as much cancer tissue as possible could be removed, so as to leave only remnants of the growth, the radium or x-ray could be applied directly into the cancer bed with no obstruction to the activity of the rays." This is the keynote of the best treatment.

The best known theory of the action on cells by x-ray and radium is that the pathological cells are less resistant than the normal, hence are destroyed first. The author's own theory is that the cancer cells are wild cells, not given the protection of the body's nervous mechanism. The absence of some enzymes or protective substance or arrangement of the chromozone weakens the resistance of the cancer cell.

The author cites a few cases from a series of fifty that he has treated in his method outlined. The first was a sarcoma of the lung. After a two-step operation radium was implanted in the cavity made by an excavation of the tumor mass, which was more or less encapsulated. Four weeks after operation stereoroentgenograms revealed only a small remnant of the tumor mass, and the tumor wall very thin. In all, six applications of radium (2,625 mgr. hours) were applied over a time consisting of about three months. Microscopic section shows a spindle-cell sarcoma. The general improvement has been remarkable. The case will be reported again in one year.

The next case is a malignant ovarian cyst. Exploratory operation confirmed the diagnosis. It continued to grow larger in spite of six months of x-ray treatment. Another operation was performed and as much of the cyst and contents as possible were removed. The interior of the cyst was then treated by direct application of radium at intervals of three weeks, 700 to 1,000 mgr. hours being given each time. The radium treatment was supplemented with deep x-ray therapy, one erythema dose being given every second day. The cavity continued to shrink and closed in sixteen weeks. It is now eighteen months since the operation and the woman is well, doing her own work. "(a) By eversion of the interior of a malignant cyst, we transferred an intra-abdominal into an extra-abdominal tumor, and thus are able to apply x-ray and radium directly into the seat of malignancy. (b) It is safer to treat the tumor in this manner than to attempt complete enucleation. (c) It is better to treat with radium combined with x-ray than with either alone."

Other interesting cases are cited of treatment given in the same general manner.

Conclusions cannot be drawn from this series alone, and several more years must pass before the ultimate value can be determined. The treatment is radical and the mortality has been heavy. Four cases died of hemorrhage due to ulceration of the arteries. Four died as a result of roentgen ray toxemia. Some of the cases have gone over the one-year test. The results are at least encouraging.

E. W. ROWE.

A Few Notes on the Diagnosis and Differential Diagnosis in Bones and Joints. By G. Forssell. Archives Radiology and Electrotherapy, 1921, XXV, 247.

THE author sets his task to be a resume of the important features in typical roentgenograms of tuberculosis of the bones and joints. In addition he discusses more fully the differential diagnosis and of this and other diseases of the same parts.

Tuberculosis of bone and joints is distinguished by the localization of the bone foci in the epiphyses, by destruction of bone and the absence of bone production, by the punched-out character of the focus, by the atrophy of the surrounding bone, the reduction of the articular cartilages, the erosion of bone and cartilaginous surfaces, condensation and thickening of the articular capsule, and the presence of abscess shadows.

No one sign is pathonomonic, but when all are taken together the picture is very definite and diagnostic.

Koehler's, Perthe's and Schlatter's diseases are differentiated, followed by other conditions such as osteochondritis dessicans, chronic traumatic arthritis, Ricket's and Barlow's disease, and syphilis. The last may be the most difficult to rule out. But usually syphilis of the bone shows bone proliferation or periosteal changes that are sufficient to distinguish it.

The points present are accurate and characteristic. If a mistake occurs it is due to faulty interpretation. Technique that is good, experience and minute study, are the most essential points in making a diagnosis. The picture must be taken as a whole after close study.

E. W. ROWE.

The X-Ray in the Diagnosis of Prostatism. H. M. Johnson. Surgery, Gynecology and Obstetrics, Vol. XXXII., P. 179.

GLANDULAR enlargement of the prostrate causes obstruction in the bladder neck. The difficulties in urination produced are called prostatism. The author finds the routine use of roentgen rays a benefit in the examination. Three plates are exposed. The first roentgenogram shows the presence or absence of calculi. The second shows the bladder filled with air and the outline of the prostate and any other abnormalities in form or size. A third roentgenogram is made after the bladder has been injected with ten per cent sodium iodide or bromide solution. Diverticuli and the bladder outline, as well as ureteral forms, are readily discerned.

This method is to be used in conjunction with other methods commonly employed.

E. W. ROWE.

Treatment of Furunculosis in Infants. Clifford G. Grulee and Cassie Belle Rose, Chicago. Journal Am. Med. Assn., July 2, 1921.

EIGHT cases of furunculosis are reported with the following comments. The lesions vary in intensity. The general impression of the success in this form of treatment is favorable. The number of cases treated is too small to draw definite conclusions. Soft rays and no filters are preferred. When the furuncles are in the early stage and not very deep, the local results have been favorable. They have not done away with surgical procedures in all. Some did not need incision. In cases with extensive furunculosis the results have been most gratifying.

E. W. ROWE.

Melano-Epithelioma. Garden B. New and French K. Hausel, Rochester, Minnesota. Jour. A. M. A., July 2, 1921.

ONLY twenty-four cases of melano-epithelioma primary in the palate are recorded in lierature. One more is added in this report. The nomenclature and literature are briefly stated, and the known theories of etiology discussed.

All the patients complained only of a tumor on the palate. Glands in the neck and obstruction were mentioned only when the cases were advanced. In fourteen cases the cervical glands were involved on the first examination. Duration was one month to four and one-half years. Seven cases were women and eighteen were men. The youngest was 24 and the oldest 80. The average age was 54.

The diagnosis is usually simple. There is a rapidly growing, pigmented, nodular peduncled tumor, usually soft and vascular. The glands in the neck metastasize early. Certain blood dyscrasies and metallic poisons may simulate.

They are the most malignant type of neoplasm. Seventeen of the twenty-five cases were operated upon. The case of this report was cauterized and radium applied. The glands of the neck are not removed by bloc dissection.

Surgery and radium are usually futile, although the exact outcome cannot yet be determined.

E. W. ROWE.

Radium Emanations in the Treatment of Goiter. Wallace I. Terry, San Francisco. Jour. A. M. A., June 25, 1921.

ON August 16, 1920, the first case of exophthalmic goiter was treated in the University of California by emanations. Eight tubes of radium emanations, representing ten millicuries, were inserted into the thyroid gland. Since then he has used six or seven millicuries.

The needles are introduced through a small spinal-puncture needle. Local anaesthesia is used. The emanations are expected to inactivate the thyroid gland.

Of eleven patients, four were considered sufficiently improved, after a lapse of from four to ten weeks for partial lobectomies. One patient died following a partial bilateral lobectomy. The other seven patients show improvement and are still under observation.

This is a preliminary report.

E. W. ROWE.

Radium Treatment for Cancer of the Esophagus. A. E. Rockey, Portland, Oregon. Jour. A. M. A., July 2, 1921.

WHILE advancement in surgery of the gastro-intestinal tract for cancer has been gratifying in the esophagus, it has made but little progress. It is thought to be more prevalent than recorded. In 1917 five persons were left with gastrotomy tubes in place for feeding to prevent early death from cancer of the esophagus. After returning from the service all were dead. There are now three cases under consideration. These are being treated by radium. One appears to be successfully treated.

Timely diagnosis permits the exact location of the radium in the lumen of the esophagus at the point of the cancer. The Sippy method is employed where the lumen has almost closed. In this method a string is swallowed. Over the string a piano wire is introduced. Over this is passed another piano wire to which is attached a rubber catheter containing the radium. The radium is thus located in the affected lumen. The exact technique is carefully described. Confirmation of position may be made by roentgen examination. Coöperation between the surgeon and roentgenologist is necessary.

E. W. ROWE.

A Treatment of Gastric Ulcer Based Upon Modern Clinical, Histopathological and Physiological Investigations. Frank Smithies, Chicago. International Jour. of Gastro-Enterology.

TREATMENT of peptic ulcer has been largely based on empiricism. It should be based more on the fundamental principle.

The problem: From the clinical viewpoint there are many well known characteristics. It may occur without manifestation. Eighty-four per cent of the cases show periodicity, recovery and relapse. Little prophecy can be made of the future. Cessation of distress does not mean a cure.

The pathology: Even extreme chronic changes cannot always be foretold. Stenoses, hemorrhage, malignancy and involvement of extragastric organs may follow with slight warning. It rarely occurs in persons not already suffering from other abnormalities, infections about the head or inflammation of appendix, gall bladder and pelvic structures.

Summary of Etiological Factors

	No. Cases	Per Cent
1. Infections (chronic and acute)	173	33.1
2. Arteriosclerosis (with 56 cases; without, 21)	77	14.7
3. Visceral hypertonia	68	13.0
4. Chronic anemia	61	11.3
5. Syphilis	41	7.8
6. Visceral hypotonia	27	5.2
7. Postoperative	27	5.2
8. Industrial intoxication	22	4.2
9. Metabolic dysfunction (throid, etc.)	18	3.4
10. Trauma	8	1.5

A single cause for ulcer is obviously impossible to find. There is no basis that ulcer is a distinct disease entity. It may be considered a local accident in a systemic upset. The course depends on the underlying systemic causes.

Ulcers occur in that portion of the stomach of greatest circulatory, muscular and nervous activity. Four-fifths occur in the pylorus, along the lesser curvature and in the antrum, away from the acid-bearing portion.

Physiological changes are not as extreme as many suppose. In 40 per cent of 500 cases the free hydrochloric concentration did not run above 25 per cent. In 35 per cent it was in the normal range. In the remaining 40 per cent it was reduced or absent. The primary damage cannot be done by concentrated acid in the gastric juices. This must influence profoundly the chemical foundation of the treatment. It has been thought that there is a hypersecretion of acid, and this must be neutralized by alkales. Again, pain is not present at the height of gastric acidity. More acid does not increase it. It is relieved as much by lavage and other means as by alkalies.

Recent studies by Cannon, his pupils and others have shown the importance of the motor function of the stomach. Upon this factor rests the rational treatment.

Gastric secretion and gastric emptying are greatly influenced by the kind of food injected. Water and normal salt diminish motor activity and acid secretion. Carbohydrates leave the stomach quickly because they do not unite with the acids, hence the acid control of the pylorus is accentuated. Alkaline solutions retard the emptying. Proteids leave the stomach slowly because they combine with the acids. These facts are given in detail. They are well known and well established and furnish the basis for treatment.

Before starting treatment the etiological factors must be sought for and remedied. Focal infections must be most thoroughly searched out.

Ulcers with much scarring and deformity are surgical unless luetic. Frequent hemorrhage, prolonged pain, perforation, or the danger of malignancy require surgery.

The roentgen demonstration of caloused ulcer exceeding 2 c. m. diameter, when associated with a history of frequently recurring ulcer symptoms and positive tests for blood constantly determined in stools, forms a clinical hint that malignancy can be expected. Callous, recurring ulcers in the pylorus should be operated. Excision if possible, infolding or cautery puncture, without gastrojejunostomy, yields the most satisfactory results. In non-obstructing ulcers gastrojejunostomy should always be accompanied by permanent pyloric closure. Gastroenterostomy properly performed acts by aiding gastric emptying by diminution of free hydrochloric acid, and by permitting limited jejunal regurgitation into the stomach.

Successful medical treatment requires the proper selection of cases by the elimination of those just mentioned.

Outline of Author's Method of Non-Surgical Treatment.

1. Rest in bed.
2. Physiologic rest to the stomach itself.
3. Local applications to the abdomen.

4. Keeping the stomach empty of food.

5. Rectal feeding.

6. When mouth feeding is begun, small quantities of food in liquid form every hour, and a corbohydrate diet, is the plan. Milk is not used. It clots and causes gastric irritation.

7. Limitation of over-production of gastric acid. Alkalies are not used. Alkalinization is harmful. Lavage increases the motor activity.

8. Medical treatment: Medicines are administered to counteract discomfort due to (a) painful gastrospasms, (b) accumulations of overacid gastric contents associated with peristaltit unrest, (c) pain associated with perforation or ulcer progression. The remedies thus indicated are paraffin, chewing wax, astropin, belladonna or bromides, and at times orthoform. For over-acid secretions, milk of magnesia or calcined magnesia. Gastric lavage is very rarely performed with Carlsbad salts.

9. Hemorrhage: Rest in bed; no food; transfusion; horse serum, coagulose. Surgical intervention very early.

10. Bowels: Soapsuds enema. Later Carlsbad salts; phosphate of soda; liquid paraffin.

11. Lues: Specific therapy. Focal infections; autogenous vaccine.

12. Anemic patients: Iron and arsenic in full doses.

E. W. ROWE.

Correlation of Results of Treatment of Goitre by Surgical and X-Ray Methods. Geo. H. Bingham and G. E. Richards. Toronto General Hospital. Can. Med. Ass'n. Jour. P. 988. Nov., 1920.

THREE hundred cases of goitre, reported as treated by x-rays, gave results of such value that the surgeon should look upon x-ray treatment in the same light as a two-stage operation.

For purposes of classification goitre are divided into:

1. Simple Colloid Goitre. Ninety per cent of the cases in this class were cured.

2. Adenomatous Goitre, including all cystic types not complicated by toxic symptoms. Purely adenomatous and purely cystic goitre do not respond well to x-ray treatment, and their treatment should be entirely surgical.

3. Toxic Goitre. This includes the hyperplastic types and the degenerating adencmata. It is in the exacerbation stage of acute toxic thyroid, when toxicity must be arrested, before operation can be done, that x-ray has had brilliant results. It should always be used before surgery. In many cases subsequent surgery will not be necessary, or if deemed advisable, in many cases for cosmetic results only.

Of the toxic type 50 per cent were cured by x-ray alone; about 30 per cent were improved, but the improvement stopped short cf complete cure; 5 per cent showed no improvement. Of the cases showing improvement only, the alleviation of symptoms abcut equalled that following ligation of the superior thyroid arteries. The sequence of relief of symptoms proceeded about as follows: Nervousness and irritability, tremor, tachycardia, weight, goitre, exophthalmos.

L. J. CARTER.

The Diagnostic Value of the X-Ray Examination in Pulmonary Tuberculosis. W. A. Wilkins. The Montreal General Hospital. Canadian Medical Association Journal, P. 999. Nov., 1920.

COLLABORATION with the clinician is emphasized, although the diagnosis of pulmonary tuberculosis from the plate alone is generally possible. In many cases the stereoscopic plates or films well give evidence of pulmonary changes before physical signs can be detected.

The presence of pulmonary tuberculosis will be evidenced by shadow changes on the x-ray plate. The earliest sign is the appearance in the periphery of a faint cloudy fan-shaped shadow with apex toward the hilus, the ribs of the fan being formed by the thickened bronchial and lmyphatic shadows. Later these bronchial ramifications become beaded and accentuated. Further advance shows fine mottling in the shadow areas. Later this mottling becomes coarser and extends to new areas. The hilus shadows enlarge early, soon lose their identity, and become merged into the general mottling. Breaking down in the mottled areas results in cavity formation.

Healing may take place without any permanent record of the invasion. But generally the shadows do not entirely disappear. Usually there are left small, dense, more or less circular shadows with clearly defined margins, shown chiefly at the apex or middle third or hilus. There may be heavy linear shadows corresponding to the region of interlobar fissures. Healed lesions give clear cut shadows, in contrast with the blurred shadows produced by active lesions.

L. J. CARTER.

In What Cases Do Uterine Fibroids Still Require Operative Removal? Fred J. Taussig, M. D., St. Louis. Jr. A. M. A., Vol. 77, No. 5.

ONE hundred and twenty-three patients with uterine fibroids were treated, of which eighty-seven were operated and thirty-six were treated by radium. The radium dosage ranged from 800 to 1,750 mg. hours, with an average of 1,250 mg. hours. Usually 75 mg. were applied within the uterus in silver and brass for about sixteen hours.

Contraindications to radiotherapy were, first, fibroids over 12 cm. in diameter; second, submucous fibroids protruding through the cervix, pedunculated and intra-ligamentos fibroids; third, rapidly growing calcified or necrotic fibroids, and those complicated with malignancy; fourth, pyosalpinx and ovarin cysts.

The author lays stress on careful diagnosis before radiotherapy is given. He prefers radium to the x-ray although admitting no personal experience with the latter.

Fibroids are nine times as frequent in the colored race as in the white, which he attributes in part to the greater frequency of gonorrheal infection and also to their earlier appearance and more rapid growth.

The cases suitable for radiotherapy have an age incidence of forty-two and one-half years. He quotes the literature to show a percentage of 95.5% cures in 1,099 cases of fibroids.

V. M. MOORE, M. D.

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The Roentgenologic Aspect of Pulmonary Metastasis

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IN 1916 Moore and I published a paper concerning pulmonary metastatic malignancy based on the study of seventy-one cases. Since then our material has been increased by 196 additional cases, and I have reviewed these in order to determine whether the amplified statistics sustain our original conclusions and whether any additional facts of interest could be elicited.

Without going into tiresome details it may be said that the enlarged series tends to confirm our former conclusions, that (1) pulmonary metastatic malignancy may occur regardless of the seat of the primary focus, (2) it bears no relationship to the extent or duration of the primary disease, (3) it can be discovered in many instances only by the roentgen examination, and (4) the character of the primary growth cannot be predicted from the roentgenogram.

McCallum has cited Virchow's dictum that in those organs in which tumors are commonly primary, metastasis seldom occurs, while primary growths are rare in situations which seem to form the best soil for secondary growths. This principle is particularly applicable to the liver, but applies also to the lungs, in which primary malignancy is quite infrequent and secondary malignancy relatively common. Among recent contributions to the subject have been those of Pfahler, Holt and Ratterman, Weil, and Funk. Pfahler, in 216 cases of pulmonary malignancy, found metastatic carcinoma in 196 and metastatic sarcoma in eleven. Of the 196 cases of metastatic carcinoma there were 150 of mediastinal and hilus involvement, twelve were pleural, thirty-four were of the nodular type, and ten of the miliary type. Holt and Ratterman reported a case of metastatic sarcoma, nodular type, proved by necropsy. Weil's case of miliary metastasis, proved at necropsy, was roentgenologically diagnosed miliary tuberculosis. Three of Funk's cases were secondary; two were carcinoma, and one sarcoma.

Table I shows the location and character of the primary lesion with pulmonary metastasis in cases observed at the Mayo Clinic during the last five years. Only cases that can be regarded strictly pulmonary have been included in this series; cases of obviously pleural metastasis and of mediastinal metastasis with apparent projection into the pulmonary hilus have purposely been omitted.

TABLE 1.

Primary Focus.

Breast	37
Kidney	18
Thyroid	17
Lower extremities	17
Upper extremities	12
Testicle	10
Abdomen	9
Stomach	7
Colon	7
Not found	7
Neck	6
Mediastinum	5
Biliary tract	4
Rectum	4
Pelvis	4
Esophagus	3
Chest wall	3

Foot, bladder, prostate, larynx, anal region, back, and lung* each two. Lip, tongue, eye, parotid, brain, jaw, ovary, uterus, vulva, and buttock, each one.

*Metastatic to the other lung.

Character of Primary Tumor.

Carcinoma	114
Sarcoma	44
Hypernephroma	15
Not stated	10
Lymphosarcoma	5
Teratoma	3
Epithelioma	3
Glioma	1
Endothelioma	1

That the clinical manifestations of pulmonary metastasis are very indefinite is strikingly verified by these cases. In 60 per cent respiratory symptoms were either absent, insufficient to justify mention, or of trivial import. With few exceptions, when pulmonary symptoms were present they were not in proportion to the extent of metastatic invasion. Metastasis from malignancy of the thyroid was, of course, among the chief exceptions. Cough was the most common symptom noted. It was usually dry and hacking, and at first unproductive, although in the later stages in some instances there was a frothy, mucoid, or mucopurulent sputum. Hemoptysis was noted in only a very few cases, pain was not a common symptom in uncomplicated cases, elevation of temperature was rare, and none of the patients gave a history of night sweats. There was also a relative paucity of physical signs unless pleural effusion was present. Save for anemic pallor the general physical appearance of these patients was good, and loss of weight, unless the nutritive functions were implicated, was not a constant and notable feature. Eight had gained in weight, and twenty-five had lost less than 10 pounds. Ninety-five patients had an average weight loss of 22 pounds.

This recapitulation corroborates the view previously expressed that the clinical picture of metastasis in the lungs is inadequate for diagnosis in the majority of cases. Without regard to the location of the primary lesion a roentgen examination of the lungs should always be made,

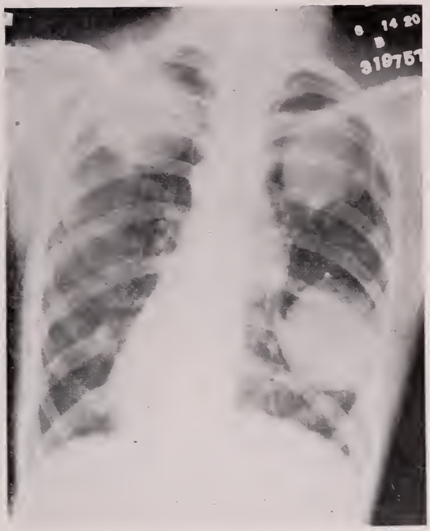

Fig. 1—(319757)—Nodular type of metastasis.

particularly in those cases in which operative removal of the primary growth is intended.

Most text books of pathology describe metastatic growths as nodular only. However, roentgenologic experience has demonstrated that there are three types, nodular, miliary, and infiltrative. Dr. H. E. Robertson, professor of pathology in the University of Minnesota, states that our roentgen classification and is also justified from a pathologic standpoint With high pulmonary resistance and low virulence of the cancer the nodules are relatively large but few in number; under contrary conditions the lesions are relatively small and the number is vastly increased. The difference is visible roentgenologically antemortem and macroscopically postmortem.

The nodular type of metastasis which is by far the most common, is ordinarily marked by round, dense, homogenous areas varying from 0.5 cm. to 6 cm. or 7 cm. in diameter. The borders of the nodules are usually sharply circumscribed, without the hazy zone characteristic of an inflammatory process. Nodules are most often multiple, involving the middle and lower lobes, the apices being quite clear (Fig. 1). While they may be large, it is unusual for them to attain great size without the appearance of other areas; this is a valuable point in distinguishing them from benign lesions. They usually invade both lungs and their multiplicity is also a distinguishing feature. In the cases in this series, when one lung only was affected, the right was involved

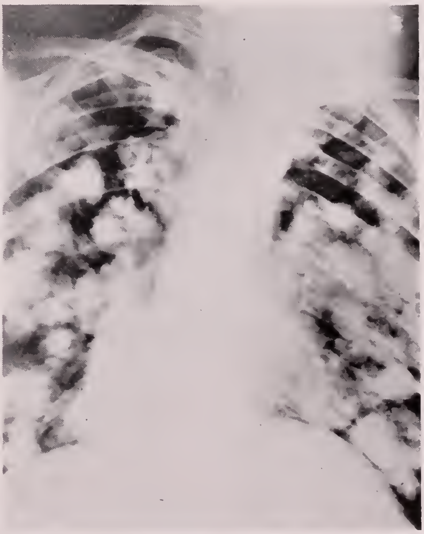

Fig. 2—(149223)—Metastasis nodules with feathery irregular borders.

three times as often as the left. While most nodules are circumscribed, they may rarely have a feathery or irregular outline due to the lessened resistance of the lung tissue and the greater virulence of the cancer. Microscopically, the periphery of this type of nodule presents an irregular appearance similar to the infiltrating borders of a primary growth (Fig. 2). Aside from the foregoing exceptions, the distinctive characteristics of the nodular type are the large size, the sharply outlined borders, the multiplicity of nodules, and the involvement of both lungs.

The miliary type of metastasis is marked by a shower of innumerable, round or slightly irregular, small, discrete areas of increased density, varying in size from 4 mm. or 5 mm. to 1 cm., depending on the stage of development. While they are mostly discrete, the overlapping of their shadows may cause a conglomerate appearance. However, it must be borne in mind that the areas grow by peripheral extension and that their confluency is merely accidental. The borders of the individual masses appear to be vaguely delimited from the surrounding parenchyma of the lungs, but stereoscopic examination shows that this appearance is due to the superimposed shadows of the numerous areas. The lesions are often fairly uniformly distributed throughout the lung fields, although in many of our cases the middle and lower lobes were more extensively involved (Fig. 3).

The infiltrative type has been described by roentgenologists who have observed it as an infiltration extending from the hilus along the bronchial markings. No instances of this type were noted in our series. From the description given it would require careful differentiation from metastasis to the mediastinal glands, primary carcinoma originating in the bronchus or mediastinum, pleural metastasis, Hodgkin's disease, syphilis, and various other hilar and mediastinal processes. Pathologists familiar with postmortem study whom I have consulted state that my failure to observe any instance is easy to

Fig. 3—(248250)—Miliary types of metastasis.

understand as the type is exceedingly rare.

Typical cases of either the nodular or miliary type are so striking that they require no elaborate differentiation from other pulmonary lesions. Early and atypical cases may, however, necessitate careful consideration as differential points cannot be described with precision.

Malignant metastasis confined to the pleura without effusion may give a roentgenologic picture so much like that of metastasis in the parenchyma of the lung that it cannot always be distinguished even by the scrutiny of stereoscopic plates. When fluid is present the pleura is usually thickened, and the whole picture is obscure.

Lesions which, in varying degree, simulate the nodular type of metastasis include cysts, abscesses, interlobar effusions, Hodgkin's disease, calcium metastasis, and syphilis.

Hydatid, or echinococcus cysts are nearly always single and occur most often in the right lower lobe, being secondary to cysts of the liver and gaining entrance through the diaphragm. An unruptured cyst presents a dense, round, sharply outlined shadow. After rupture and partial drainage, it may resemble a ring with a translucent center or a cavity partly filled with fluid.

Practically all of our cases of pulmonary abscess show the hazy border characteristic of inflammatory processes and are irregular in shape. In one of our cases of abscess of the lung, confirmed at necrospy, the roentgenogram revealed a single dense area, irregular in outline and so large that the absence of other densities practically excluded malignant metastasis if the existence of the latter was considered at all.

Often interlobar effusions have a wedge-like form with one or more curved borders. An instance of interlobar effusion displayed a well rounded opacity between the right middle and lower lobes (Fig. 4). There were no accompanying lesions except a large calcified gland in the left hilum whose character was evi-

Fig. 4—(142964)—Interlobar effusion. The round shadow is much like that of the individual metastastic nodules in Figure 1, but a metastatic nodule of this size would be accompanied by others.

dent, and malignant metastasis was not even momentarily considered.

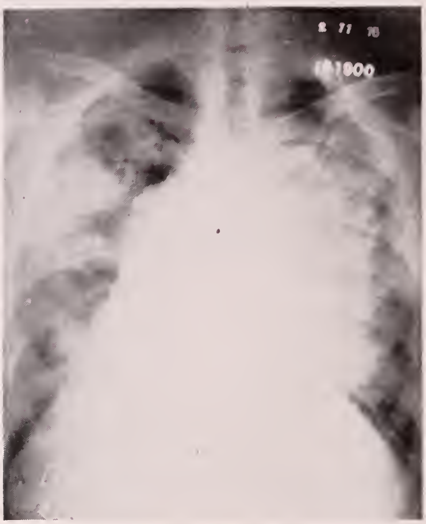

Fig. 5—(151900)—Syphilis of the lung. Fan-like infiltration, more marked on the right. Confirmation of diagnosis at necropsy.

Syphilis of the lung is usually listed among the possible roentgenographic simulants of pulmonary cancer. In one case, proved at necropsy, large patchy fan-like infiltrations, irregular in shape and density, and quite unlike pulmonary cancer, either primary or metastatic, were found in both lungs. Another case, clinically syphilis, was also of the pneumonic type (Fig. 5). A third case presented a large gummatous mass projecting into the hilar region. Association of pulmonary findings with mediastinal and cardiovascular changes shadowed in the roentgenogram should arouse suspicion of syphilis, and a positive Wassermann reaction will be reasonably convincing.

While the thoracic manifestations of Hodgkin's disease are commonly limited to the mediastinum, in exceptional instances the lung itself may also be invaded and the pulmonary lesions, as seen radiographically, exactly resemble those of malignant metastasis (Fig. 6). Various pathologists have recently been inclined to classify Hodgkin's disease with the lymphosarcomas, and if this becomes the established view any attempt to distinguish them roentgenologically would be superflous. One of our cases in which there were typical nodules in the lungs, could not be

Fig. 6—(250092)—Hodgkin's disease. Infiltration extending from the right hilus. Diagnosis proved by biopsy.

distinguished roentgenologically or grossly at necropsy from those due to other malignancies (Fig. 7).

Fig. 7—(332343)—Nodules in the lung in a case of Hodgkin's disease.

The "calcium metastasis" of Virchow which has been fully described by Harbitz, and more briefly by Crane, is, of course, not a malignant process, despite its somewhat suggestive appellation, and in the roentgenogram bears little likeness to pulmonary malignancy. The shadows are smaller than carcinomatous nodules, are often sparse, and their density makes their calcareous nature evident (Fig. 8). We have many examples of this type of metastasis in our plate files.

The differential diagnosis of the miliary variety of metastasis is much more difficult than the identification of the nodular type. Fortunately, the miliary type is far less frequent than the nodular. Simulants from which it should be distinguished are the miliary type of tuberculosis and pneumonoconiosis.

In acute miliary tuberculosis the lesions are more numerous, smaller, and less dense than in miliary metastasis; if the miliary tubercles are associated with chronic tuberculosis the shadows are likely to be more dense because of a deposit of mineral matter in the central necrotic zone. Tubercles grow by forming conglomerate masses and are therefore irregular in outline and tend to cavity formation (Fig. 9). In metastasis the growth is by uniform peripheral extension, producing a regular outline. In tuberculosis the tubercles are distributed most thickly in the upper and middle portions of the lung, leaving the bases relatively

Fig. 8—(224531)—Calcium metastasis.

Fig. 9—(316447)—Miliary type of pulmonary tuberculosis.

clear, whereas the areas of metastasis are often most numerous in the lower two-thirds of the lung and the bases are clouded with them.

The differential diagnosis of metastasis from pneumonoconiosis is seldom difficult. Pancoast, Miller and Landis, have noted three stages in the development of pneumonoconiosis; (1) increase of hilar and trunk shadows and prominence of the linear markings; (2) mottling throughout the lung structure involving especially the middle portion opposite the hilus, and (3) diffuse, dense fibrosis resembling consolidation. Malignant metastasis is not easily confused with either the first or the third stages of pneumonoconiosis, and in the second stage the smaller size and greater number of the mottled shadows, as well as their principal distribution in the middle portion of the lungs distinguish them rather definitely from miliary metastasis (Fig. 10). The most common mistake is the diagnosis of tuberculosis in cases of miliary metastasis. This may be explained by the comparative frequency of the former. Furthermore, some of our apparent errors may be merely incomplete diagnoses (Table 2).

The credit for teaching that tuberculosis and cancer are incompatible has been given to Rokitansky. Broders, however, has interpreted Rokitansky's teaching to mean an antagonism rather than an incompatibility; he gives an extensive bibliography of observers who have noted the coexistence of the two conditions, and cites 236 cases

Fig. 10—(321973)—Pneumoconiosis.

TABLE II.—DIFFERENTIAL DIAGNOSIS

	SIZE	DISTRIBUTION	APPEARANCE
Nodular metastasis	0.5 to 6 or 7 cm.	Both lungs. Most common in right lung.	Usually large. Dense homogeneous areas. Borders sharply circumscribed.
Miliary metastasis	4 or 5 mm. to 1 cm.	Uniform throughout the lungs with most involvement in the middle and lower lobes. Growth is by peripheral extension.	Innumerable round, slightly irregular discrete areas of increased density. Areas are larger, denser and less numerous than those in **acute** miliary tuberculosis. Areas are likely to be less dense and less confluent than the tubercles seen in chronic tuberculosis.
Miliary tuberculosis	Tubercles smaller than metastatic nodules.	Upper and middle lobes are most frequently involved. Bases are usually clear.	1. **Acute miliary tuberculosis:** Areas smaller, less dense and more numerous than in miliary metastasis. 2. **Chronic tuberculosis:** The tubercles tend to form masses, irregular in outline and denser in appearance than the areas in metastasis. Marked tendency to cavity formation.
Pneumonoconiosis (Special stage only)	Areas smaller than in metastasis.	The middle portion of the lungs is mostly involved.	The areas of mottling are less dense and more numerous than in metastasis.

of concurrence in various organs, adding twenty cases of his own in which both pathologic processes could be demonstrated microscopically in the cervical and axillary lymph glands. Concurrence of pulmonary tuberculosis and metastasis was suspected in several of our cases, and proved at necropsy in one. When such association exists, roentgen differentiation may be very difficult as one lesion may destroy the characteristics of the other, or only the predominating lesion may be recognized.

Differential indicia derived from our own observations are not advanced as being pathognomonic. It must freely be conceded that atypical cases of pneumonoconiosis, miliary tuberculosis, and miliary metastasis may easily be confounded even by an experienced observer. It follows, therefore, that the roentgenologist should be informed with regard to the age, sex, and occupation of the patient, and the presence or absence of a primary focus to correlate with the roentgen findings, or the correlation should be made in conference with the clinician.

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A Symposium of Observations on Radiotherapy

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MUCH has been written, and vastly more has been said, concerning the more recent methods that have been evolved in Germany in Radiotherapy, more particularly in the treatment of malignancy, but inasmuch as a personal visit to these centres aids one in conceiving the modus operandi, a short resume of these observations may prove of interest, so that I will try to cover the field as completely as is possible.

To get down to actual observations, inasmuch as I feel that you are desirous of something that is not too lengthy, I will hurriedly pass over the part that is probably better known to you; that is, the work of America and England—but in passing may I be allowed to state that in my opinion the diagnostic "work" on this side of the water is superior to the majority of similar work that I chanced to observe across the pond. The same applies to apparatus, and so much is this the case that it is really difficult to conceive how or why men who are so fully conversant with the physics and the practice of Radiology, should be plodding along with mediocre appliances, and in quarters that are not only inadequate, but in many instances actually unhygienic, but I suppose one must allow that more credit is due them for the excellent quality of their work on this account. Then, again, one must remember that it was on this very apparatus that so many of the principles of today were elaborated.

It was rather pleasing to find that the largest x-ray clinic that I visited anywhere was at home in Canada, at the Toronto General Hospital, under the direction of Doctor G. E. Richards. (*) There is one item in this department that I believe should be brought to the notice of the Society, and that is a "Gastro-Intestinal" table, designed by the Director of the Department, which combines all the advantages of the Cole Table and in addition to this allows for Fluoroscopic observations and palpation, which appears to me a very desirable, even essential, thing.

However, as the point of real interest today appears to centre in the work of Europe, more par-

*—I understand from the Rockefeller Report that it is second to Mayo Clinic.

ticularly that of Germany, I will confine the balance of my remarks to what was seen there.

We have all been rather astounded, as well as interested, to learn of the heroic measures that are claimed to prevail in the administration of Radiotherapy in Germany. Their methods of treatment differ in many respects from our procedure here. Not only is the penetration claimed to be greater, but so also is the filtration, the target-skin distance, and, consequently, the time is considerably in excess of the time that I found common in America.

But probably the best way to review it in an orderly fashion would be to begin with the apparatus.

Various men are using different types of apparatus, but the principle of all appears alike. These types consist of two coils with the primaries and secondaries in series. The line leads directly through a resistance into the primary of one coil, then through an interrupter, and on with the primary of the second coil, through the balance of the resistance, and so completes the circuit on the primary side. The secondary windings are connected in series through a vacuum valve which "holds up" the increasing potential until the pent-up energy bursts through as a very high and consequently almost constant voltage, which is said to be about 200 to 400 Kv. This is the working of the Symmetrie-Instrumentarium, manufactured by Reiniger, Gebbart and Schall of Erlangen, and used almost exclusively in the Frauen Klinik of Seitz and Wintz in this place. An instrument practically identical in construction, appearance, and in the claim of the manufacturers is the one made now by Schall of London, in use at the present time at the West London Hospital.

There are other models which have been developed to meet the requirements for a higher penetration. Principally among these others are the Dessauer and the Veifa Reform. Any of these are, I am told, capable of developing and delivering continuously a current of 3 Ma. at 240 Kv., and are essentially alike. Some of them are constructed to operate a single tube; others twin tubes, while still others will operate four tubes at the same time, holding this terrific potential at each of the four tubes.

What appears to be a most recent refinement, however, is an installation which is entirely separated from the patient by a lead wall and the tube is enclosed in a grounded lead compartment, which of course, is fixed. The patient is adjusted to the tube, rather than the tube to the patient. Because of the fact that all the wires are enclosed within one lead-lined chamber, which is grounded, the danger of high tension wires is completely eliminated, and, further, it is not necessary to increase the discomfort of the patient by submerging him under the heavy lead rubber protective that we use here. Sir Robert Knox in discussing this particular contrivance, expressed his approval and suggested that the armentarium of the Radiologist of the future would consist entirely of this type of appliance, but with a mechanical contrivance which causes the tube in operation to travel in a circle while accurately directing the beam to the growth.

There seems to be some dispute as to what the kilo-voltage they are using actually is. I may say that they are measuring it between fairly sharp points, with a maximum separation of 40 Cm. Incidentally, I think a factor which should be taken into consideration with reference to this measurement, is the fact that the breaking across this gap of 40 Cm. is in a room where there are several machines in operation and have been for hours, so that the air is vitiated to a degree that it can no longer be called normal atmosphere, as I think there is ionization of the room air and this would seem to discount the reading. Hirsch of Altoona says that the 240 Kv. is quite correct, but that is measuring at the secondary terminal without the tube in circuit. On this point there seems to be considerable contention.

While on the question of apparatus, mention should be made of the instrument devised by Pilon of Paris. Here a step-up transformer is connected with a condensor through kenotrones wired in reverse directions in such a way that the first impulse in one direction passes through the kinotrone to the tube. The second impulse in the inverse direction is directed by the other kenotrone to the condensor, so that when the third impulse comes along, to it is added the further potential of the stored energy in the condensor. So that with a transformer delivering a given Kv. it can by this means be augmented and is made to deliver practically double that voltage to the tube terminals. The tube in this instance is the Universal type Coolidge tube, immersed in oil and mounted on an overhead track. The principle of the apparatus is identical with that shown by Professor Duane of Harvard. The essential difference is that Pilon's Condensor appears about one-quarter the size of Professor Duane's and he has done away with the gigantic filament heating transformer for the kenotrones, so that the whole apparatus is more compact and certainly more suitable for a hospital than this enormous assembly that I saw in Boston.

However, what I did see myself was an actual sparking across between these sharp points at thirty-seven centimeters with the tube in operation, but this was just an occasional spitting across and not a continuous flame. As I had no means myself of measuring, this, like many other statements, had to be accepted as given, so that I am passing it on just as it was received.

While on this subject, I would like to mention a really pleasing contrivance, known as the Oscillograph, shown me by Doctor Voltz, which consists of an oscilloscope mounted in an eccentric manner on a revolving black drum. This Oscilloscope has its terminals connected in series with a tube in operation, and because of the speed at which it is revolving, the luminous fluctuations between the points of the Oscilloscope become actually a continuous "graph". In a most simple and pleasing manner the behavior of the tube can be observed and recorded by photographing this oscillograph in motion. Doctor Coolidge, I believe, has obtained photographs of the various tubes in operation, connected to this Oscillograph, and, according as I understand it, he claims that the potential (their 240 Kv.) is equivalent to our 13-inch S. G. But allowing this is so, it is a higher spark gap than I observed being used previous to this European trip, although I have seen men who are using probably close on to that now.

Now, with reference to tubes: there are quite a variety of tubes in use. The Mueller Boiling Tube appears the most popular. It is a gas tube with a metal reservoir in which water is kept constantly at 100° C, as advantage is taken of the 537 calories necessary to convert water at 100° C to steam at 100° C, so it boils constantly and in doing so maintains a constant temperature of the target during bombardment, with the result that a more homogeneous bundle of rays is emanated. This is one factor that is kept constant, then to maintain a constant vacuum it is fitted with an accessory automatic regenerator devised by Wintz of Erlangen. This is a most ingenious device and consists essentially of a Milliampere meter which instead of registering the current passing can be set for a given milliamperage, say 3 Ma. Then if the tube hardens with a consequent decrease in the milliamperage this device, through a sensitive system of electrical relays, charges a solonoid, which operates the control cock of the gas flame playing on the palladium rod of the osmotic regulator. This in turn permits the entering of gas into the tube, with its resultant reduction, but only to the point desired: namely, 3 Ma., as when this is reached, the regulator causes the gas flame to diminish in a similar but reverse manner to that described, so that the tube is practically kept constant. During a treatment this reduction occurs with an irregular frequency and the apparatus is apparently quite automatic in its operation, although an attendant "stands by" constantly.

In addition to this Mueller Boiling Tube there is a hot cathode tube, also a Mueller product, which is having a very limited use. It appeared to me to be essentially a Coolidge Tube but complicated by an additional heating filament, and the reason for which the physicist at the Mueller factory would not explain to me. There is also another with a Quartz cylinder, surrounding the target, which I am informed by users of the tube is a detriment to it, as when it becomes ionized it upsets the internal equilibrium and renders the tube unstable and so of questionable value.

The Lilianfeld tube is rather a handsome and complicated looking affair, consisting of several glass bulbs with a length of almost a meter, also a hot cathode tube with a most cumbersome looking aerial regulator, but which I am informed requires a particular type of generator (the Radio-Silex) to excite. While this tube is used to a certain extent, there is some diversity of opinion as to the particular field in which it is of the most value. In the laboratory of Professor Albers-Schonberg, I was told that it was the ideal tube for radiography, and that by it the finest detail could be produced. However, in other laboratories I was informed that it was quite useless for radiography but excellent for therapy, but that its use was limited as the tube had not yet been refined to its highest degree of perfection, although it is spoken of in a most hopeful manner.

The only other tube that I found in common use was the Coolidge-Furstenau Tube. This is a similar tube to our own Coolidge tube, with the exception that the bulb is slightly bigger and the terminals longer. I think that a misfortune has occurred with regard to it. Throughout Germany it appears to be an uncertain quantity, because an occasional one appears unreliable, and on this score a rather interesting observation was made while in Paris when going over the factory of Gaiffe-Gallot & Pilon. Doctor Pilon was showing me the tubes which they make under license for the supply of France. Here I noticed that the target in their tube had a dull appearance, instead of the polished metallic lustre that our American tube has. On pointing this out to Doctor Pilon he stated that it was their means of checking, as they found by experience that if the prepared target was touched by the bare fingers that it was quite impossible to satisfactorily exhaust the tube into which that target was built, and it was a source of continual annoyance until the trouble was discovered, after which they were sand-blasted, not entirely with a view to avoid the sealing of intermolecular spaces, but rather because of the surface, any handling was easily seen by the grease mark left, and therefore no attempt was made to use that target until it was again prepared.

Doctor Coolidge, I believe, says that this precaution is not necessary in America, so that it would seem that there must prevail some peculiar physical conditions which upset the equilibrium of the German tube, and therefore may be responsible for the erratic behavior of the German tube, which is to be seriously regretted. They do admit that it is the best tube, the most universal, and the most flexible when they get a good one, so that I believe that their trouble is entirely due to their local manufacture, and not in any way a reflection on the efficacy of the tube.

With reference to their methods of estimating or calculating dosage, several appliances are in use. One is the Intensimeter of Furstenau, for the operation of which advantage is taken of the peculiar properties of selenium, which has a varying electrical conductivity under the excitation of ordinary or "x" light. This contrivance consists of a selenium cell, electrically connected to the dial of the instrument or scale, which is divided off into 100 arbitrary units, known as Furstenau Units, this in conjunction with an apparatus called a "Wasserphanton", forms an experimental means of determining the dose delivered at a given depth. The Wasserphanton is a cubicle water container which allows of the holding of this selenium cell at any fixed depth. Therefore the actual dosage to be delivered to the tumor mass can be pre-determined and thus duplicated.

There is an accessory instrument in the form of a computing scale called the "Hartezkale" based on the principle of a sliding rule. The difficulty, however, with this instrument, I am told, is that temperature and humidity affect the sensitivity of it. So that under ordinary operating conditions it is subject to a 40% error and consequently would appear to be hopeless as an exact erythema dose criterion.

The instrument that really impressed me was the Iontoquintometer, which consists of a very small ionization chamber; the actual size being about that of a tailor's thimble, which is very much smaller than anything hitherto developed, and so it can be inserted into the body cavities and connected by means of a flexible cable to the electroscope, the actual dose administered thus being determined. The only objection that arises in my mind to it is the fact that the direct beam impinging on the metal walls of the chamber in themselves set up secondary radiation within the Ionization chamber, and this will hasten the rate of ionization and consequently subject the reading to a slight error, but inasmuch as this factor is practically a constant, the exact conditions under which the reading was obtained can be duplicated, so that it would seem that this is not a practical disadvantage. This instrument would consequently appear as a very valuable addition to our means of accurately calculating dosage.

With the aid of the Iontoquintometer a rather interesting procedure has been established at Erlangen where they have selected a tube which is operated under certain fixed conditions until an erythema dose, as determined biologically, has been delivered to the living tissue. The record of the Iontoquintometer is taken and then this tube is set aside as their norm, to be used as a means of standardizing others, and is not actually used in therapy but retained as the criterion. It is guarded with the same religious care that any other standard is, and all the operating tubes are regulated according to this one. So that you can readily see that if the determination of this standard has been made with precision, and the working tubes carefully standardized, they will obtain results that are really difficult to duplicate with any other method that we have at the moment.

With regard to filtration, there is a variety of opinion and consequent procedure. In some of the clinics aluminium and sole leather are being used, aluminum up to 14 mm. in thickness, whereas in others they are using copper, zinc, brass and gold, the aluminum, zinc, and copper by far the most common. In talking over this matter with some of the operators, I find that the claims they make for copper, are almost parallel with those claimed for zinc; if anything the argument is rather in favor of the copper, and Professor Wintz confided that the reason they were advocating copper was that they had initiated the idea of a copper filter, whereas the Frieburg school had come out with the zinc filter, and that so far as actual results were concerned, there was no difference. Their claim is that 1 mm. of copper is equivalent to 17 to 19 mm. of aluminum. Working with a 10-inch S. G., the half-absorption value of aluminum varies according to whether or not the rays have been filtered previously. By "half-absorption value" is meant that thickness of aliminum that is necessary to cut down a given bundle of rays to one-half. It is found that with unscreened x-ray 2.5 mm. of Al reduce the quantity to 50%, which of course means that the other 50% is absorbed by the aluminium. Similarly, 3 mm. of aluminium absorb 60% of the incident beam. Now, taking this bundle of rays through 3 mm. of aluminium filter, it will require 4.5 mm. of aluminium to reduce this to 50%. Using 10 mm. of aluminium results in the absorption of 85% of the primary beam and it requires 7 mm. of Al to further cut this to 50%. One mm. of copper causes the absorption of 93% of the primary beam, and it requires 11 mm. of Al to absorb one-half of the rays filtered in this way. This, therefore, is about the practical limit, as this is the hardest ray, and further filtration causes practically no difference in the quality of the bundle, but by securing a homogeneous bundle the absorption rate of succeeding layers of soft tissue will be practicly constant, therefore with a tension of over 200 Kv. as advocated, certainly heavier filtration than we have been used to is required.

In Professor Bumm's Klinik in Berlin the following technique is used:

Carcinoma of the Uterus

Filtration: Copper, 0.8 mm.; aluminium, 0.5 mm.; celluloid, 1 thickness (piece of photographic film).
Distance: 30 cm. target to skin.
M.-amperage: 2.
K.-voltage: 220.
Time: 90 minutes to each of four areas.

Myoma

Filtration: Copper, 0.8 mm.; aluminium, 0.5 mm.; celluloid, 1 layer.
Distance: 22 cm.
M.-amperage: 2.
K.-voltage: 180.

Elsewhere 0.5 mm. of copper filter is used, while still again up to 1 mm. of copper is used.

While the filtration varies from place to place, this is approximately the range used in deep therapy.

Baumister has done some experimental work with a gold filter of which he has determined that 0.18 mm. affords certain advantages, over a zinc or copper filter 0.5 mm., but because of the fact that it is almost impossible to obtain such a filter with less than 1% variation, and also in view of the fact that such a thin filter, when bent or buckled, disturbs the relationship of the material so that it actually varies in a wave-like form, he has dispensed with his gold filter and admits that the zinc or copper is really more practical.

With reference to distance, this also varies considerably: from 23 to 50 cm. seems to be the choice, although I did see work being done at distances up to 100 cm. In breast malignancies the technique is somewhat different, chiefly in the target-skin distance, which is greater, generally, than for "deep" conditions, 70 cm. and 90 cm. The Kilovoltage, current, and filtration, are the same, but the time is proportionately increased. Halberstadter of the Krebs Institute, Berlin, has a most remarkable series of encouraging results with this technique. So much so that he says carcinoma of the breast is no longer a surgical condition.

It is obvious that the increase in distance and filtration very greatly increases the duration of the treatment. When to this is added the fact that the tube delivers only two to three milliamperes, it is readily seen that the time factor is seriously protracted: in fact, under these conditions it requires from thirty-five to one hundred and twenty minutes to deliver the unit skin dose, and as this is for but a single portal, one must multiply this time by four or six for the complete dose.

When it is remembered that the patient under treatment is often seriously ill, and that the full treatment is given at one sitting, and to this must be added the necessary interruptions; the changing of a tube, readjusting of the patient, which is often necessary because of nausea or in cases where the patient finds it necessary to void, the treatment, including the interruptions, quite often runs from six to eight, and even ten hours, (in fact, up as high as fifteen hours at Schmieden.) So that it will be seen that the treatment becomes really an ordeal.

To assist in obtaining quietude of the patient during this session, scopalamine and morphine are administered, but even this does not to any appreciable degree alleviate the suffering occasioned by such drastic measures. Although attention is paid to the ventilation of the treatment rooms, yet the matter of roentgen sickness is an extremely serious one. The patient becomes intensely nauseated in most instances, and it may be so severe that the treatment cannot be completed, but the radiotherapeutists seem to pin their faith, rightly or otherwise, on the necessity of the whole dose being administered at one fell-swoop. On catechising them regarding this matter I was told in one clinic that in view of the fact that some of the patients came considerable distances, it was really a matter of convenience that the whole treatment be administered at one sitting. However, it was argued again by another individual in the very same clinic that this was not so, (and I think they are sincere in this belief), but that a precipitous dose must be administered if the treatment is to be successful. One of the premises for this argument was that the dose being an intense one, reaction was bound to occur, consequently the full dosage must be delivered before the beginning of the reaction.

That a reaction occurs sometimes sooner than one would ordinarily imagine is emphatically emphasised in a case recently reported by Alois Czepa, (Strahlentherapie: Vol. 12-239, Feb. 15, 1921) where a patient strangulated within one hour after irradiation of the chest because of the oedema induced in a bronchial gland.

With reference to the actual areas, the size of the portal used previously was 6x8 cm., with cross-firing based on the same principle to that which has been our custom here for some time back, but these are increased to as high as 16x18 cm., and even in some places in the treatment of myoma the pelvis is irradiated from two areas only, front and back. In treating a malignancy in the pelvis six areas are used in Erlangen—three front and three back. Four portals are used at Berlin—two laterals, front and back. Inasmuch as the cancercide dose has been determined to be 100% of the erythema skin dose, this amount can be delivered at a depth of 10 cm. in a patient of 140 pounds, as they have shown that through each anterior lateral portal, 20% can be delivered to the depth of 10 cm. 23% through the anterior median portal; 20% through the posterior median portal, and 15% through each of the lateral portals, this being 113% of the erythema skin dose. Where a heavier patient is being treated an additional dose via the vaginal route allows for another 20%, so that the desired lethal amount can be obtained from this seventh portal.

For pelvic malignancy there has been developed at Erlangen a rather impressive method which, because of the analogy of its aim to the radical operation of Wertheim, has been called "The Roentgen Wertheim." In this an attempt is made to reach not only the primary growth, but also the lymphatics and glands in the adnexia and pelvis. No attempt is made to administer this whole dose at one sitting. Rather it is devided into three seances; the first, which includes the cervix and body of the uterus and its lateral parietes is administered through six portals; three in front and three behind (this in one sitting); the second covers the right parametrium; the third covers the left parametrium. Each of these are similarly divided. Because of the effect on the blood a minimum time of six weeks elapses between the first and second and between the second and third.

In preparing a patient for treatment, not only is the bladder, but also the large intestine, completely evacuated, and this may be repeated during the actual seance.

The tube is supported by a wooden holder properly isolated with lead, except a window for the primary beam. On the skin there is placed a wooden convex disc which, by pressing on the skin, forces it down and therefore secures surface homogeneity as well as helping to fix the patient, and, incidentally, acts as a soft filter next the skin. It further aids by dispersing or spreading the abdominal contents and therefore in certain areas where it is applicable, renders the depth of the tumor considerably less than if no pressure was brought to bear on the skin.

There are several points in the actual technique that impress one, among others is the exact precision which they regard as being of importance in the adjustment of the tube and, so, the incident beam. This is done with extreme care, and to assist in securing the greatest exactness, one of the novel methods they employ is the use of a long dark glass tube, somewhat on the order of a Ferguson Speculum, about two meters long. At the distal end of it there is situated a small fluoroscopic screen at an angle of 45°, which is surrounded entirely by lead, except for one small window on a marked side. This glass tube is inserted into the vagina. The roentgen tube is then excited and it is readily observed whether or not the fluoroscopic screen lights up, so by the aid of it the path of the beam can be directed and the necessary adjustment made.

Treatment is directed toward the uterus and checked up by the lighting up of this fluoroscent screen above mentioned, so that the axis of each treatment actually traverses the uterus. The success of the treatment, it is argued, depends entirely on the correct orientation of the rays and really appears difficult although the description may sound easy.

Forty minutes with 3 ma. of current, .0.5 mm. of copper and 1 of aluminium at 23 cm. are the factors used in this dose in each area (in delivering the Roentgen-Wertheim). Such treatment, of course, is attended by rather serious sequela; roentgen sickness is almost invariably present, and the patient complains of malaise and anorexia for days after treatment. The vomiting may last as long as a week and not infrequently there is an associated diarrhoea and tenesmus with bloody and mucous stools. This may be more protracted than the nausea and may even go into the third week. The patient is kept in bed for thirty days and the skin annointed with a preparation known as "Zink Lovan." The whole of the exposed area blisters and desquamates.

In addition to apparent changes, there is also a serious effect on the blood. Examinations are made at regular intervals of six hours, then on the third day, and after that at weekly intervals. At times the haemolysis is so severe that blood transfusion becomes imperative, although in certain asthenic cases it is done as routine. These examinations show a rather sweeping destruction of the white blood cells, more particularly the lymphocytes, but these rapidly reappear. It is the disastrous result on the red blood cells that appears to be the serious factor. The average treatment results in the destruction of at least 25% of the red blood cells and their re-appearance is rather slow. It is not until after six weeks that the blood picture again resumes a normal appearance and for this reason the irradiations cannot be repeated until the R. B. C.'s are restored, so that eight weeks is the usual time and the shortest period they consider safe is six weeks.

Experimental evidence, together with actual experience, shows that the blood will stand this severe destruction only a limited number of times, usually after four treatments the patient loses his ability to reform the blood cells, with the result that further raying causes an anemia that may terminate fatally, even in spite of the fact that the primary ailment, the cancer, has been destroyed.

It may be also noted that it has been determined that 135% U. S. D. is all that the bowel will stand without a disastrous destruction occurring, so that with this limitation known, 130% of the U. S. D. is the maximum dose that is allowed to be given to any patient.

This "Roentgen-Wertheim" has been in use at Erlangen since January, 1918, and it is extremely gratifying to review their statements of the twenty-four cases treated in this time, which, when reviewed in January, 1920, showed 23 of the cases were apparently cured. They are enjoying good health, they had put on weight, the mass had disappeared, and there is no microscopic or macroscopic evidence of malignancy. This is 97% of the first series. Of course it is unnecessary to repeat that it is too early to be sure of definite results, but these reports are surely encouraging and argue well for the method.

According to Professor Wintz, the technique is just as complicated and demands as high an order of skill to correctly perform as does the Wertheim operation. So true is this, he thinks, that he emphasizes his conviction that only specialists in this particular branch of medicine should attempt it, and it does require some experience on their part before even they are actually qualified to do it properly.

Just here may I be allowed to digress a moment to sound a word of warning. This technique is different in many respects from what we are used to here and if we attempt to change over, let it be done intelligently. Pfahler has taken a rational and conservative attitude on this, but he is conversant with the pros and cons of the practice of radiology. What I fear is an attempt by unqualified men, infused by the brilliant and unsurpassed results obtained, to attempt this work, which is entirely beyond them. The result will be terrible disaster in one of two ways, either horrible burns or the actual stimulation of the neoplasm by their doses being too small, and so the method, which is established beyond dispute, would be threatened to fall into disrepute by incompetent operators. Radiotherapy is a difficult, complicated, and highly technical specialty, and should not be dabbled in by any one and everyone. It is just as potent for harm as it is for good, and is far more dangerous than a dirty probe in the hands of a meddling "surgeon."

It has been shown that the ovaries are three times more sensitive than the skin, so that the castration dose has been found to be 34% of the U. S. D. or 12 units as measured by the Iontoquintometer. The sarcoma dose is 60% to 70% of the U. S. D. or 24 to 26 on the Iontoquintometer. The U. S. D. is 100% or 35 on the Iontoquintometer, whereas the cancercide dose, which is 110% U. S. D. is 37. Here I may say that there is some apparent diversity as to the exact proportion of the U. S. D. that constitutes the cancercide dose. For example, Seitz and Wintz say 110%, whereas Halberstadter (Bumm's Klinik) says 90%. This is due to the fact that the reaction in Bumm's Klinik that is considered a unit skin dose is very much more severe than the one which is the standard at Erlangen.

The results of these treatments begin to be macroscopically apparent in fourteen to twenty-one days, but it takes considerably longer before the tumor entirely disappears, generally seven to ten weeks. Microscopic changes induced by this radiation appears identified with those following the exhibition of radium, with the exception that when radium is used they appear earlier and the retrogressive changes are more rapid, the difference being thus chiefly a matter of time in their occurence, not actually what occurs. The mass that has been subjected to x-radiation shows no microscopic changes until the end of three weeks other than the fact that the neoplastic cells stain more readily. This subject has been the source of considerable comment and some investigation by these workers, and they conclude it is not a biological action, but a purely physical one, dependent on the wave lengths of the gamma ray of radium as compared with the highly filtered x-rays. As a result of this treatment there is a most extensive cicatrization of the pelvic contents. Regarding this sequela I believe one must wait some time before it can be taken that there will not ultimately ensue disastrous results, because in cases already reported there has occurred an almost complete atresia of the vagina, so that this, if it can be regarded as an index of the resultant condition, is really a potentially dangerous one.

Experimental evidence would seem to indicate that the x-ray and radium have similar biological effects, although a radium burn is not so obstinate as an x-ray burn. If the same number of scattered beta-rays are produced in the tissue either from radium or x-ray, biologically and therapeutically they appear similar, although there is really a wide gap in the position on the spectrum of the heardest x-ray produced today when compared with the hardest or shortest wave gamma ray of radium. While at the present time with the apparatus at our disposal, the extreme short wave x-radiations obtained are those excited by a tube with a potential of 250,000 volts, to simulate the shortest waved gamma rays of radium it will require a potential of close on 2,000,000 volts or a parallel spark gap of 16 feet. This of course, would appear to be beyond the limit of possibility and, even so, that of practicability.

So far I have been usurping most of the time in dealing with the question of deep therapy, but probably the moment of this subject justifies this monopoly. However, I would like to hurriedly make mention of some of the other achievements, and to call attention to the gratifying results that are being obtained in radiotherapy for tuberculosis. Here the technique is a small dose at frequent intervals and the results really appear excellent. The secret of the success appears due to the fact that proliferation of fibrous tissue can be caused *if*, and only if, it is previously sensitized by inflammation of pathological processes within it or about it.

On the question of increasing the coagulability of the blood, Stephan has demonstrated that by irradiating the spleen with a dose that is equivalent to about 15% of the unit skin dose, the coagulation time is increased with the same rapidity and to practically the same degree as follows a hemorrhage. As this occurs only by raying of the spleen, he argues that the spleen must be the source of prothrombin. It may be this or it is possible that a hormone is produced which results in an increase of the thrombokinase and prothrombin in the circulation. Based on this argument he is of the opinion that irradiating the liver, the spleen, the kidney, and other glands with minimal doses will have a similar effect, stimulating their specific functions. However, this work has not been done on the normal with a view to stimulating the secretions, but investigation has been carried on in cases of pancreatic deficiency, in renal incompetency, and he actually cites instances of three uremic cases where symptoms were so grave that decapsulization was being considered. However, after an experimental attempt at raying, the kidney excretion rose from a practical anuria to over 1,000 cubic centimeters in twenty-four hours.

In cases of diabetes mellitus their tolerance to carbohydrates was increased after raying the pancreas. There was not a complete suppression of the glycosuria, but an appreciable diminision. Further exposures were not successful in rendering them sugar-free, but further increased their carbohydrate tolerance.

Among other things he reports successes in the treatment of osteomyelitis and in chronic gonorrheal arthritis. Similarly, he has found that insufficient dosage delivered to a cancer mass had resulted in not only an increased cell proliferation, but also apparently an increased cell secretion, with the result that the cachexia became more marked and the patient was actually injured as a result of this misguided treatment.

The treatment of sarcomata appears eminently successful under radiotherapy and requires only 70% of the U. S. D. for its complete destruction.

Of course it is impossible to treat in an exhaustive way the methods in use or the diverse uses to which radiotherapy is being successfully applied today, and no attempt is being made to do so. But, in conclusion, may I say that, contrary to rather adverse criticism that I have heard regarding the methods as outlined above, I am personally convinced that in it a definite advance has been attained and when one considers statistics and actually sees the patients, it is convincing indeed. But aside from this the actual rationale appeals to one as being based on logical principles, so that this science is now becoming, or rather is actually already, established, and we are rapidly approaching the time when the surgeon must realize his total inadequacy to deal unassisted with malignancy. The knife can no longer stand alone as the panacea for cancer, because is it not a fact that if the condition could be extirpated with the ease that appears at present by some to be apparently assumed, the condition would not be a malignant one? And, further, is it not so that malignancy is a constitutional and not a local disease? That being so, and it certainly appears to be, it is too much to expect any surgeon, regardless of his ability, his technique, or his experience, to remove en masse such a recidivous condition as a malignancy. The ramifications, being more extensive than is macroscopically apparent, cannot with certainty, be reached, but even allowing they were perceptible, it is still quite impossible to completely eradicate them, because a dissection so extensive and so tedious could only be completed on the cadaver.

So that the future of this science is assured, and appears particularly promising, as it is pregnant with possibilities, and to hasten this a friendly and intelligent cooperation between the surgeon and the radiologist is indispensible. At the present day neither one method alone can claim the field, but by a close association, results can be obtained that were hitherto undreamed of, and real achievements accomplished.

Some Phases of Intensive Radiation Therapy

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BEFORE an audience composed of radiologists and their enthusiastic colleagues there seems little necessity of relating any indications for radiotherapy. We are inclined to believe that the usefulness of radiotherapy is recognized, that the limitations are not realized and that the failures are acknowledged.

In the first place it may be suggested that we declare our adherence to the principles and practice of tried and successful radiotherapy. These passing days are full of chaos with the rapidly changing technique of venturesome radiologists. The news from foreign parts is disconcerting to those who may be following the dose formulas of their chosen radio-hero.

Sucessful radiotherapy has been achieved uniformly in the superfiicial lesions of the skin. The latitude of dosage is such that success seems to attend the efforts of those who choose a single or multiple dosage and a filtered or unfiltered technique. It is suggested, however, that close adherence to the published dose tables of Witherbee and Remer (1) will always be good advice to those who have not passed through the fire of experience and the days of variable tubes, spark-gaps and filtration.

Personally speaking, I am inclined to favor what may be termed a graduated filtration dosage, which demands the exposure of the lesion, after careful protection of the surrounding parts, to the naked tube for one-third of the time and then using one and two millimeters of aluminum for the other two-thirds, respectively. One must take the superimposed crusts and scales into account as possible filters. The personal equation is an enormous factor in all this superficial technique and the garnerings of experience are more valuable than advice or study.

Among the conditions that lend themselves to sucessful radiotherapy and in which newer methods of technique will hardly afford any more uniform results, may be included the following:

1. Thymic enlargement of infants and young children. Almost any reasonable reontgen technique obtains results.

2. Tinea Sycosis. Any technique which accomplishes epilation affords rapid response.

3. Epitheliomata of the face from the eyebrow to the upper lip yield to any technique which protects the surrounding parts

and delivers sufficient radiation to promote a mild erythema.

4. Keratosis senilis. Yields to any radio-technique which is successful for epitheliomata. The lesions are multiple and widely scattered but there is little excuse for failure to secure results.

5. Tinea Favus. The success in this disease depends upon working out a technique which produces a uniform epilation without destruction of the hair-follicles by scarring. Results are bound to be satisfying although the variations in technique may be numerous.

There are without doubt many individual radiologists who register results to the point of specificity in other conditions than the above and there may be some among you who may feel that I have not included enough in the above listing. At least, there remains no argument as to the uniform results obtained by all radiologists in the above list if they possessed any knowledge of radiology before they secured apparatus, equipped with measuring devices.

Before proceeding to a consideration of deep radiotherapy problems, it may be well to call attention to the fact that I have omitted to mention eczema, psoriasis, erthyemata, thyroids, carbuncles, keloids, and other conditions which are quite extensively treated by radiologists. In these latter conditions it is not always best for the radiologist to be the primary attacking therapist. Radiotherapy is only one of many methods which are available in these conditions. Intensive radiotherapy may result in disaster if applied vigorously enough to control these conditions. Over-treatment is dangerous in many instances. Specificity of any treatment allows for latitude in technique. Multiplicity of therapies denies over-indulgence in any one method and should encourage a most careful technique.

And now to engage in a discussion of deep therapy problems, more especially in relation to malignancy. It may be well to lay down certain laws regarding radiant energy as displayed by the roentgen ray and radium.

1. The sensitiveness of the malignant cell to exposure to radiation is in direct proportion to the activity of its reproductive power. (Morson) (2).

2. Immature cells and cells in active state of division are more sensitive to radiation than are cells which have already acquired their fixed adult morphological or physiological characteristics. (Bergonie and Tribondeau) (3).

3. Infection interferes with radiation therapy results.

4. Inoperable is not synonymous with incurable. (4).

What are the *purposes of radiotherapy?* Fenzi has outlined these excellently as follows:

1. Prevention of inoculation of tumor cells into a wound.

2. Destruction of a growth in situ.

3. Treatment for relief of pain and discomfort.

4. To render the inoperable growths, operable.

The laws of the biological action of radiation have been outlined by Kroenig and Friedrich as follows:

1. The biological action of the rays depends on the quantity of rays absorbed by the tissues.

2. This action is (within wide limits) independent of the hardness of the rays.

3. Action is more powerful if the dose be administered at one time than if it is split up.

4. Action is stronger, with the stronger intensity of irradiation in unit time.

5. In practice, therefore, it is best to apply the whole dose in one seance with the maximum intensity.

The question of sepsis in malignant tissues being subjected to radiation, has not received the attention it deserves. Many of the inoperable malignant cases presented for radiotherapy have a mixed infection of the growth and the surrounding tissues. Now, there is no effect upon bacteria by the rays by any technique in ordinary use, only by enormous experimental dosage. In fact, Russ and Chambers have shown that prolonged exposure reduced the phagocytic power of the leucocyte. The lymphocytes were the more sensitive type and more readily destroyed. It is generally conceded that the lymphocyte is the most active cell in the destruction of malignant tissue. Therefore, any action of radiation which contemplates the destruction of bacteria in tissues must be in such enormous doses that the fighting lymphocytes will be destroyed and the resistance to the malignancy diminished. Morson (7) declares that the action of radiation in destroying bacteria is neutralized by the harm it does the leucocytes, and that the spread of a growth is hastened by radium if sepsis is introduced.

The problem of radiation in the presence of sepsis becomes extremely embarrassing when we contemplate the inoperable malignant conditions of the prostate, anus, uterus, mouth and jaws that are being presented for radiation treatment as a last resort. Practically nothing is accomplished unless the infection is controlled. It must always be remembered that it is the patient we are treating and not the malignancy. Too much attention to the malignant tissue and too little attention to the patient will not produce results.

Inasmuch as we have listed in an early paragraph, the tried and successful field of superficial therapy, it may be well to include an estimation of roentgen values in the deeper tissues, with both benign and malignant conditions. To this will be added the analysis of Finzi with regard to the irradiation of individual tumor types.

The tissues and their peculiar diseases which are amenable to radiotherapy may be grouped under headings as follows:

1. Tegumentor. 2. Lymphatic. 3. Alimentary. 4. Gynaecologic.

The Tegumentary System is subdivided as follows:

(a) Metabolic Diseases—Acne Vulgaris, Eczema, Psoriasis.
(b) Benign Growths—Keloids and Warts.
(c) Cancerous and Pre-Cancerous Lesions—Keratoses, Epitheliomata, Rodent Ulcer and Sarcomata.
(d) Parasitic and Infectious Diseases—Tinea Sycosis and Favus, Carbuncles, Furuncles, Hair Follicle Infections.

2—The Lymphatic System:
Tonsils, Exopthalmic and Toxic Goitres, Enlarged Thymus, Tubercular and Chronic Inflammatory Adenitis, the Leukemias, Lymphoscarcomata, Glandular Sarcomata.

3—Alimentary System:
Leukoplakia, Labial Cancer and Cancer of the Mouth, Oesaphageal Cancer, Rectal Cancer.

4—Gynaecologic Conditions:
Mennorrhagia and Metrorrhagia, Fibroids, Ovarian Papillomata, Cancer of the Cervix and Inoperable Pelvic Cancer.

Finzi (8) has outlined recently the forms of tumors for which radiation should be used, as follows:

1—Growths to be treated by radiation in preference to surgery: Lymphosarcoma and Rodent Ulcer.

2—Optional for Radiation or Surgery: Endothelioma, Epithelioma of skin and lip, Non-infiltrating epithelioma of tongue or palate, Cancer of the body of the uterus, Epithelioma of the penis.

3—Surgery to be preferred, but prophylactic radiation demanded: Cancer of the breast, rectum, ovary, tonsil, cervix, floor of mouth, pharynx and anus. Spindle cell sarcoma, alveolar sarcoma, melanotic sarcoma, hypernephroma and glioma.

4—Radiation contra-indicated in:
Epithelioma of the tongue of infiltrating type and Epithelioma of the vulva.

5—Benign Tumors to be treated by Radiation:
Angiomata, Lymphangiomata, Keloids, Fibromyomata of uterus after age of 38, Papillomata (warts and corns), Exopthalmic goitre.

The first of these classifications is distinctly anatomical and that of Finzi is pathological. Undoubtedly, a more thorough understanding of Finzi's ideas would reveal his reason for placing cancer of the fundus uteri in the optional class, and cancer of the cervix in the surgical class. We would turn this around and place cancer of the fundus in the operable class without argument because there is slow invasion of the lymphatics and adnexa and it is possible to take out the growth entirely. While in cervical cancer the patient has already suffered the extension of the malignancy into the lymphatics and the vaginal vault and complete excision is no longer possible.

The surgical clinics themselves are proving the values of radiation therapy in cervical carcinoma. Competent surgeons who also possess radium are slowly but surely learning to depend upon this newer therapy in malignancies which cannot be totally and completely ablated by the knife. It does little if any good to remove portions of malignant tumors.

Again, contrary to Finzi, we would place cancer of the penis in the 4th list as being not available for radiation. We have never been able to do any good for cancer of the vulva or the penis by radiotherapy.

It is noticeable that both the anatomical and pathological listings place tumors of the lymphatic structures in the radiation class. Undoubtedly this is the most easily influenced tissue in the body. It is not surprising that the radiation attack upon tonsils has sprung into prominence. Among the uninitiated there is a belief that the x-ray affects the bacterial infection in the tonsil but this is not a primary effect of radiation. Rather does that radiation produce a shrinking in the lymphatic tonsillar tissues and thusly the infection within the crypts is expressed as these shrink. This method of treating tonsils will probably only be an incident in the career of roentgen therapy in spite of its value and ease of accomplishment. It immediately engages the opposition of a well-entrenched specialty. Furthermore, the removal of tonsils is not difficult or dangerous. These are not sufficient arguments against radiation but they are efficient from the standpoint of the laryngologist.

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A Study of Eighteen Cases of Epithelioma of the Penis

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OUR reason for reporting these cases at this time is, first of all to present a new thought in the treatment of epithelioma of the penis, that is the use of unfiltered x-ray, in the hope that the knowledge gained by us in this particular field can become more widespread, and applied by many radiotherapeutists to establish the absolute value of this method of procedure.

Cancer of the penis is one of the oldest known neoplasms. References were made to this lesion by the early physicians, especially Celsus, Saporta, Hildanus, and Roland, who described tumors of the penis and methods of operation for this condition.

This disease is more prevalent than one would suppose. Various observers (Paget, Billroth, and others), have shown it to comprise 1 to 3% of all cancer cases occurring in the male.

Cancer of the penis occurs more frequently in the 5th, 6th, and 7th decades (C. Kaufmann). One case has been described in a young man of 18, and several cases between the ages of 20 and 30. Among our eighteen cases there was one aged 29, two in the thirties, five in the forties, five in the fifties, four in the sixties, and one in the seventies. Of these, fourteen were married and four single.

Phimosis has frequently been given as being a predisposing cause. Thomson describes a catarrhal balanitis occurring with phimosis, which lead to desquamation of epithelium and later a hypertrophy of the epithelial cells with overgrowth of the subepithelial connective tissue, to which Schuchardt gave the name, psoriasis preputialis. It is a significant fact of importance in this connection that there has been no authentic case of cancer of the penis observed among the Jews or the Mohammedans, who practice circumcision (Winiwarter). Czerny had been so impressed by these facts that he practiced circumcision as a prophylactic measure. Among our eighteen cases there was a marked phimosis present only four times.

Syphilitic scars or venereal warts have been frequently recorded as etiological factors. In three of our cases, the Wassermann test was positive; fifteen were negative, but of these two gave a history of having had syphilis.

Trauma due to circumcision has been recorded in the history of at least one of our cases. There is a history of a warty growth appearing in the line of incision after operation for phimosis, which in the course of a year was definitely shown to be a malignant tumor. In one case there was a distinct history of trauma. This man, aged 70, received an injury on the glans penis by being struck by the handle of a plow. Eight months after he had an epithelioma which was confirmed by section.

References have been made to the possibility of the transplantation of epithelioma by contact with malignant disease of the cervix. This is not borne out by observation because cancer of the penis of men whose wives suffered from cervical cancer is not more frequent than in those whose wives are free from the condition. Among our cases there was only one man who gave a history of his wife having died from epithelioma of the cervix.

In the diagnosis of epithelioma of the penis we must take into consideration the possibilities of syphilis and venereal warts. Early epithelioma of the penis may be regarded as a simple wart or eroded papule (Partsch and Winiwarter), which is described as being more dense and pearly than a chancre, or as a smooth lump or thickening of the epithelium. During this stage there is little or no pain. As the disease progresses there is marked papillary or warty growth which soon begins to ulcerate, becomes cracked, infected, and suppurates. We have come to believe that all papillary growths on the glans penis are potentially malignant.

As a rule, local extension occurs relatively late, but eventually there is invasion of the lymph channels. The superficial vessels drain into the inguinal nodes, or invasion may be along the deep lymphatics of the urethra or dorsal vein of the penis, into the pelvic nodes. The inguinal nodes are involved in the majority of the cases when first seen (Kaufmann), and in over 75% of these cases it is bilateral (Martin). In some of the cases the inguinal nodes are markedly enlarged due to infection rather than metastases. This was proven by Küttner and bears out what we have observed in some of our cases.

It is possible, as study has shown (Küttner) that metastases may spread to the internal organs without involvement of the inguinal nodes. These metastases may occur in the liver or other internal organs. Rarely the disease is implanted by contact to the scrotum or skin of the thighs.

The most common site for epithelioma of the penis is on the glans (Barney—69%); fourteen of our cases were in this location, and four were on the prepuce.

These growths are either of the papillary type, especially on the glans penis, or the infiltrating epithelioma which is the usual type found on the prepuce (Partsch). The histological structure of epithelioma of the penis shows numerous pearls and hornifications, which are also well marked in the metastases that occur in this disease.

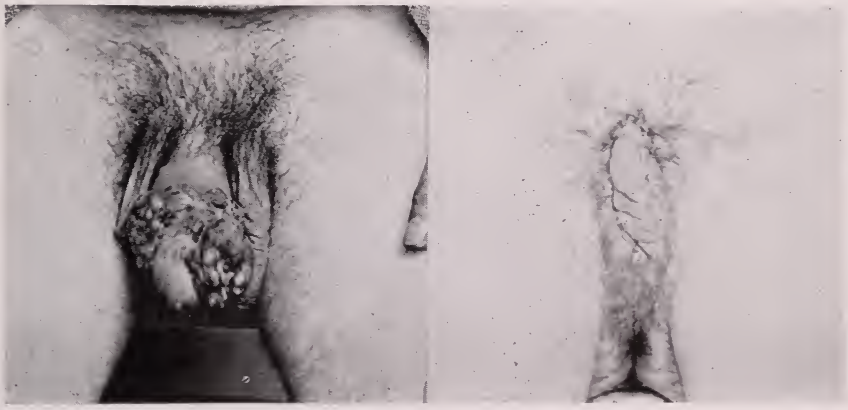

Figure 1—Case No. 1
Before treatment, May 15, 1918. After treatment, June 10, 1921.

There were two cases of malignant papilloma. In these there was marked surface proliferation with little tendency to infiltration or metastasis. Thick layers of irregular epithelial cells showing numerous mitotic figures, arrange themselves upon a delicate framework of connective tissue. This type is comparatively benign.

The course of the disease is usually relatively slow (Barney) before reaching the critical condition. Cases have been known to live eleven years without operation. The gross mortality is estimated about 32% Fifteen per cent of the cases develop visceral metastases. All types of cases give a 38% recovery by surgical methods (?). Recurrences are usually observed during the first year. A few occur from one to five years and an occasional case has been observed which recurred after eight years.

In this series the duration of the lesions, before treatment was instituted, varied from six months to two years. Six cases were far advanced and showed definite metastases. Of these three were operated upon. All in this group died. Twelve cases on admission had distinct palpable nodes in the groins; five of these were operated upon but showed no histological evidence of metastases in the lymph nodes. These cases are still under observation. One case was treated by radical operation followed by radium, in which there were definite metastases in the groins. The disease recurred and the patient died eleven months afterwards. Radium alone was used in one case which was far advanced showing extensive involvement of both groins. Treatment was of no avail.

Three cases were treated by x-ray followed by radical operation, which consisted of amputation of the penis, removal of the testicles and scrotum, removal of all lymph-bearing tissue in both groins, and transplanting the urethra in the perineum. There were no metastases found in the lymph nodes in the groins. All three cases are alive and well after four years, three years, and two years. (Photographs, Case No. 1).

X-ray and radium treatment was used in two cases. One case was far advanced with defiinte metastases in both groins. Treatment was discontinued, unimproved. In the other cases, the lesion on the penis which was extensive, was treated with unfiltered x-ray in three sittings in the course of six weeks with twice the erythema dose each time. On account of enlarged lymph nodes the groins were packed with radium filtered through .5 mm. of silver, 1 mm. of lead, 1 mm. of aluminum, 1 cm. of rubber, at a distance of 6 cm., each groin receiving 9700 millicurie hours. The patient is alive and well six months after treatment.

Figure 2—Case No. 2
Primary epithelioma of the penis, before treatment. Eighteen months after treatment

X-ray with conservative operation was used in two cases. Operation consisted of amputation of part of the penis and removal of lymph nodes in both groins. One is alive and well two and a half years after the treatment. There were no metastases found in the groin in this case. The other man died one year after treatment from recurrence of the disease, but in this case there was definite metastatic involvement of the lymph nodes in each groin.

Six cases were treated with x-ray alone. One discontinued treatment. One case is alive and well one and a half year after treatment. Fig. No. 2. One is alive and well six years after fractional doses of unfiltered x-ray. This last patient had a very small lesion on the glans penis. Three others are about healed, but are very recent cases. (Fig. No. 3). One case which was treated with filtered doses of x-ray was well when last seen, but has not been heard from in two years.

From the analysis of these cases it would seem that when the disease is local a cure can be effected by treatment of the lesion with unfiltered x-ray. It, however, is not only necessary to have in mind the local lesion, but also the areas into which the lymph channels drain. It would seem that the ideal treatment would be filtered x-ray treatment of both groins, and unfiltered x-ray of from two to three times the erythema dose on the local lesion.

Where there is definite lymphatic involvement in the groins, large radium packs supplemented by operation, or the implantation of emanation, or operation and unfiltered x-ray of the open wound is indicated.

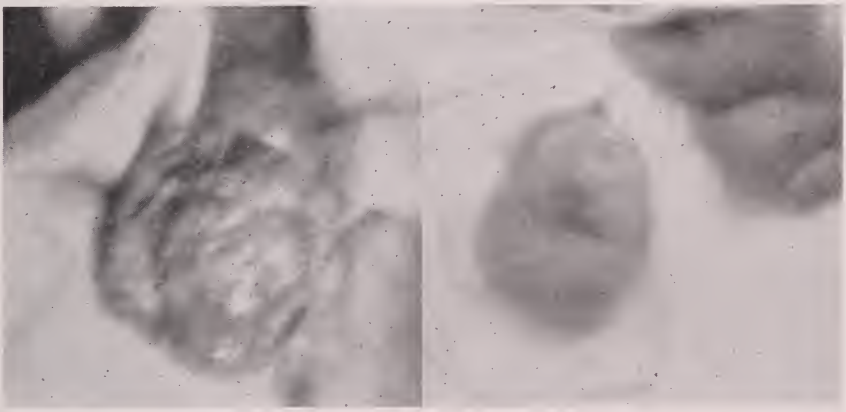

Figure 3—Case No. 3
Before treatment, January, 1921. After treatment, June, 1921.

The method most used in x-ray treatment of these cases was 10 milliamperes, 90,000 volts, no filter, at a distance of 20 cm. The time varied from five to six minutes which was approximately two to three times the erythema dose.

Conclusions

First—Cancer of the penis can be healed with unfiltered x-ray.

Second—X-ray treatment of the lesion followed by radical operation, has resulted in the healing of three cases which have remained well for two, three, and four years.

Third—Where definite metastases are shown in the lymph-bearing tissue results of treatment have been only palliative or ineffective.

Fourth—It is expected by improved technique, and the earlier recognition and institution of treatment, that more cases of cancer of the penis can be healed.

Fifth—The implantation of small doses of emanation, supplemented by large packs, will prove of value in those cases which have already metastasized in the lymph nodes.

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The Importance of an X-Ray Study of the Spine Following Injury

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THE patient with a spine injury wants two things. He wants a diagnosis and he wants treatment. I have seen a good many medical reports on patients who have had industrial accidents to the spine in which the statement is made, "There is no objective evidence of injury." In a few instances, such patients have told me that they were not even stripped for examination. Careful x-ray in such cases is the exception rather than the rule.

The examiner must first consider the objective signs. If the patient says he has pain, there are many possibilities of deciding whether or not his statement is correct. One may look for bone deformity kyphus, flattening of the lumbar curve, etc. There may be a limp, list of the trunk to one side or the other, difficulty in getting up and down and consistent tenderness to pressure. There may be even diagnostic disturbance of protopathic or epicritic sensation—or both. All of these points and the x-ray must be taken into account in deciding for or against an inflammatory or traumatic spine lesion.

Moreover, it is necessary to consider the character of symptoms likely to be present immediately after or late following a traumatism to the spine. A diagnosis which is not made early may be more difficult to make but very important later on. This is especially true if a suit for damages is contemplated or in progress.

It is well known that a great many spine fractures are not diagnosed at all at the time they occur. Sometimes they are not recognized until many months of disability have gone by.

Two x-ray plates recently seen gave a diagnosis of fracture in the cervical region, in the third week after injury.

This man, eight months after injury, has bony union in bad position, his head is in a wry neck position and he is still classified as 50% disabled. He has never worn an efficient head or neck support of any kind.

Spine or sacroiliac injury, whether fracture or strain, calls first for immediate reposition. The parts should be restored at once to normal relationship or as nearly so as possible. Then an efficient device for maintaining correct position and for immobilization must be put on and worn until sound healing has occurred.

In injuries to the cervical region, the trunk and head must be fixed. In the lumbar and

Fig. No. 1.—Anterior-posterior view of lumbar spine, showing area of bone destruction on the right half of the body of one of the lumbar vertebra.

sacroiliac region one must immobilize one or both limbs with the trunk. In the dorsal region unless very high up an efficient spine brace or packet will do. In my own work, plaster paris is preferred.

In making the x-ray examination, it is important to bear in mind that the same rule applies to the spine as to the other bone and joint injuries, namely: a plate should be made in both the antero-posterior and lateral planes. This point and the importance of late diagnosis, are brought out in the case of which plates are shown here. (Figs. 1-2).

This patient, a young man, hurt his back three years ago. He has had some back disability ever since. At times, it is much more severe. He had attacks with severe pain in July and November, 1920. Upon the latter occasion x-ray examination by Dr. Roscoe L. Smith showed the lesion to be a destructive one of the third lumbar vertebra. Until that time, the patient had at no time during nearly three years had a proper diagnosis. In fact, it had been suggested on several occasions that there was really nothing the matter with his back. In November he was put to bed and within ten days was free from pain. Late in November, 1920, a bone transplant was put in extending from the first lumbar vertebra into the sacrum (Albee method). He is progressing steadily toward recovery. His back is entirely free from pain, he is gaining weight and will get entirely well as a result of

Fig. No. 2.—Lateral view of the same case, showing the destruction to be located in the anterior portion of the right half of the lumbar vertebra.

ideal (in this case surgical) immobilization of the spine.

Fixation of the spine—that is, jacket or brace—must be continued for a fairly long time. Eight to twelve weeks time is usually necessary to get sound healing. In injuries that are at all severe a spine brace (Ridlon or Taylor pattern) should be worn for several months even after the patient seems to be well.

In a few words, this paper is a plea for early accurate diagnosis of spine injuries or of disease sequelae, in which the radiogram is so important a factor and for early efficient treatment to which the radiologist can often point the way.

EDITORIAL

The JOURNAL OF RADIOLOGY

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The Spirit of 1922

CERTAIN fundamental things are absolutely essential if Radiology is to enjoy a broadened influence, and ultimately succeed in any large measure as a scientific agent serving the public welfare.

Such a statement may sound a trifle abstruse. But the time has come when that man or body of men seeking to attain the fulness of his or its heritage as an integrated part of the medical profession, a heritage, if you please, whose chain of succession depends entirely on human service, must observe in the present flux unprecedented opportunity for extended scientific inquiry; must inevitably feel that there is just cause for hope of renewed vigor in the present demand for a restatement of those purposes for which they stand committed—purposes which somehow must be made big enough at base to include all men everywhere, and at once bear unmistakable evidence of direct individual contact and benefit.

That kind of a program does not constitute an easy job either in the making or in the consummation. But the fact is, during the past couple of years most men have learned pretty thoroughly how to measure the value of scientific undertakings, especially where their own personal interests are involved: they have come to believe that they have a right to demand the achievement of those scientific things which enhance individual well-being and comfort that thereby the public health may be assured.

With this knowledge has come a peculiar ability to strip the professional man bare, to burrow clear through every pretension for the purpose of finding out exactly, once and for all, whether that pretension is grounded in fact and fortified by truth, and then, mercilessly, to leave him who professes the thing standing to defend himself against the world or falling under the scourge of public obloquy, according to the measure of individual value in those things done, or the public importance of those things left undone.

It makes no particular difference that such a procedure is more or less arbitrary, nor that it fails to take account of the manifold details which must be explored, understood, and coordinated into a common plan before the scientific man can be sure the thing which he aspires to accomplish is at all possible of achievement, or that once achieved, it will be susceptible of reduction to the public good.

There is plenty of evidence of the fact that the test of the common weal, as thus ruthlessly portrayed, has thrown its mighty arm across the path of nearly all business men these past few years. Some have fallen before its vigorous push; others have been exalted and proclaimed the people's fortunate own. And judging from the indications which are the outcroppings of public opinion, the probabilities are that the same rules of conduct will be applied to professional life with unbounded vigor during the coming year. People must have a fetish to worship, a cause to pursue—and the medical profession seems to present that happy combination of both which holds tremendous possibilities. That is why 1922 will see actual deeds catalogued and appraised, aspirations submitted to the crucible of public opinion—and through the whole galaxy of human readjustments will reverberate a seductive clamor for professionally scientific men whose creed is "I can, and I will," whose prayer is "I have, and I must."

Men who would hold fast to principle will have to chart a course in advance and adhere strictly to facts. That is especially true of the medical profession, for there is an increasing purpose coursing through its veins. Radiology, simply because it is a branch or specialty of medicine, is not exempt. On the contrary, its latent possibilities, only the most meagre of which have been discovered and applied, clearly indicate that it may not with impunity trust its future to any haphazard program. The expanding horizon of preventive and curative medicine holds an inner urge whose intelligent application to the development of the science of x-rays, radium, and electro-therapeutics is vital. The Divine purpose of Radiology must be studied and charted, its principles and factors laboriously selected and explained, and the correlated expression of the whole placed in the hands of those men best fitted for the task.

The future holds a cross for every man. It is futile to play with words against the hope that the demand for a new vigor in professional life may be averted or stayed. It is idle to contend that the medical profession is sufficient unto itself, or that it proceeds on a high level of professional and scientific attainment where economic law or social necessity can command neither respect nor obedience. The fact is, professional men have for many years been telling other people how to live, and they now find themselves in that anomalous position where they have to prove their points by first-hand application of their own theories in order to demonstrate beyond peradventure that they speak with authority.

This does not present a situation altogether pleasing in prospect. But the evasion of duty or facts is not in the code of the medical man. Particularly is this true of the Radiologist who deals in tangible things, and whose shibboleth per se is certain discovery of cause followed by treatment based on known facts.

Thus Radiologists will not be permitted to remain content in their adolescence. They will be constantly reminded that facts are the yardstick by which their professional intent and worth are to be measured as a scientific agent in social life.

It seems but the part of wisdom, therefore, to try to set up some preliminary working plan. It is understood, of course, that such a working plan will have to provide sufficient latitude for individual vitality and initiative if it is expected to focus the activities of The Radiological Society of North America on the larger phases of future effort and achievement. It will have to be big enough, broad enough, to coördinate the efforts of Radiologists everywhere with the needs and desires of the medical profession. And it will have to command the admiration and respect of the members of this society by its preëminent purpose to unerringly set up those sign posts whose inscriptions must be read and observed as Radiologists proceed in the performance of their duties in the stirring march of events. Briefly, that program will have to underwrite the intelligent development of the science of x-rays according to the specific needs of the whole people in conformity with those profound truths which Radiologists have already come to recognize as the bulwarks of their profession.

One must approach such a problem in deep humility. The responsibilities are so great, the opportunities it offers so vast, that any man who sets himself this task must seem overbold. He is sure to learn that words and figures of speech are inept and weak. He must perforce offer in defense of a feeble intellect an unquenchable zeal for professional achievement, a zeal whose vigor must be expended in an ever-widening circle of service by a profession whose Alpha and Omega are life and death in the raw.

These are the thoughts which trouble the minds of the outgoing as well as the incoming officers. They know that in theory it is their duty to bring to the society membership some message of hope, of good counsel, and of infinite wisdom, to the end that the individual units of membership may go forward in the fulfilment of their professional obligations as a cohesive scientific precursor of physical and mental betterment in the composite social structure. But those same officers know, also, that such a spirit and unity of purpose cannot be invoked save in support of some program which is rooted in the Divine scheme of things, and which by its eminent practicability impresses each and every member with his individual responsibility and at the same time holds out some assurance of personal benefit.

To provide such a program is the duty of the offcers. It is the only way in which they can toll off that earnest of good faith and thoughtfulness and sincerity of purpose which is bound up with the performance of their duties. It is the price they must pay for their preferment in being clothed with the highest honors it is in the power of this organization to bestow.

In order, therefore, that there may be neither deliberate nor unwitting evasion of duty, the following suggested activities are submitted for the earnest consideration of the society membership. What is said is neither final nor conclusive. Rather, what is written is written for the purpose of stimulating discussion, inspiring individual thought, and laying the foundation for collective activity. It is hoped that as a natural consequence a program may be adopted at the annual meeting which will seek the achievement of those permanent things which are accepted by all men as evidence of righteous intent and irrevocable fealty of purpose.

Exemplification of the ideals which this organization has forged into its Magna Charta requires that the society members individually and collectively shall provide the flesh and blood which will stimulate scientific achievement, quicken the conscience of the world by magnificent and magnanimous social service, and firmly entrench the science of Radiology in the confidence and respect of all the medical fraternity and the public at large.

These are not empty words. They throb with the half uttered demands of thousands of honest and honorable practitioners who do not yet appreciate the full value of this science, nor the opportunity for extended service which it holds; they pulse with the inarticulate feelings of millions of men and women and children whose usefulness as citizens in this great nation rests absolutely on the shoulders of the medical profession in the certain discovery of cause and the correct development of prevention and cure.

Those who have run the whole gamut of x-rays, beginning when the first attempts were made to incorporate it into the practice of medicine as a collateral aid for diagnosis, and continuing to its present state of dependability and wide range of utility, see so many things of importance which should receive the undivided support of this society and all others interested in the development of Radiology, that it is a trifle difficult to coördinate them into a single inclusive plan of action.

However, there are at least two major undertakings which embrace unlimited opportunity for the proper development of those things which lay close to the heart of every member of this organization, and which will provide that unity of purpose which is so essential to sustained effort and ultimate achievement. They may be stated as:

1. A working arrangement with the faculty of every reputable medical college in the United States for the purpose of establishing Chairs of Radiology, in order that the regular curriculum of each medical school will guarantee proper grounding in medical and dental physiology and pathology, a working knowledge of the complementary sciences of physics and electrical engineering in their relation to the science of x-rays, and a comprehensive study of the newer science of electro-therapeutics.

2. The creation, within the profession itself, of the necessary agencies for the serious study of the public relations of the profession from the socio-economic side, and coupled with that, an unprejudiced and exhaustive effort to develop and harmonize the functions of the interrelated and interdependent branches of medicine, the better to serve the public health.

A brief discussion of ways and means may prove of some value.

Medical colleges are of three classes: first, those maintained and operated as a part of our national and state educational systems; second, those supported by endowment through the favor of some person or organization; and third, those conducted by individuals or groups of individuals as self-sustaining institutions.

These details are set up for the purpose of indicating that no particular difficulty should be encountered in accomplishing the establishment of Chairs of Radiology. The first class of schools embraces those public institutions which are by their very nature subject to the demands of the public interest and operate with their ears pretty close to the ground. The officers of these institutions will undoubtedly be found perfectly wiling to coöperate with this society or the Radiological profession generally in any serious effort to raise the standards of medical teaching as by equipping their students with a more thorough and practical knowledge of all the collateral sciences of medicine. What has been said applies with equal significance to those schools of the second class. And those of the third class will not be slow to adopt methods which will increase student registry once it becomes certain an organization like The Radiological Society of North America is behind the proposition.

By way of comment: Already a few of the more progressive medical colleges are giving instruction in Radiology. Some have established chairs; others are providing lectures. This fact should lend emphasis to the practicability of, and necessity for all other reputable colleges adopting a like course.

Without fear of over-statement, therefore, it would seem to be the duty of members of this as well as other like organizations, to offer their services as instructors and members of faculties for the purpose of assuring the success and certain benefits of such a movement.

At this juncture, forethought suggests the interpolation here that the benefits of this educational undertaking can be very materially increased by the creation and maintenance of a research bureau. Such a bureau can be established by this society single-handed or in conjunction with all other organizations interested in Radiology, as in the judgment of the membership seems best.

In addition to serving the Radiological profession in an utilitarian manner by way of conducting experiments, prescribing protective measures and devices, testing apparatus and equipment, disseminating information, and other duties too numerous to be recited here; conducting scientific explorations for the purpose of benefiting and extending the applicability of the science of x-rays and co-operating with manufacturers of equipment and appliances—such a bureau if properly constituted and conducted, could be of incalculable assistance by compiling in permanent form all the information of value on every phase of diagnosis and therapy pertaining to every branch of medicine and dentistry accumulated by Radiologists in the pitiless school of experience, and supplying it to medical colleges for their use and guidance. This would most assuredly serve to unite theoretical instruction inseparably with good practice and provide a source of constant intercourse between teacher, student, and practitioner—a thing whose benefits for all parties cannot be measured in tangible terms.

Such a bureau would also serve to identify this society and the Radiological profession with constructive leadership, and enable it and them to create greater professional and public confidence in the science of Radiology, expand its uses, and secure the manufacture of apparatus and appliances in accordance with good standards.

So much for this phase of the subject, which involves the scientific side of the proposition.

The question of public relations is one of tremendous importance. A great deal has been said about various aspects of the subject by men in the profession and out, but nowhere has there been the slightest suggestion that it may be possible to organize all branches of the medical profession on some deliberate plan for national social service. Yet that appears to be the way out of the present dilemma. Certainly there is sufficient opportunity in such a program to satisfy every medical man, even the most belligerent advocate of state medicine. For in a comprehensive undertaking to introduce order and purpose into the medical profession to meet the requirements of a large social service, direction will be afforded for all the surplus energies of every man interested in the subject in devising administrative methods by which the great human resources of the country can be safeguarded.

Radiologists are perhaps more vitally concerned with this problem than is any other specitlay of medicine. Radiologists must maintain large investments in physical plant. And those investments have to be considered in arriving at a schedule of charges which the public is asked to pay. Not only that, but those charges must be justified. Quite naturally, therefore, the question of hour cost of operating various classes of equipment in the various classes of cases which pass through the average medical radiologist's laboratory is something to conjure with. And this is not all: there is the additional problem of arriving at the proper amount to be set aside each year for depreciation, interest charges, overhead expenses, diagnostic service, insurance, etc.

These details are mentioned because the public has a very real interest in them. That it is not altogether satisfied with the sort of answers thus far given to its embarrassing questions is pretty conclusively demonstrated by the almost universal effort to establish some form of state medicine, industrial medicine, compensation insurance, and other forms of paternalistic health indemnities, in each of which medical fees are fixed without regard either to money investment in laboratory or in professional knowledge and skill.

It's a long cry from the open sesame of barber bleeding to the present scientific practice of medicine. The distance traversed in so short a period of time is nothing short of remarkable. But the profession has been so intensely occupied with the scientific development of its practice that it has not given any serious thought to the economic or social side. That it must now do at its own peril.

As a beginning, it is suggested a committee should be appointed to study this phase of medical practice, and since this committee is to be a creature of this society, it should give particular attention to the peculiar conditions of the Radiologist. This committee should study operating costs, laboratory investments, depreciation and interest charges, accounting systems, insurance and protective problems, administrative methods generally, for the purpose of making recommendations concerning reasonable charges, classes and kinds of apparatus and equipment best adapted for various kinds of radiographic and therapeutic work. It would seem that each laboratory might be studied with reference to five divisions of cases, i. e. genito-urinary, gallbladder, gastrointestinal, chest and bone.

The information which will naturally result will provide a very tangible basis for outlining a plan of activity which will answer the socio-economic requirements of the profession. Certainly it will dispose of many of the vexatious riddles every Radiologist encounters every day in his regular routine work.

From this base, also, it should be comparatively easy to set up a program which will coordinate the activities, both present and potential, of the Radiological profession with those of all other branches of medicine, and give direction to scientific research and cooperative effort.

It is realized these are major undertakings. It is also realized they cannot be accomplished by a mere wave of the hand. But it is believed they can be accomplished by that steadfastness of purpose which springs from an appreciation of their value, by that sustained effort which has brought the science of medicine to its present state of reputability and respectability, and by that painstaking study of cause and effect which every Radiologist gives every day to cases coming under his observation.

That all these things can be reduced to a common method for a common purpose—the conservation of the public health through an organized medical profession—there is not the slightest doubt. They are the natural problems which go with the science of medicine. They are the problems of leadership. They will be, they must be answered by some organized force, if not by the medical profesison in response to its social obligations, then by economic agencies which will impose certain penalties for failure to function.

The spirit of 1922 is already casting its shadow across the full length and breadth of the medical profession. The opportunity is ours. In all sincerity and fraternity these suggestions are submitted for consideration and action.

State Medicine

A GOOD deal of press comment, professional and lay, has been incited by the recent action of the Board of Trustees of Johns Hopkins Hospital in fixing maximum fees for surgical and medical attendance.

Nowhere, however, so far as has been observed, has there been any serious effort to throw off the sickening shroud of hysteria over fee fixing, and discuss the principles involved once they have been come at: nowhere has there appeared any one imbued with that innate nobility of purpose which is generally conceded an accepted fact with the medical profession, and stripping the situation of all non-essentials, shown the utter futility of following the vicious circle thus set in motion to its logical and absolute conclusion: nowhere has any person, within the profession or without, come forward with the courage of his convictions and tread under an iron heel the implied imputation that the medical profession is evading the full responsibility for its inevitable part as a functioning unit in the composite social structure.

These are the purposes which run through this thesis. Perhaps some of the practices of the profession which have come to be received and recognized as honored customs will fall under the axe. Perhaps some of those practices will be justified up to the point where they give birth to a combination of circumstances and conditions which no self-respecting member of the profesison will tolerate, and then vehemently denounced because they prove themselves not what they seemed. And perhaps, just perhaps, in what is said will be found cause for calling into action some of the latent energies, some of the hidden resources of the profesison to defend that profession against the insidious onslaught of encephalitis.

So that, if in the thousands of words which constitute the English language can be found any vigorous enough to picture the importance of getting right on this question now, if in stumbling about to get at the striking features of the principles woven into the texture of the thing, something is said or implied which will galvanize the profession into certain activity in the development of a specific plan for achieving a better public health, then the effort will have been more than compensated and whatever of calumny may follow will be thankfully received.

It is perhaps well to say here, in order that no misapprehension of intent may be possible, that there is no thought of calling into question the sincerity of purpose of the Board of Trustees of Johns Hopkins Hospital. Nor is there any thought of impugning the motives of the Rockefeller Foundation by which that hospital is maintained under endowment. The Board of Trustees of Johns Hopkins have a very real and distinct trust to perform. That they are performing it with a singleness of purpose which merits the entire approval of every thinking man is proven by the fact already alluded to. And the work which that hospital and that foundation have done in the past, are doing at present, and will most certainly do in the future, is both commendable and invaluable. The human family at large, and the medical profession in particular, abides in profound obligation for the exhaustive and far-reaching research accomplished and planned by the staff of Johns Hopkins and the Rockefeller Foundation.

The irony of the thing is in the fact that such important and beneficial work has not been undertaken under the direction of and prosecuted by the profession as an entity in the discharge of its avowed obligations to serve society in a material and physical way as by conserving the ability of its individual members to do a day's work.

Impossible? Nothing of the sort. The support of the Rockefeller Foundation and many other individuals and organizations of individuals, if such support be necessary to the fulfilment of the purposes of the medical profession, would unquestionably be obtained much more quickly in support of some well-defined health program than otherwise. And there is every indication that cooperation in the accomplishment of any such undertaking which gives assurance of practicality and public weal would have been, is now, and most certainly will in future be more easily secured than finding some man or institution public spirited enough and with enough resources at his or its command to assume the entire burden and stand before the scientific and lay world in the shadow of the consequences inherent in the discharge of such an enormous job.

There is something in this situation beside the dramatic effect of a clash over fee fixing by an institution which was not conceived in the travails of the profession.

What is it? Just this: the question whether the medical profession is willing now for all time to concede that agencies outside the profession are better able to devise and administer a comprehensive public health program than the profession can devise and administer it. If it is willing to admit that, then there is but one conclusion possible: the only way in which any member of the medical profession can ever hope to attain a commanding position of eminence or public respect for worthy achievement is to find some patron saint with oodles of money who is willing to gamble on his ability with no possible hope of personal return.

It is submitted that sort of a condition is unworthy the medical profession. It is submitted that there is a larger sphere of usefulness for every man who by due preparation has earned the right to subscribe to the noble ideals and certain obligations of the medical profession. It is submitted that, in the coordinated activities of the profession as such for the achievement of some inclusive plan designed to build and conserve the public health, will be found ample opportunity for the full expression of the individual initiative and native ability of every member of the profession. It is submitted that in no other way can those members of the profession who love it for what it is, as well as for what it hopes to become, behold in the future the certain achievement of those things they cherish as life itself.

Unless the profession is willing to entrust the future fulfillment of those sacred vows which make it responsible for the life and death of men and women everywhere to some social unit without its control, it must realize immediately that it is not possible to meet the health requirements of more than a hundred millions of people engaged in highly organized industrial and commercial pursuits except by an equally rational and highly organized health program. The fact is, the present demand for a complete socialization of medicine is but the reflection of industrial organization. It is at bottom a demand that the medical profession as individuals bring to the welfare of their respective communities a national purpose, a national interest.

The burden of meeting this test cannot be shifted to the government by the medical profession unless it is willing to accept the other horn of the dilemma, or stated otherwise, unless it is willing to take such pay for its services as the government is willing to give. That is to say, those forces at work in the medical profession covertly and openly suggesting that the question of public health is one for governmental action on the theory that the government as the representative of all the people should assess taxes to finance it, cannot escape the right of the people to say how many medical men they will have and what they will pay them for their services. To assert the one while denying the other is sheer nonsense.

The action of the Board of Trustees of Johns Hopkins is a case in point. That institution, operated as it is on a non-profit basis, cannot consistently permit surgeons and physicians practicing there to conduct their business on a profitable basis. It makes no difference now that the maximum fee for operation has been fixed at $1,000.00 and weekly attendance at $35.00. The precedent has been established and if it shall be found that those amounts are not correctly representative of the principle on which the institution is conducted, it will be easy to revise them downward to the point where, in the judgment of the Board of Trustees, they will represent it. They can do nothing else and remain true to their trust. It is simply the principle of benevolent autocracy pressing down on the medical profession as differentiated from the public generally, and as such it must run true to form or become a thing at which men will sneer for its empty pretensions. And the Rockefeller Foundation, because it is the creature of unexampled individual wealth in all the world, must lay down its course in strict conformity with that rule or forever close the door of public respect and professional confidence in its own face.

All which brings us to the crux of the problem: the medical man can no longer pursue a scientifically individualistic course: he must measure his conduct by those requirements imposed by all the medical profession collectively: and the medical profession as the composite representative of all the people for the preservation and betterment of the public health, must devise and enforce some plan which wil discipline medicine, which will create a permanent public record, and provide that high moral purpose whose mighty impetus will insure continuity of effort.

Precepts Applied

CONSTANT preaching without practice soon becomes odious. Precepts, however good, are valueless except as they are applied and made to fructify in conduct. If you happen to have more regard for deeds than words, the job of avoiding the stigma of preaching by accomplishing something in practice is a good deal like one of those hideous nightmares where you find yourself in a public place half dressed.

For these and many other reasons, The Journal undertakes to discharge that imperative duty which it has consistently asserted devolves on every person or organization of persons seriously interested in substantial affairs. So much has been said in this and previous issues about the importance of a deliberately constituted program that The Journal feels it would be open to criticism did it not make a specific statement regarding its own motivating causes. It will, therefore, endeavor to state with as much accuracy as possible those salient things it is striving to assist The Radiological Society of North America to achieve: and it will go further by saying that it will always endeavor to correctly respond to that inner urge which if pointed in the right direction will accomplish much of benefit for all those persons honorably and legitimately interested in the science of x-rays.

In passing, it hardly seems necessary to further delineate the ideals and purposes of The Radiological Society of North America. They have been stated too often to need repetition here. It is sufficient to say that The

Journal subscribes to them in all sincerity and will be governed by them.

The present effort will be confined to an attempt to give an accurate interpretation of the vision which The Journal holds concerning the ultimate posibilities incipient in the science of x-rays. And that it may profit by having constantly before it a perpetual reminder of its duties, it will endeavor to be so specific in this declaration that neither it nor those persons constituting the science will ever forget that at this particular moment they stand on the threshold of unlimited opportunity for extended scientific service, that they may, if they will, exercise the unparalleled privilege of going forward to the universal use of x-rays in diagnosis and treatment, or by remaining inert and self-sufficient, they can and will, slough off into a restricted sphere of activity through sheer failure to perceive the way of usefulness. In other wordls, the science of x-rays must prove itself a dynamic force in the health structure of the world, or pay the penalty which the public always exacts for a static existence.

All this applies to those physicists and electrical engineers interested in the development of the science of x-rays, as well as to the manufacturers and distributors of apparatus and equipment. Certainly their concern in the question of a broadened influence of the science as expressed by an expanding market because of the universal application of the benefits discovered and applied is just as vital and real as the same question is of paramount interest to the Radiological profession.

Believing that there exists a mutuality of interest which should beget the earnest cooperation of all parties identified with the science, no further discussion will be indulged in these general phases of the subject.

Wherefore, The Journal makes bold to say, predicating its statement on the most meticulous observance of all those conditions and requirements imposed by the ethics of the medical profession and the high professional and scientific standards of The Radiological Society of North America, that it believes it can, and should, serve a four-fold duty as an exponent of the science of Radiology. It holds to the view that it will not have justified its existence unless:

FIRST: It does everything in its power to subserve the public health by employing all proper means and instrumentalities at its disposal to familiarize the public at large with the known benefits and latent possibilities of the science of x-rays diagnostically and curatively.

SECOND: Unless it establishes and maintains intimate contact with as many members of the medical and dental profesions as possible, in order that they may correctly understand the aspirations and limitations of the science of Radiology.

THIRD: Unless it serves as a positive agency through which the best interests of the public may be properly portrayed and conserved, and the activities of the manufacturers of apparatus and appliances coordinated with the needs and ideals of the Radiological profession.

FOURTH: Unless it uses its influence in assisting all these forces to organize into a cohesive unit by disseminating known facts, by striving to point out at all times those developments which are posible through the projection of established principles, and by attempting to preserve that nicety of balance between the public, the profesion, and the manufacturers which will insure a happy combination of past worth with future purpose as a guaranty of present performance.

To be sure, these are enormous undertakings. But they are not larger than the opportunity the science enjoys. And since only in proportion as its vision is comprehensive can a journal of this kind function fully, it is better to state the problem broadly, set the stakes high, and then proceed as far as the combined intelligence of all will carry.

Some of the machinery incident to the results indicated is detailed in the suggested activities for The Radiological Society found elsewhere in this issue. Much remains for the future. One phase of the subject is worthy special emphasis. Greater diligence must be accorded the acquaintance of the public and the profession with full details concerning the accomplishment of medical radiologists in the treatment of eczema, infected tonsils, cancer, venereal diseases, rheumatism, in diathermy, ionic medication, etc. The public health demands it; and if that information be tendered in a proper spirit of helpfulness, it cannot be refused. Nor will it be refused. The fact is, every reputable physician and surgeon worthy the name is always on the alert for assistance which will reflect itself in his patients' welfare.

The Journal believes that the primary object of the Radiological profesion is the universal application of the peculiar scientific knowledge that profession posseses and applies in alleviating human ills. Proceeding from this premise, two major propositions are immediately encountered:

1. The necessity for accurate classification of those ailments in which at present the use of x-rays is of known benefit, with a detailed statement of methods employed and results obtained in each: and likewise classification of those ailments in which exploratory research is in progress, with a detailed statement of accomplishments and failures in each.

2. The methods which can be used most sucessfully in getting this information into the hands of the medical profession at large in such a manner that it will be used in furthering the use of x-rays for the purpose of producing a better public health.

The classifications indicated in the first of these two items will serve to dispose of many mooted questions and will afford everybody a clearer conception of their opportunities and responsibilities, as by establishing a definite line of cleavage between those things which the science of x-rays can defend as accomplished facts, and those things toward the attainment of which it aspires.

The importance of the correct determination and use of the factors involved in the second item begins to strike a responsive chord when one is confronted with the fact that the prosperity or development of the professional and commercial subdivisions of x-ray science is of immediate concern to the general public and to the medical profession as differentiated from the Radiological profession. The public is intensely interested in the development of the science of medicine in all its branches because in that fact it sees the answer to a great economic problem. The medical profession on its part has assuredly expressed its extreme desire to employ all the collateral sciences in the performance of its work. And the manufacturer finds safer ground in a large volume of business at less profit on each transaction. Thus the circle is complete. The various factors are so interrelated that they are absolutely interdependent.

No serious argument can be interposed, therefore, against the proposition that the one big idea into which The Journal can coördinate all these various factors, is an increasing public and professional recognition of the practical usages of Radiology in the diagnosis and treatment of human ailments.

To the attainment of this end, The Journal will attempt to be constructive in its criticisms and suggestions at all times: it will hold that the public welfare is paramount, and will measure its opinions and actions by that fact.

Dropping to the commonplace for a moment: attention is directed to the fact that among more than a hundred thousand physicians and surgeons in the United States will be found less than two thousand medical radiologists, meaning by the latter term graduates of reputable medical schools specializing in the practice of Radiology. The present population of the United States exceeds 100,000,000 of people, more than fifty per cent of whom are suffering from some disease according to the United States Surgeon General's statistics. This means that for every practicing medical radiologist there are more than 25,000 potential patients for diagnostic and curative application of x-rays. Of course, not all of these persons are suffering from ailments where x-rays would be beneficial diagnostically or curatively. But from the classifications made by the Surgeon General and the extensive use of x-rays by the medical corps of the U. S. Army, it is safe to assume that at least half of them would be benefited by the use of x-rays in one instance or the other, or both. Based on three hundred working days in the year, this would mean, if all those persons were receiving x-ray attention, that every medical radiologist would have more than forty new patients every day without counting those returning again and again for treatment purposes.

No sane man will contend, of course, that the medical radiologists of the country are enjoying any such fabulous practice. But the point is, there is a tremendous opportunity for the development of the science, first in its beneficial application, and second, in the kind of educational work which will bring the benefits of the science to the notice of all these people.

At the present time, approximately ninety-five per cent of those persons actually receiving x-ray examination and treatment do so at the suggestion of the attending physician. Only five per cent voluntarily go to an x-ray specialist or demand his services while under the care of a physician or surgeon. These observations are made because they indicate pretty clearly the hiatus which must be bridged before the broad functions of the science of x-rays will be certain of fulfilment.

The medical profession, and through it, the public, must be kept fully informed of the certain benefits and possible uses of x-rays. This statement is made with full cognizance of the fact that everybody knows there is such a thing as x-rays. The difficulty with the situation is that the public generally—indeed the same thing applies to many practicing physicians, surgeons and specialists—is not aware of the splendid results obtained by medical radiologists in genito-urinary disorders, gastro-intestinal disturbances, malignancies of one kind and another, and so on. The public has been told about the value of x-rays in the exploration of bony structures. But there it stops, because that is where its information stops. It has been fed up with a lot of wild hallucinations about the dangers of x-rays, but absolutely nothing contrariwise.

Certainly those persons concerned first-hand with the successful development of the science of x-rays should have faith enough in that science, should be enthusiastic enough about what it has accomplished in the brief period of its use, and what it bids fair to achieve in the immediate future, that they can without any loss of dignity or prestige, and without the violation of any of the ethics of the medical profession, stand four-square before a world which is confessedly athirst for specific knowledge that will aid in the prevention and cure of disease.

Knowledge is power. And The Journal proposes to lend its support to the development of the science of x-rays in order that knowledge of the subject may be materially increased and the power of the medical profession in preserving the public health greatly enhanced.

With these things constituting its ultimate aim, The Journal will:

1. Endeavor to conform its every act with, and give unrestricted visualization to, the purposes, ideals, and standards of The Radiological Society of North America. In this it will include all other reputable organizations whose incontestible purpose is the progress of the science of x-rays and the technique and apparatus thereof.

2. By constructive and impartial discussion seek to command the certain recognition of and be wholesomely supported by the various specialties of the medical profession as well as the profession in toto. In this way The Journal hopes to stimulate the free interchange of accomplishments and desires between all branches of the profession so that the limitations of each and the peculiar benefits of all others will be instantly perceived, guarded against, and utilized without stint in every activity affecting private welfare or the public health.

3. Endeavor to demonstrate as practically as may be, all things considered, every major idea advanced either on behalf of the public, the profession, or manufacturers of apparatus.

4. Judge every condition sought to be corrected and every cause promoted by the test of its applicability to the diverse ramifications of the public welfare.

The Journal assumes to undertake such a comprehensive program because it is of the firm opinion that thereby:

1. It can be of greater usefulness to the public, The Radiological Society of North America, the Radiological and medical professions, and the manufacturers and distributors of x-ray apparatus and equipment, diagnostic and explorative instruments, and supplies of every kind designed to facilitate the determination of the correct situs and character of all manner of human ills.

2. It can engender much favorable editorial and news comment and bring to the science of radiology as a vigorous factor striving to conserve private and public welfare, champions whose hands will not be stayed by any misconception of public interest.

3. It can inculcate into the science of x-rays that happy combination of active public and professional participation in the attainment of a broad and exact sphere of usefulness which will bring unequivocal credit to it and to the medical profession as a whole.

The Journal appreciates that the working out of such an extensive program will require an enormous amount of study and call for lavish expenditure of energy and time. But it is perfectly willing to assume all the responsibilities devolving upon it as a comprehensive Journal of Radiology. Perhaps it may at times seem hopelessly involved in the maze of complications incident to the coordination of so many interests into a common plan. But it will never falter in its determination to bring to the public health a constantly increasing application of the beneficial properties of x-rays wisely administered.

DEPARTMENT OF TECHNIQUE

The Elbow

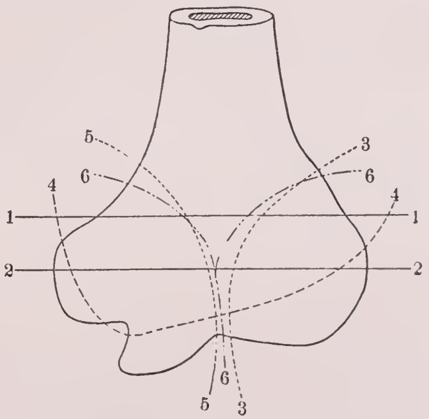
IT is always necessary to make plates in the antero-posterior and lateral planes or, if this is impossible, a set of stereoscopic plates will usually give the desired information. In fact, we find it helpful to make one plate in the antero-posterior plane and a pair of stereoscopic plates in the lateral plane as a routine. The latter are very helpful in determining the source of a piece of loose bone or in getting a good understanding of the relationship of the different articular surfaces.

One of the most difficult tasks set for the radiologist is to determine the presence or absence of a fracture of the lower end of the humerus in the young before ossification is complete. It is advisable for the radiologist to make plates of normal elbows of children at different ages up to the time of complete ossification and to mount these in a viewing box where they will serve as an atlas of normals for ready reference.

Another point which will serve the radiologist well is a good knowledge of the anatomy of the lower end of the humerus. The fact that all fractures of the lower end of the humerus (save that of the epicondyle) are inside the joint capsule makes them always serious and the outlook grave. We believe, however, that when the surgeon thoroughly understands the anatomy and pathology and mechanics of reduction, together with proper after-care, that the great majority of these fractures will result in good function. We feel that every radiologist and every surgeon dealing with fractures should master that most excellent monograph on Fractures of the Lower End of the Humerus, by Ashurst. Although this book has been published several years, it still stands without a peer in this field. The classification of fracture of the lower end of the humerus as given by Ashurst is as follows:

1. Supracondylar.
2. Diacondylar.
3. External condyle.
4 Separation of entire lower epiphysis.
5. Internal condyle.
6. Intercondylar, T. or Y.
7. Trochlea.
8. Epitrochlea.
9. Epicondyle.
10. Capitellum.

The classification is arranged in the order of their frequency, the first three comprising the great majority of all fractures.



After Ashurst—Lines showing position and direction of different types of fractures of lower end of humerus, the numbers corresponding to the types in the classification above.

The radiologist will be helped by the knowledge that the lower epiphysis of the humerus is horse-shoe shaped and that the first center of ossification to appear is the one for the internal condyle. In the normal elbow of the child this rounded bone shadow will stand distal to the shadow of the shaft on the ulnar aspect and slightly anterior to the shaft. Frequently, one is able to determine the presence of a fracture by the shifting of this center of ossification even though the line of fracture extending through the cartilagenous portion is not demonstrable. In no case is it more important to correlate the physical findings with the radiological findings than in fractures of the lower end of the humerus in the young.

The actual exposure technique used by us is as follows:

	KV	SG	Dis.	Ma.	—Time— Film	Plate
A.P.	50	5	26	30	1-1½ sec.	2-2½ sec.
Lat.	50	5	26	30	1-1½ sec.	2-2½ sec.

NEW EQUIPMENT

The Victor Deep Therapy Unit

FOR those contemplating the installation of new equipment either for the first time or in replacement, it should be gratifying to learn that the Victor X-Ray Corporation has combined the more important of its latest devices into what it is pleased to announce as a Deep Therapy Roentgen Apparatus.

Briefly, the outstanding component features of this new unit comprise:

1. High voltage transformer capable of producing and operating at 280,000 volts, or an equivalent of twenty inches spark gap. This transformer carries a "Snook" cross-arm rectifying switch.

2. A control stand on the panel of which are mounted the motor switch, x-ray switch, polarity indicator, volt meter, Coolidge Filament Control, and resistance control.

3. A deep therapy table, whose especial feature is a tube stand with a travel of 44 inches lengthwise, operating on four ball bearing wheels riding on tracks; a tube holder with a travel of 10½ inches across the table, and a 60 degree tube tilt, i. e., 30 degrees on each side of the vertical crosswise of the table; a 40 degree tube tilt, 20 degrees each side of the vertical lengthwise of the table. Calibrated scales in degrees cover all these tube tilts.

By means of a rack and pinion, the tube holder can be raised or lowered over a travel of 22 inches. With the tube in the lowest position, the distance from the center of the tube target to the table top is twenty inches; the maximum is 42 inches. The 8-inch lead glass bowl is mounted on a swivel providing complete rotation, a rack of filters is provided, and any of the positions obtained by the tube can be retained by lock-clamp.

4. Filament Transformer — practically the same as the standard Coolidge filament transformer used in connection with 10-inch spark gap. Provision has, however, been made for the additional voltage.

5. Victor Kearsley Stabilizer—It is suggested that the stabilizer forming a part of this unit be suspended from

the ceiling with two milliampere meters in series. The two meters, it is asserted, provide a double check on the milliamperage through the tube, one meter checking the other, and making certain of correct tube current.

6. Coronaless Overhead System—Special tubing has been designed for this outfit of three-quarter inch diameter, which when suspended 18 inches from the ceiling on insulators designed for 280,000 peak volts, will prevent corona.

7. New Coolidge Deep Therapy X-Ray Tube—Follows Coolidge Universal type of tube construction. It is built to operate at a voltage not exceeding 200,000 peak volts, at which it will stand a current of 8 milliamperes.

8. The Victor Sphere Gap—The only instrument of absolute precision for peak voltage measurement. This particular device was discussed at considerable length in the September issue of The Journal.

The Victor Corporation, at the time of announcing this unit, also brings out The Victor Bucky Diaphragm Table, the trough of which extends the entire length. The arc of the trough corresponds to the radius of the grid of the diaphragm, which is mounted directly underneath and traverses the entire length of the table on roller bearings. This movement is in unison with the tube stand to which it is locked. This table carries with it a false top so as to make it a piece of apparatus of universal utility and avoid the necessity of purchase of two tables. Another added feature is the fact that the Victor Compression and Immobilizing Device has been adapted to this table.

On the whole, this outfit represents all the latest Victor accomplishments in new apparatus and equipment, embodying all the well-established principles that have come up with the profession, and is a long forward step in the direction of duplication of dosage and standardization of technique.

Patterson Cleanable Intensifying Screen

THE first public exhibition and announcement of the new Patterson "Cleanable" Intensifying Screen was made at the annual meeting of The American Roentgen Ray Society in Washington, D. C., September 27th, 28th, 29th, and 30th.

This screen is a very real advance in screen manufacture. Of course, most radiologists and technicians appreciate that the chief cause of damage to intensifying screens is dirt, dust, and other foreign particles which in some manner become attached to the surface of the screen, becoming imbedded in the emulsion and thus preventing removal.

The Patterson "Cleanable" is impervious to dirt or dust which may work into the cassette or settle on the screen when lying open on the table. It also resists smearing materials like soot, crayon, lead pencil or aluminum marks.

The screen is also waterproof. Thus any dust or liquid spilled on the screen can be wiped off without damage. Developing solutions have no effect on the screen provided they are not permitted to dry down. These solutions carry a precipitate which leaves an indelible stain if permitted to dry down before removal. The cleansing of this screen should be with a piece of cotton cloth and soap and water. The screen should not be dipped into a bath or held under a spigot.

Patterson guarantees the same standard quality in this screen that has characterized Patterson products for years: it may be used as Standard or Special, and in either position in double screen technique.

Wappler Radiographic and Fluoroscopic Table

As usual, Wappler Electric Company is on the market with something decidedly advantageous in a table for radiographic and fluoroscopic work. The table incorporates the well-known Wappler Counter-balanced, gravity operated plate changer; a trochoscope mounted on rails beneath the table and travelling its full length; a stereoscopic tube-stand, also mounted on rails and travelling the full length of the table; and as a part of the tubestand a combination device for holding the fluorescent screen for fluoroscopy. This device has space for a 11x14 cassette, making possible radiography from the underside of the patient.

The table itself is largely of wood construction, beautifully finished in mahogany.

ABSTRACTS AND REVIEWS

Stereoscopical Roentgenoscopy and a New Apparatus for its Application. J. Van Ebbenhorst Tengbergen, "Archives of Radiology and Electrotherapy," No. 252, Vol. 26, July, 1921.

CONSIDERING the marked advantage of stereo Roentgenoscopy, the author expresses his wonder that it is not in more common use, and states that he knows only one radiologist using this method of stereo fluoroscopy. He goes into the principle underlying this procedure and then describes his device, which consists essentially of a single stereoscopic tube, or twin Coolidge tubes, wired in opposite directions in the secondary circuit and this can be operated with or without a rectifying device. The lead is taken off to operate the dual electromagnets of his instrument, which he has designated as a "SYNCHRONOSCOPE." This instrument works in a similar way to the ordinary kinematograph shutter by a revolving shutter with its blades running in synchronism with the appearance of the fluoroscopic image from the twin tubes in such a way that the left eye is covered while the left tube is excited, and when the right tube is excited the shutter has turned sufficiently so that the left eye is free to visualize the screen image, while the vision of the right eye at this instant is blocked. In this way the rapid alternation produces a pseudo stereoscopic effect which aids materially in visualizing the object being examined.

He has extended his experiments to apply the method to the projection "x" by using duplicate plates thrown on the screen by two lanterns with the aid of the synchronoscope, but in order to visualize it properly each observer must be provided with another synchronoscope.

NOTE:—This instrument appears essentially the same as that described by Doctor Eugene Caldwell in the "American Journal of Roentgenology," page 547, No. 12, Vol. 5.

x—Of the stereoscopic image on the screen.

L. K. POYNTZ.

Intestinal Radiography for Chronic Appendicitis. L. Erasmus Ellis, M. D., "Archives of Radiology and Electrotherapy," No. 252, Vol. 26, July, 1921.

THIS paper begins with favorable comment on the advance made in abdominal diagnosis by aid of Roentgenography during the past few years. He describes the technique used in his examinations, which consists of the administration of 20 to 25 ounces of an opaque milk meal, the patient in the standing position behind a Fluoroscopic screen. Deglutation is watched and a recording plate is made of the stomach at once, and at intervals varying according to the particular indications of the case, (but chiefly one, three, seven, twenty-four, forty-eight and seventy-two hours after ingesting the meal) additional plates are made, supplemented by further fluoroscopic examination.

As a result of his experience he now concludes that "chronic appendicitis is no longer merely a name, but an actual entity with such a constant analogy of signs as to constitute almost a classical picture. These he enumerates to include : (a) reflex erratic spasm of the stomach with a delayed emptying time; (b) a Lane's kink which he claims nearly always exists; (c) appendix may be shown apparently adherent to the terminal ileum; (d) he regards the kinking, clubbing, or segmentation of the barium contents as pathological—this latter condition he describes as "sectional." (e) the non-filling of the appendix is often significant of a chronic inflammation which has resulted in an obliterating sclerosis; (f) delay in the terminal ileum with a hypertrophy or dilation of this gut is frequent; (g) drawing down with a resultant kinking of the hepatic end of the transverse colon into the right iliac fossa he considers as a constant sign. Any or all of these signs may be present in a single case and often give the clue to the Clinician of the cause of the vague clinical symptoms or complaints of gastro - pyloro - duodenal - dyspepsia, where no suspicion of the appendix appears from clinical examination.

Eight cases are then cited illustrated by a similar number of radiographs. The case histories, the roentgen findings are briefly gone into and the surgical findings checked. He is very honest in admitting his errors and he reiterates what he considers the "four cardinal signs", which he designates as the "syndrome":

1. Delay in the progress of the meal in the ileo-caecal region.
2. A Lane's kink.
3. Controlling pathological appendix.
4. A kink in the proximal portion of the transverse colon.

L. K. POYNTZ.

A Case of Large Penetrating Ulcer of the Lesser Curvature. F. Herman-Johnson, M. D., -'Archives of Radiology and Electrotherapy," No. 252, Vol. 26, No. 2, July, 1921.

THE writer cites the case of a patient, 60 years of age, whose clinical history and Roentgen findings show conclusively a large penetrating ulcer of the lesser curvature of the stomach. Operation was refused, so medical treatment, consisting chiefly of rest and milk diet, was instituted with a complete amelioration of the symptoms. An interval of several months of ease followed this. There was a gradual reappearance of the symptoms and eighteen months from the date of the first Roentgen examination he was re-examined by this method and an attempt was made to duplicate the conditions under which the original plate was made. This showed a perfect silhouette of a normal stomach. However, another view from a different angle showed that there was still some excavation at the site of the original ulcer.

The writer points out the total inadequacy of a single plate for gastrointestinal diagnosis and calls attention to the apparent healing, though only temporary, of this large ulcer cavity, under medical treatment alone.

The article is illustrated by three excellent plates.

L. K. POYNTZ.

Research and Radio-Therapeutics. As Reported in "Archives of Radiology and Electrotherapy," No. 252, Vol. 26, No. 2, July, 1921.

IN view of the rather brilliant results that have been claimed by Professors Seitz and Wintz of Erlangen, in Bavaria, there has been appointed a committee consisting of Sir William Milligan, Professor H. R. Dean, Professor W. L. Bragg, Dr. Powell White, James Watts, Esq.; Dr. A. Burrows, and Dr. A. E. Barclay for the investigating of their methods and claims. The sum of £4,000 has been donated and set aside to defray the expenses incurred in this investigation and the manner suggested to accomplish this end is the appointment of a scholar for a period of two years who shall visit the Clinic at Erlangen, Frieburg, Berlin, Mannheim, and other centres in France, Holland, and Sweden, as are considered desirable. This scholar is to furnish a preliminary report of his visit to Erlangen and if this report is favorable a complete equipment is to be purchased and sent to the Manchester Royal Infirmary to carry on the investigation there. This will be done by the scholar on his return from the Continent and there will be placed at his disposal the complete facilities of the hospital, consisting of three other equipments. The sum of £350 per annum will be offered as salary with an additional £50 as travelling allowance. Because of the amount of work undertaken the announcement states that it is probable that assistance and collaboration from others will be required.

NOTE:—This announcement is being abstracted because it is a rather significant step being taken by the British school to find out the real truth about the intensive x-ray treatment of cancer as practiced in Germany and I believe will be of interest to the radiologists of this country.

L. K. POYNTZ.

Clinical Features as the Determining Factors in the Application of Radium and Roentgen Rays in Malignancy. Dr. Paul Eisen, Detroit. Jour. Michigan State Medical Society, February 3, 1921.

THE physical and biological aspects in the treatment of malignancy usually crowd out the clinical considerations. The most important clinical feature to consider is to determine if the tumor is localized or metastatic. Even if the latter, it may need treatment. Operability and prognosis enter in.

The second clinical feature of importance is to determine how rapidly the tumor is growing. Any part of the body may be treated by roentgen ray. The resistance of the patient to malignancy is the all-important question. Patients react differently.

A third clinical factor to determine is the origin of the tumor. Cancers of the bladder, the tongue and vulva, and some periosteal cancers and chondrosarcomata yield very poorly.

The greater the age of the patient, the greater the resistance. Malignancy in the young travels fast. The longer a patient has a cancer, the easier it is to attack it. Cachexia is a disastrous feature. The intervals between treatments depend on the patient's tolerance. Surgery must go hand in hand with roentgen ray and radium—their use must be complementary. Infections increase the rapidity of spread and lessen the chances of recovery. If pain does not disappear under treatment the prognosis is bad. Hemorrhage generally ceases. The blood supply must be conserved. Organs with a large blood supply, such as the thyroid, must be treated carefully. The blood and urine must be under constant control where heavy dosage is applied. It is suggested that tumors generally produce immunity in the body.

A resultant scar in malignancy is a clinical manifestation that the lesion is healed. Contradiction of the whole area is a good sign.

These remarks apply to localized malignancy only. The clinical features determining the method of raying generalized malignancy are different.

E. W. R.

Symposium on Uterine Cancer and Irradiation. Drs. Rex Duncan, Los Angeles; Henry Schmitz, Chicago; John G. Clark and Floyd E. Keene, Philadelphia. Jour. A. M. A., August 20, 1921; pp. 604-620.

THESE three papers were read before the section on Obstetrics, Gynecology and Abdominal Surgery at the seventy-second annual session of the Amedican Medical Association. They cover nearly every phase of the subject. The high standing of the authors, whose opportunities for handling a large number of cases assure them a careful hearing, demonstrates the importance of radium in carcinoma of the uterus. One is chosen from the west, one from the middle west, and two together present a paper from the east. This gives them a wide range of experience.

In each paper careful attention is paid to the history of radiation treatment, to the physical aspects, to the pathologic changes, to the technique and to the results. The conclusions are brief and are as follows:

Dr. Duncan:

1. Uterine cancer, when given early and appropriate treatment, is curable in a large percentage of cases.

2. Curative treatment depends on early diagnosis. It is necessary, therefore, to extend public knowledge so that women will consult the physician early.

3. The profession must be more keen in the early recognition of uterine cancer, and greater attention should be given to the removal of chronic irritation and the extirpation of precancerous lesions.

4. Appropriate radium therapy in recurrent and inoperable carcinoma surpasses any known therapeutic agent. Pain, hemorrhage and odorous discharges are relieved, and there frequently occurs prompt improvement in the general condition of the patient. Life is prolonged, and there results a comparatively high percentage of clinical cures.

5. Radium therapy, when employed by one with adequate facilities, skill and experience, is the treatment of choice in early, or so-called operable, carcinoma of the cervix. It avoids operation with the attendant suffering, invalidism, complications, and high immediate mortality. Symptoms are promptly relieved, and there results a higher percentage of cures than from surgery or any other method of treatment.

6. The efficacy of radium therapy depends on an adequate quantity of radium or radium emanation and appropriate facilities, together with sufficient knowledge and experience for its proper application. Proper dosage and technique are of the utmost importance.

Dr. Schmitz:

1. Prophylaxis plays an important factor in the treatment of cancer.

2. Classification of uterine carcinomas is of paramount importance to separate localized from the more advanced cases.

3. Localized carcinomas must be treated by surgical methods, preferably with the use of the actual cautery, while the borderline and advanced cases should be referred to ray therapy.

4. A combination of surgery with radiotherapy is not advisable. However, a combination treatment of gamma and roentgen rays assures better results than the application of either agent alone. The radium must be inserted into the cervical canal, while the roentgen rays are applied through the suprapubic and sacral regions. This also renders the treatment available for all classes of patients, owing to the lessened expense.

5. It is hoped that with an improvement in the technique, permanent recoveries will become more numerous.

Drs. Clark and Keene:

1. Radium in 100 mg. amounts will yield most gratifying results if properly applied.

2. To pursue a set course without variation in the frequency of treatments regardless of the progress of the healing is hazardous.

3. To attain the best results, the first irradiation should be done under nitrous oxid anesthesia, as a more careful examination may be made, and the radium more advantageously brought in contact with the malignant areas either through radium tubes or by radium needles. Gauze packing instead of metal shields should be used for protective purposes.

4. The process of cure passes through three stages: local destruction, connective tissue formation, and hyalinization.

5. A hysterectomy after successful irradiation of an otherwise inoperable case is hazardous and does not promote the best interests of the patient.

6. Results of irradiation in cancer of the cervix practically remove this class of cases from the surgical field, although we have not yet completely yielded this point.

7. Cases of cancer of the fundus, unless too far advanced, or unless there is a critical surgical contraindication, should be submitted to hysterectomy, followed from fourteen to twenty-one days later by a light irradiation of the vaginal fornix.

8. Irradiation is dangerous immediately before or soon after an operation, or when employed in fresh operative fields.

9. Frequent repetitions of irradiation are probably unnecessary and possibly hazardous, as the foregoing observations point to the fact that the chief blow is struck at the first application.

10. The frequency of irradiation fistulas may be reduced to a minimum or almost completely avoided by the application of a well placed vaginal pack which removes the healthy tissues from the zone of intensive emanations.

ABSTRACTS OF DISCUSSION

Dr. William P. Graves, Boston: The propaganda for general education goes on. The good that radium has done is witness to this fact. If radium never cured a case the wonderful good accomplished by palliation has been a boon to humanity. Rarely can a patient not be helped. Operability depends on whether the patient can be cured by operation. Results around Boston do not warrant condemnation of the operation to cure cervical cancer.

Dr. Ochsner, Chicago: For years the cautery in carcinoma of the cervix had been used in the Ochsner clinic. During the last four years the number of operations has been reduced. In the last year none have been operated upon and all have had radium. A section for pathologic examination is not advisable because of the danger of metastasis. Radium can be introduced under spinal anesthesia without any discomfort to the patient.

Dr. Taussiz, St. Louis: There is no routine radium treatment for cancer of the cervix. Every case has to be handled differently, with different amounts of radium, of filtration, and different dosage. Morphine-scopolamin anesthesia is useful in applying the radium and the packing. This should always be done in the knee-chest position.

Dr. Schmitz, Chicago: Radium can be effective for only 3 cm. in any direction. For reasons of this limitation roentgen ray irradiation is combined with it. Every patient should be treated the same, by one standard method. The disease and not the patient should be treated.

Dr. Keene, Philadelphia: Treatment should not be by rule of thumb, but by adaptation of method to the patient. Local anesthesia is useful. Emanation needles in the broad ligaments have never resulted in harm in our hands.

Dr. Duncan, Los Angeles: Even if there are no cures, the palliation is superior to any other method. Cervical carcinoma is not surgical and should be treated with radium.

E. W. R.

Radium in Carcinoma of the Uterus. William Kohlman, New Orleans. Surgery, Gynecology and Obstetrics, August, p. 159.

THE use of radium began as a palliative in malignancy. The results obtained have made a place for it in treatment as an adjunct to surgery, and often rivaling and even exceeding it in results obtained. The low operability, the high operative mortality and the low percentage of cures of surgical treatment give encouragement to any method which promises better results. The palliative and curative results of radium have been surprising.

In inoperable carcinoma the treatment of radium is the method of choice. Preoperative radium treatment is advantageous, but it should be followed by early operation. Late operation following radium treatment is difficult. Post-operative treatment is the routine. Post-operative radiation by the roentgen ray may be used instead of radium.

On the question of the use of radium in early operable cancer of the uterus there is a division of opinion. Such cases treated by radium, because some complication contraindicated operation, have done surprisingly well. Surgery could not have done better. Less frequent local recurrence was observed.

Claims for the great value of radium must not be over-emphasized. Cures can only be expected in early cases.

Radium radiation is considered effective at a distance of from 3 to 5 centimeters. Combined radium and roentgen radiation should increase the value of treatment. Within three to four days there are apparent decided evidences of the effect of the radiation. The tumor lessens in size, due to destruction of the cancer cells and the slow formation of connective tissue. In order to lessen the blood supply the internal iliac and ovarian arteries are ligated as early as possible. Of twelve cases treated in this way, six are clinically for periods ranging from three months to one year and eight months. Some of these were advanced cases.

Since June, 1915, 96 cases have been treated in the Touro infirmary by the author, 56 by radium alone. Improvement was obtained in practically all. Recurrence or failure to respond promptly were considered ill omens. Most of the cases were advanced and inoperable.

SUMMARY OF RESULTS

Group 1. Carcinomata which are early and easily operable: (a) Cases treated with radium only. (b) Cases with panhysterectomy and post-operative radiation.

Group 2. Carcinomata that are doubtful and inoperable. (a) Cases treated with radium. (b) Cases treated with ligation and radium.

Group 3. Recurrence of carcinomata after panhysterectomy.

	Living	Dead	No Report	Tot.
Group 1				
(a)	4	1	1	6
(b)	5	4	0	9
Group 2				
(a)	22	22	12	56
(b)	7	5	0	12
Group 3	4	4	5	13
				96

The technique is simple. Silver tubes and 25-50 mgm. of radium in a 3 mm. brass filter and a finger cot are packed with gauze in the cancer crater. The packing is arranged to protect the bladder and rectum. Later the cervix is treated. In most cases the periods of treatment were eight to ten days apart. Examination was made from every four to six weeks. The rule is followed to treat every three months all cases that are clinically improving.

E. W. R.

X-Ray After Inflation of Pelvic Cavity. Dr. Reuben Peterson, Ann Arbor, Michigan. Surg. Gyn. and Obs., August, 1921, p. 154.

THIS is not a new procedure, but it has not been generally adopted as an aid to pelvic diagnosis. There was early prejudice against the method because it was supposed that little additional information could be detected, and for fear of the dangers. Bimanual examination aids in the diagnosis of inflammatory pelvic lesions, but it does not go far enough. Long experience made the author rather sure that he could tell all there was to tell after a bimanual examination, but he does not think so now. To one who is honest with himself and knows he makes mistakes, this method will be helpful and lessen the number of errors. Exploratory operations are fewer. More exact diagnoses are made.

Over 150 cases have been injected without any injury to the patient. This agrees with Rubin and Stein and Stewart. Such evidence is more valuable than any theoretical considerations.

Discomfort is common, and dependent almost entirely on the amount of gas inflated. As little as possible should be used. From 600 c.c. to 1,000 c.c. is sufficient. Inflammatory lesions increase the discomfort. Discomfort can be largely controlled by the slow introduction of the gas.

Carbon dioxide gas has supplanted the use of oxygen because of its rapid absorption, hence the brief period of discomfort. In 15 or 20 minutes the patient is comfortable. The rapid absorption does not prevent good work if the technique runs smoothly.

Transuterine gas inflation: The gas is passed with the patient in the Sims position. A uterine cannula is introduced after iodine sterilization of the cervix. The gas is introduced with no more than 200 mm. pressure. If gas passes freely, 500 to 1,000 c.c. are allowed to enter. The plate is then taken as if the inflation were through the abdominal wall.

Transperitoneal gas inflation: Most cases are handled by this method. The Rubin technique is employed for guaging the gas. Patient is in moderate knee-chest position, changing to Trendelenburg. The plates are then made in the usual manner.

SUMMARY

1. The uterus, together with tubes and ovaries, can be clearly shown by pneumoperitoneal roentgenography.

2. The tubes are more easily shown following the inflation by the transuterine route.

3. On account of rapid absorption, CO_2 would better be used.

4. Irregularities of the uterus, omental and bowel adhesions are clearly demonstrated.

5. By this method, diseased appendages may be more easily and accurately diagnosed.

6. The use of the knee-chest and Trendelenburg positions requires less gas, hence less discomfort.

7. If technique is good, retention of bowel loops in the pelvis is a proof of adhesions.

8. The pneumoperitoneal x-ray makes earlier diagnosis of pregnancy possible. The transperitoneal route is always used. (See discussion).

9. Both methods are free from danger.

10. Bimanual pelvic examination and pelvic pneumoperitoneal roentgenography are not antagonistic diagnostic methods. Each is valuable, and the value of either is enhanced when used conjointly.

The Treatment of Carcinoma of the Cervix and Uterus by Radium Supplemented by Deep Roentgen Therapy. Dr. R. H. Boggs, Pottsbury, Pa.

SURGERY has made no progress in the treatment of carcinoma of the cervix and uterus in twenty years. Refinement in technique has reduced the operative mortality but it has not lessened the ultimate results. Radiology and cautery have effected the only advancement. Carcinoma of the cervix is still a surgical disease, but cooperation between the surgeon and radiologist is necessary to obtain the best results. The radiologist must have sufficient radium and considerable experience to do the best that can be done. Too much work is being done poorly. Many methods of procedure are being followed out. Radiation is being given in so many ways that it is hard to draw conclusions.

Instead of hopeless cases, borderline and favorable cases are coming for radium treatment. Removing the local lesion is not so important as destroying the lymphatic invasion.

Radium destroys disease at a greater distance than the knife can reach. The pelvic glands should be rayed in all cases. The extent cannot be told by the size of the primary lesion. If 7 or 8 per cent of the cases coming for treatment of carcinoma of the cervix are free from disease in five years, then at least 90 per cent should have the benefit of radium.

When radium is used as an acute operative procedure, the operation should be performed within from four to eight weeks before fibrous formation has taken place. Observers report that 30 to 60 per cent show parametrial involvement at the time of operation.

Probably the only cures following the Wertheim operation are those in which there was no glandular involvement. Proper radium treatment locally, supplemented by deep roentgen therapy, would have given more cures.

On account of the rapid spread of the cervix and the hopeless condition so soon reached makes any amount of palliation from radium treatment mean much to the patient. Today radium is indicated as a palliative measure for hopeless inoperable and recurrent cases, as an antioperative procedure, and for prophylaxis after surgical removal. Lately radium is being used for some primary cases in carcinoma of the cervix when the disease extends into the cervical canal. The malignant process should be treated by radium promptly.

Radium will clinically cure many cases. It is a specific palliative. If recurrence takes place the patient suffers infinitely less. The hemorrhage and discharge ceases. In two to four weeks the local condition improves and clears up. The deodorizing and disinfectant work of radium is remarkable.

From 3,000 to 6,000 mg. hours of radium, filtered by 1½ mm. of brass and sufficient gauze and rubber to make 15 mm. of filtration, are usually employed in the cervix and vagina. Three tubes are usually introduced, one in the cervix and one pointing toward each broad ligament. Due precaution to prevent injury of the bladder and rectum is taken.

At present there are several methods of applying filtered roentgen rays to the deep lymphatics. They are all producing about the same results if the technical points are known and sufficient lethal doses applied.

E. W. R.

X-Ray Treatment of Basedow's Disease. Dr. I. S. Trostler, Chicago. The American Physician, April, 1921, p. 289.

THE thyroid is the balance-wheel of metabolism. When normal, it influences oxidation so that no function is disturbed. When over-active, it causes the well-known symptoms of Basedow's disease. The main problem now is: What is the best means of slowing down these over-active, overworked glands?

Drugs may be administered, but the patient will not get well. Surgery cures but one-half of the cases operated upon, and many cases are too poor risks for operation. Crile now advocates non-surgical treatment. Surgery has an operative mortality of 3 to 6 per cent. It requires eighteen months to effect a cure. Fully 90 per cent of all cases are cured by x-ray therapy.

REASONS FOR X-RAY THERAPY

1. There is no harm, and past results show that many have been cured.
2. There is no operative risk.
3. There is no fear of operation.
4. There is greater likelihood of cure and less likelihood of recurrence.
5. There is likelihood of earlier cure, and shorter period of disability.
6. There is no scar on the neck.

The effects on the gland are simple. There is lessening of the activity of the gland by an obliterating endararteritis of the blood vessels. It is as sure as ligation without the risk. Besides, there is a sedative action on the gland cells themselves. Treatments are continued until the action of the gland is normal.

Da Costa and the Mayos advocate roentgenization before operation in order to lessen the activity of the gland.

Four to eight full-dose treatments are necessary to effect a cure. A full dose may be given every 21 days except in the most toxic cases.

Because of the failure to secure cures in a small number of cases, it is necessary to treat the thymus area.

Of course damage to the heart or other organs which has already occurred cannot be remedied. But the damage will stop where it is and the repair will be surprising. In a few treatments all the symptoms improve. Even the exopthalmos, the last to improve, usually disappears entirely.

The treatment cannot be given except by an experienced physician.

E. W. R.

Roentgen Therapy in the Treatment of Carcinoma of the Breast. Dr. H. M. Stewart, Johnstown, Pa. Pennsylvania Journal of Roentgenology, July, 1921.

IMPROVED apparatus has increased the efficiency of roentgenotherapy. Good results require special attention to the therapeutic side of roentgenology. "Early diagnosis, early radical removal of the infected field by the roentgen method" was advocated by Dr. Leonard twenty years ago.

Four out of five cases operated before glandular involvement get well. When axillary glands are involved, the ratio is reversed. When supraclavicular glands are involved they usually consider the case inoperable. According to Pfahler, Boggs, Todd and Deane, 25 to 50 per cent more are cured by thorough pre- and postoperative roentgen therapy.

Mayo speaks of the importance of the lethal dose sickening the malignant cells and forming fibrous tissue and a barrier to the spread of the disease.

The mammary gland has more lymphatics than any other part of the body. X-ray causes an atrophy and partial obliteration of the lymph channels, as well as destruction of the cancer cells.

Medullary carcinoma usually responds more rapidly to radiation than the scirrhous type, but it grows more rapidly and demands earlier effective treatment. The health of the patient must be guarded as well as roentgen rays administered.

Prior to the course of treatment the chest should be examined for metastasis. Massive doses such as the Germans advocate are not feasible. Treatment consists of raying the entire torso, including the supraclavicular areas and the liver. Areas 2½ by 3 inches are advocated. Each area receives a massive dose. Fixed factors employed are the 9-inch gap, 5 to 10 mm. aliminum filter, 8-inch distance, and 18 to 20 minutes. With larger areas, greater distance is being tried on some cases.

This much is given preliminary to operation. In two weeks operation is performed. Post-operative treatment is begun as the patient is out of bed. Three series are given after the operation, each a month apart. No further treatment is given except in the very malignant types. The present tendency toward heavier filters and higher voltage is being experimented with.

E. W. R.

X-Ray Treatment of Tuberculous Lymphadenitis. Dr. I. S. Trostler, Chicago. The American Physician, August, 1921, p. 617.

SINCE 1903 the roentgen treatment of tuberculous lymphadenitis has grown in importance until it is now recognized as one of the best methods of treatment. The advantages are:

There is no fear of operation.

There is no anesthetic given.

There is no hospital expense.

There is no operative scar.

There is no confinement.

There is no pain connected with the treatment.

There is less likelihood of extension or recurrence.

The only argument against the treatment is the time element, which varies from five weeks to five months.

Brilliant results are obtained in early cases, especially the young, approximating 80 per cent cures. Sinuses close up earlier under treatment, though broken-down glands may need drainage. Aspiration is usually sufficient. Suppuration is not a contraindication. It is advisable to swab out suppurating sinuses weekly with equal parts of phenol and tincture of iodine.

Tuberculous glands anywhere in the body are benefited by the treatment. Pulmonary tuberculosis is helped by the action on the lymphatic tissue of the mediastinum and hila.

Dosage varies, but a full dose once in 21 days is advisable, given as the experience of the operator dictates. Technicians should not give the treatment. Only trained experts in roentgenology should attempt the care of these cases.

E. W. R.

An Analysis of 200 Gynecological Cases Treated With Radium at the Women's Hospital in the State of New York. Dr. E. W. Titus. Am. J. Obst. & Gynec., 1921, p. 685.

TWO hundred and one patients have been treated in a period of eighteen months, with results the same as other workers.

Ninety-five cases were carcinoma of the uterus. In 86 the cervix was affected; in nine it was the fundus. Fifty-five of the first class are living and free from symptoms. Duration of treatment ran from six to eighteen months. Thirty-one patients died. Sixteen died in less than six months after radiation. Death was from metastasis in the lungs in two. Pneumonia took one.

In 64 the pain was relieved. It was increased in but few. Hemorrhage and leucorrhoea ceased in all but two cases.

Bladder symptoms anad rectal irritation developed in only a few cases. Fistulae in bowel or bladder arose in two patients.

Seven patients with advanced carcinoma are alive and well after eighteen months. All except two of the patients with cancer of the fundus are well. Four of them had a hysterectomy. Of five patients with carcinoma of the vagina, two are living. Involvement of the vulva has been treated twice. One was too advanced for treatment; the other has been treated recently.

Carnicoma of the urethra and bladder were unsatisfactory.

In carcinoma of the rectum the results were good. Four patients are living; three over one year.

Non-malignant conditions: There were 44 cases of uterine myoma. In all the hemorrhage was controlled and the tumor reduced in size. In two cases the tumor disappeared. Thirty-nine cases of menorrhagia and metrorrhagia were in patients under forty years old. Hemorrhage was controlled in all but three cases.

It was considered safe to the menstrual function to use 600 milligram hours' application. Menses usually return to normal after two or three months. More than that may cause complete amenorrhoea.

Leucorrhoea ceased in all cases. Large doses of radium caused severe menopause symptoms in quite a number. Eight cases of severe hemorrhage at the menopause were treated successfully by 1,200 to 1,800 milligram hours.

E. W. R.

The Treatment of Epithelioma With Radium. Dr. Viola Zoe Allison, Pittsburgh, Pa. Jr. of Roentgenology, July, 1921.

NON-IRRITATING methods which destroy epithelioma are the methods of choice. The prognosis depends on the extent of involvement but not the size of the growth. Epitheliomas divide into the squamous-cell and basal-cell types. Rodent ulcer is the most common of basal-cell types.

These new growths may be classified according to results obtained, as follows:

1. Premalignant lesions, warts, moles, excrescences, and open irritation or abrasion such as a cracked lip or cold sore which exists more than three months. These require only a small amount of radium to effect a permanent cure.

2. Small localized lesions definitely malignant. One application of radium is sufficient.

3. Extensive superficial lesions without glandular involvement. If bone or cartilage are involved, the prognosis should be guarded. Large doses of radium will be required and will cure more than surgery.

4. Epitheliomata with glandular involvement. Radium with roentgen therapy gives the best results. Many are cured, but palliation only for the others.

Carcinoma of the cervix requires no more than the lower lip. The lower-lip cancers come early and metastasize early. Epithelioma of the tongue, floor of the mouth, buccal mucous membrane and tonsil are less hopeful because of rapid metastasis. Tonsil growths yield readily before metastasis, but the spread is rapid. Tongue tumors are bad because the muscle is resistant and the glands are early invaded.

"Radium will cure a larger percentage of epitheliomas with the least possible destruction of tissue, leaving practically no scar or deformity, with fewer chances of a recurrence, than any other method."

E. W. R.

The Practical Medicine Series, 1921. General Editor, Dr. Charles L. Mix; also Dr. Frank Billings, Dr. Burrell O. Raulston.

THE object of this book is to state briefly that which is important in the year's progress in medicine and surgery. Reference is made to the roentgen ray as a diagnostic measure in gastric ulcer, pleuro-pulmonary tuberculosis, the gastro-intestinal tract, and in arthritis. Its effects are studied under articles on metabolism in cancer patients, in tuberculosis and exophthalmic goiter.

The article on the "Results of Treatment of Exophthalmic Goiter by Surgical and X-Ray Methods" is by George H. Bingham and G. E. Richards of the Toronto General Hospital. Three hundred patients with goiter were studied. Theoretically—that is, reasoning from conclusions based upon the study of the histology and pathology of the thyroid gland and properties of the x-ray, the influence upon the different types is about in the following order:

1. The hyperplasias should be influenced most.

2. The adenomas should not respond as well.

3. The cystic type should not respond at all.

It is found that the results obtained are in accordance with this selection of cases.

It is possible, though difficult, to produce myxedema.

Simple goiters yield the best. One hundred per cent are cured if properly selected. Pure adenomas and cystic goiters are entirely surgical. Toxic goiters should be treated first with x-ray, and if this fails, surgery may be tried. Very few fail to show improvement. The hyperplastic type is looked upon as the ordinary exophthalmic type of goiter. The thyrotoxic type, with chiefly cardiac symptoms and occasionally an exaggerated nervous element, has been frequent.

Of 300 patients treated, 76 per cent showed some improvement, while 5.3 per cent failed to improve. The remainder could not be accurately classified.

It is not a question of x-ray versus surgery. It is the interest of the patient that must be watched. If intoxication can be reduced, whatever means is safe and sure should be employed.

Two objections have been raised. One is the length of time required. This is only a real objection in the mild cases which may be operated on. In severe cases it is dangerous to operate. Rest is demanded. X-ray can be given at the same time and surgery deferred or dispensed with.

The second objection is the production of adhesions and an increased blood supply. Opinions differ on this question. Whenever a patient is operated who has been treated by x-ray, any difficulty arising is blamed on the x-ray.

E. W. ROWE.

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Roentgenological Study of Primary Lung Carcinomata

Lloyd Bryan, M. D.
San Francisco, California

PRIMARY lung carcinoma is generally conceded to be rare, and on this account and because of the different types of picture which it may give, these nine cases are presented. No attempt has been made to include the histories or clinical examinations. The pathologist's reports are merely summarized, as the detailed pathological reports will shortly appear in a publication by Prof. G. Y. Rusk of the University of California who examined all these cases except Case No. 1, which was examined by Prof. Wm. Ophuls of the Stanford University.

In this series, there were five women and four men. The youngest, a woman, was 32 and the oldest, also a woman, was 63. Five of these cases were between 50 and 60 and two between 40 and 45.

In only one case, was occupation a possible etiological factor and that was in Case No. 8, a smelter.

One case was associated with lues and one with coccidioides of the opposite lung.

Both lungs were involved in five cases, the right lung only in three cases, and the left lung only in one case. The seat of the original lesion in three cases was in the middle lobe of the right lung, the base of the left lung in three cases, and the base of the right lung in two cases. The apices were involved in only two cases, and then only by extension late in the course of the process.

There were metastases to the pericardium resulting in fluid in the pericardial sac in three cases, to the liver in two cases, to the bones in one case, to the subdiaphragmatic lymph nodes in one case, to the cervical and axillary glands in one case, to the right kidney in one case, and to the wall of the ileum in one case.

Seven cases showed fluid in the pleural cavity at some stage. One case showed extensive breaking down of lung tissue with formation of multiple small abscesses.

The predominating symptoms were dyspnoea and cough following an acute febrile attack which had been diagnosed pneumonia. Pain was not a prominent nor an early symptom.

The roentgen diagnosis in this series was as follows:

Pneumonia unresolved	1 case
Malignancy	6 cases
Tuberculosis	1 case
Pneumonia unresolved	1 case
Abscess	1 case

The most common type in this series was the infiltrating showing a mass at the hilus or the extreme base, with radiations out along the bronchial ramifications causing thickening of the peribronchial markings with a tendency for bead-like formations at the bifurcations and a hazy infiltration of the long tissues. Early, this may be difficult to distinguish from an inflammatory process as is sometimes seen following influenza, but repeated examinations will show the rapidly progressing nature of the process with marked extension out toward the periphery, causing marked increase in peribronchial thickening with only slight increase in lung field density. One case showed simply a dense tumor involving the entire left lung. Three cases were of the miliary type with large irregular mottled areas with indefinite borders which gradually faded out into the normal lung tissue. In one case, there was only a rounded discrete mass arising from the bronchus which showed no tendency to advance along the bronchi and no involvement of the lung fields and yet produced extensive bony metastases.

While the roentgen examination may be one of the greatest factors in establishing the diagnosis of this unusual condition, still there should be close correlation with the clinical examination. It has been stated that tuberculosis will rarely, if ever, be confused with primary carcinoma of the lung, yet in one of these cases, the pathologist reported a miliary tuberculosis from the gross specimen, and only a microscopical examination revealed the true nature of the disease.

J. D.—Case 1

Case No. 1—J. D. (m); aged 55; occupation, laborer and car repairer; referred by Dr. B. F. McElroy.

Roentgen examination shows a dense shadow involving practically the entire left chest. At the central portion of the left lung are small rounded discrete masses. At the central and lower portions of the right lung, there is rather marked fibrous thickening, with interlacing of the process extending out toward the periphery giving a network pattern. At the base, the process is more dense and seems confined about the course of the bronchi. The heart shadow is obscured, but neither the heart nor the mediastinal contents are displaced.

D. H.—Case 2

Pathological examination showed carcinoma of the bronchus on the left side, metastatic carcinoma of both lungs, of the lymph glands of the neck, axilla, muscles of the chest wall to the liver and to the right kidney, and syphilitic changes in the aorta.

Case No. 2—D. H. (f): aged 45: occupation, seamstress. Dr. H. C. Moffit's Service University of California Hospital.

Roentgen examination shows irregular coarse mottling throughout both lung fields except at the apices, the left one of which is clear and the right one somewhat grey. Overlying the mottled areas is a somewhat uniform shadow of increased density. The heart and mediastinal contents are not displaced.

Pathological examination shows a gelatinous and caseous pneumonic process which is diffuse in both lung fields. Microscopic section of these areas proved them to be primary carcinoma of the lung.

Case No. 3—E. L. W., (f): aged 43: occupation, housewife. Referred by Dr. E. W. Willits.

Roentgen examination shows a dense, rather homogeneous shadow involving the entire left lung except at the peripheral portion of the central region where there is an area which is somewhat more radiable than the rest of the lung. Within this area can be seen small radiating areas of increased density. At the right base, there is a shadow of increased density extending well up into the axilla which has a definite sharply outlined medial border suggesting thickened pleura. The remainder of the right lung, except at the extreme top, shows rather marked peribronchial infiltration which extends well out to the periphery. There is marked tendency for bead-like formation along the course of the bronchi, with irregular areas of coarse mottling scattered throughout the tissue between the bronchial markings. The trachea is displaced to the right.

Pathological examination showed fluid in the pleural cavity of both sides. The fluid from the left side was clear, and the fluid from the right side was blood stained. There was enlargement of the bronchial glands and both lungs were adherent to the chest wall. There were numerous discrete nodules throughout both lungs. The pathologist's report on the gross specimen was miliary tuberculosis.

Section and miscroscopical examination showed this to be primary carcinoma.

Case No. 4—H. P. (f); aged 63; occupation, housewife. Dr. H. C. Moffit's Service University of California Hospital.

Examination shows rather marked scoliosis of the thoracic spine. Heart is slightly displaced to the left. Rather marked enlargement of the bronchial root glands, particularly on the right side. In the first interspace anteriorly on the right, there is a small discrete nodule about .25 cm. in diameter lying close to the mediastinum. At the right base medially, there is an indefinite shadow of increased density, with rather marked peribronchial infiltration. In the right axilla, there is an oblong smooth mass apparently springing from the rib extending into the pleural cavity. There is also a destructive process

E. L. W.—Case 3

involving the upper lumbar vertebrae. The bodies of all the vertebrae are markedly decalcified.

Pathological report showed a nodule in the right lung near the spine medially about the size of a walnut which on section showed the tissue infiltrated by a firm, white growth occuring in irregular small interlocking foci. There was metastases to the sternum, to the third, fourth, fifth, and sixth ribs on the left side, to the lower thoracic spine, and to the bones of the pelvis.

Conclusion: Primary carcinoma of the lung, with bone metastases.

Case No. 5—W. H., (m); aged 54, occupation, farmer. Dr. H. C. Moffitt's Service University of California Hospital.

Roentgen examination shows the upper two-thirds of the left chest infiltrated with rather coarse irregular mottling. These mottled areas are typical of those of tuberculosis. There is slight enlargement of the bronchial root glands from this side. The heart is small and central. At the right hilus, extending out into the lung fields, there is a fan-shaped, irregular, coarsely mottled area. In this area are rather large irregular areas of increased density without definite borders but gradually fading out into the lung tissue. There is considerable increase in peribronchial infiltration. The trachea is displaced slightly toward the right side.

H. P.—Case 4

A plate taken two months later shows practically no change in the process on the left side. The right side at this time shows a homogeneous area of increased density involving the entire right chest. The heart is displaced to the left and is enlarged.

Pathological examination showed a coccidoidal granuloma of the skin and lungs, with a small cavity at the right upper lobe and of the left kidney. The central lobe of the right lung showed a primary carcinoma with metastases to the liver. The right pleural cavity filled with fluid.

Case No. 6—A. L., (m); aged 52; occupation, laborer. Referred by Dr. Max Rothschild.

Roentgen examination shows a rather homogeneous shadow of increased density involving the entire left lung. Underlying this shadow, there can be seen rather right cardio-hepatic angle, there is a rather dense irregular mottled area.

Pathological report showed primary carcinoma of the left lung, with metastases to the pericardium and to the right lung, with pleural and pericardial effusion.

Case No. 7—R. M., (f); aged 32; occupation, housewife. Referred by Dr. H. Allen and Dr. Grant Selfridge.

Roentgen examination shows an irregular area of increased

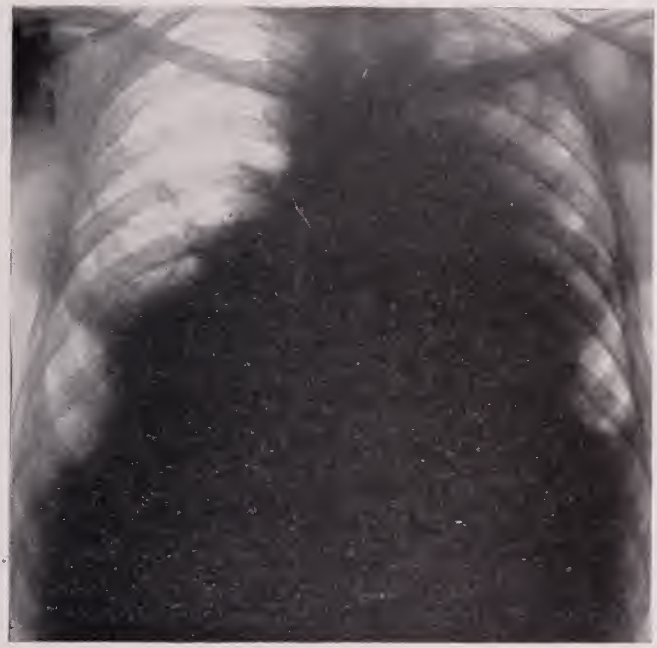
W. H—Case 5

marked infiltration of the peribronchial tissue, which extends well out toward the periphery. At the right hilus and extending out into the lung fields, there is increase in peribronchial thickening, with rather coarse mottling of the lung fields between the areas of the bronchial thickening. In the right axilla, at the base, there is a homogeneous shadow of increased density and at the density at the right hilus. Rather marked peribronchial infiltration of the right lung extending well out toward the periphery. Slight tendency for beading of this process, with rather fine mottling of the lung fields between the peribronchial infiltrated areas. There is thickening of the interlobar pleura between the middle and lower lobes on the right side. A similar infiltrated process extending out along the bronchial markings, with slight mottling of the lung tissue is seen at the left side. Heart is rather markedly enlarged to the left, with prominence of the left border, and this enlargement extends well up on to the root of the vessels. It is globular in shape and broadens superiorly in the supine position, suggesting pericardial effusion.

A plate taken two months later after the pericardium had been tapped and markedly blood stained fluid withdrawn, shows a normal contour of the heart shadow. The infiltration process in the lungs had extended more toward the periphery and except for slight increase in density at the right hilus and toward the right base, the character of the lesion remained the same; that is, infiltration of the peribronchial tissues, with beading and fine mottling in the lung tissues.

Pathological report showed primary carcinoma of the right lung, with extensions into the mediastinal and subdiaphragmatic lymph nodes, metastasis to the left lung and to the pleura on both sides and to the pericardium.

Note: It is of interest that while the pericardium was tapped some two months before the patient's death, there was no recurrence of the fluid in the pericardium, although at autopsy, the pericardium was studded with multiple small carcinomatous nodules.



A. L.—Case 6

Case No. 8—L. F., (m); aged 53; occupation, smelter. Dr. H. C. Moffitt's Service University of California Hospital.

Roentgen examination shows an irregularly outlined shadow of increased density at the right hilus which extended rather markedly toward the right base. There was slight increase in density of the central portion of the right lung.

Within this area, there were irregular small multiple areas with indefinite borders which fade out into normal lung. There was rather marked enlargement of the root glands at the left hilus, with slight increase in peribronchial infiltration toward the left top.

One month later, the lower two-thirds of the right chest was filled with rather homogeneous shadow of increased density. Heart was not displaced.

Pathological report showed primary carcinoma of the right lung, with extensive local infiltration throughout the mediastinum and about the pleural surface, invasion of the mediastinal lymph nodes to slight extent only, hemorrhagic exudate in the pericardium, and encysted fibrinopurulent pleurisy with secondary abscess in the mediastinum. The growth appears to originate in the bronchi near the root of the right lung.

Case No. 9—T. L. F., (f); aged 59; occupation, housewife. Referred by Dr. George Ebright.

Roentgen examination shows an irregular shadow of increased density at the left base, which extends higher medially than laterally. Underlying this shadow can be seen rather marked interlacing of infiltrated peribronchial tissue with coarse irregular mottling of the lung fields. There is rather irregular oblong shadow extending from the pleura into the thoracic cavity from the level of the seventh rib posteriorly to the apex. The heart is slightly displaced to the right.

One month later, this shadow at the left base increased in size both superiorly and laterally. Also, the shadow at the apex and lateral portions of the left thorax extended rather markedly into the thoracic cavity. At this time, a considerable amount of clear, straw-colored fluid was aspirated. The heart and the mediastinal contents were displaced rather markedly to the right. At the insistence of the family of the patient, the thorax was opened and a small amount of tissue at the left base was removed for examination.

R. M.—Case 7
Figure 1—NOTE—One month between figures 1 and 2. and one month between figures 2 and 3.

The pathologist's report was carcinoma of the lung, probably primary. The general picture of cell type suggests more a growth originating from the lung tissue than one arising in the mesothelium.

I am deeply indebted to the physicians with whom I had the opportunity of seeing these cases and to Dr. G. Y. Rusk, and Dr. Wm. Ophuls who have so kindly furnished the pathological reports.

R. M.—Case 7—Figure 2

Discussion on Papers of Drs. Bryan and Carman

DR. FRANK BISSELL, Minneapolis, Minn.: My only excuse for discussing these two very interesting papers is that I have been placed on the program for that purpose. I have nothing to contribute. The slides and the paper by Dr. Bryan seem to be rather convincing proof that if a diagnosis of primary carcinoma of the lung is to be made it must be at the autopsy. In my own practice I recall but one case of primary carcinoma of the lung which was correctly diagnosed at least as carcinoma; and since there was but one nodule present and since nothing else was found at autopsy, it must have been a primary carcinoma of the lung. It must be a rare condition.

One point came to my mind as I observed these slides. Someone several years ago in discussing this subject, made the statement that a thickening of the interlobar pleura was a diagnostic sign of carcinoma of the lung. I have forgotten who made the statement, but it was a very positive one and he showed a number of slides to confirm his theory. I began looking more diligently for that indication and found it of considerable frequency, so I am convinced that it is not a reliable sign of cancer. The point brought out by Dr. Carman of the necessity of a pathologic examination of these miliary carcinomatous nodules to differentiate them from tuberculosis is very important.

Both essayists are to be congratulated upon the excellent presentations they have made.

DR. PERCY BROWN, Boston, Mass.: I have had very little experience in this subject. The radiographs which were shown by Dr. Carman are very interesting and very striking. The difficulties, it would seem to me, would be where a double lesion existed, one of which he showed, which might be a metastatic carcinoma and tuberculosis. The skill with which he has apparently made the differential diagnosis between what he calls the nodular type, which is the most difficult, and tuberculosis is very striking in that so many of the differential points of these conditions are quite rare. I regret that I did not come early enough to hear the first paper. I am, therefore, incapable of discussing it.

R. M.—Case 7—Figure 3

DR. A. F. TYLER, Omaha: I would like to ask Dr. Carman a question. He made the statement in his paper that the infiltrating type of carcinoma extending out from the mediastinum along the bronchi was very rare if at all present. In the last year and a half I have had ten different cases come to me for post-operative treatment following amputation of the breast for carcinoma in which this type of infiltration was present, gradually extending out and involving the entire lung on one side and part of the lung on the other. I would like to ask the Doctor what that is if it is not the infiltrative type of carcinoma.

DR. GEORGE E. PFAHLER, Philadelphia, Pa.: I am not sure that I have not at some time made the statement that sarcoma, beginning in the mediastinum or along the root of the lung, tends to extend outward along the septum between the middle and upper lobes of the right lung. I have seen at least four such cases and have followed them up until they died, which means that the whole of that right lung gradually became solid with this sarcoma. I have no doubt about the diagnosis. My experience is the same as Dr. Tyler's and I have been able to follow these cases over a period of more than three years and some have come to autopsy. I cannot quite see how the experience that Dr. Carman has had, which is so very extensive, should differ so widely from our experience. Surely carcinoma must be the same in Philadelphia as in Rochester. If I had only seen these patients once and then forgotten them, I would not feel so sure about what I am saying, but they came to me for treatment of this condition which I recognized and which I treated.

Dr. Bloodgood said he had not seen any improvement in mediastinal carcinoma. I have, but I have not seen any get well. I have seen mediastinal carcinoma appear, then gradually increase in size, and fill up the lung, so the patient could do nothing but sit up. I have only seen four cases, of primary carcinoma of the lung. One case examined and treated by me was referred to me by Dr. Jacques. The diagnosis was made because the patient, who was a doctor, coughed up a part of the tumor and had sense enough to take it to a pathologist for examination. He got an almost complete disappearance of the tumor but later the patient died of some pulmonary condition; I presume of carcinoma. He would not permit Dr. Jacques or anybody to make an examination, so we do not know exactly what he died from.

DR. A. C. CHRISTIE, Washington, D. C.: We get the idea that primary carcinoma of the lung is a rare disease. Dr. Bryan's paper would show that it is not so uncommon. I think it is often a very difficult disease in which to make a differential diagnosis. I have had two cases within the last year that have impressed this upon me very strongly. In both of them there was a homogeneous infiltration in the upper lobe of one lung. We thought it was primary carcinoma and we followed these cases over several months, in which there was a gradual increase in the area involved until nearly the whole upper lobe of the right lung was involved in each case. The first one ran a temperature during all this peiod and finally died. Although we never found tubercle bacilli in the sputum we believe he died of a caseous pneumonia. The second case followed almost the same course, but he is still alive. We found tubercle bacilli in his sputum and we feel sure it is a case of caseous pneumonia.

L. F.—Case 8
Figure 1—NOTE—Two weeks between figures 1 and 2.

DR. LLOYD BRYAN, San Francisco (closing his part of the discussion): In regard to the diagnosis of primary carcinoma, I admit it is extremely difficult at times, but I am very glad to hear Dr. Christie remark that the finding was not very uncommon. We have a number of other cases which I did not report because we did not have complete autopsy findings on them. We had one more case in which we had complete autopsy finding. We had one more case in which we had complete findings in which the plates were negative.

Last week in Portland Dr. Watkins of Phoeniz presented six cases of primary carcinoma of the lung. While this is fairly uncommon we should keep it in mind all the time. We should watch these cases so we may get enough data to enable us to diagnose these cases ealy.

DR. TYLER: One case showed mediastinal infiltration and then later the spot in the lung gradually enlarged.

DR. CARMAN: My reason for going into this infiltrating type was because I felt as Dr. Pfahler does, that there was no difference in carcinoma in Philadelphia, New York or Rochester. Just before coming east I visited Dr. Robertson at Minneapolis and went over this question with him.

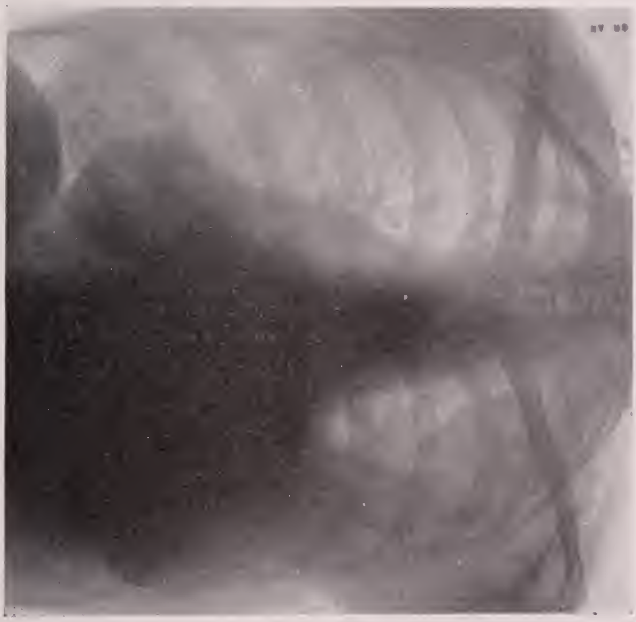
L. F.—Case 8—Figure 2

He said this type could occur but it was very infrequent. Last Tuesday I visited Bellevue Hospital in New York and called on Dr. Symmers and went over the question with him. He agreed that it was very rare to see this type in malignant metastasis. In our series of 267 proven cases there was no single case that showed this infiltration. We do see infiltration in primary malignancy of the lungs.

Regarding interlobar pleurisy, Dr. Hickey told me that all his cases showed thickening of the interlobar pleura. Only three of our cases showed this condition.

DR. RUSSELL CARMAN, Rochester, Minn., (closing his part of the discussion): Before answering Dr. Tyler's question, I would like to ask him if he was sure these were not pleural cases rather than mediastinal.

T. L. F.—Case 9
Figure 1—NOTE—One month between figures 1 and 2,



T. L. F.—Case 9—Figure 2

*—Read at the Mid-Summer Meeting of The Radiological Society of North America, held at Boston June 3rd and 4th, 1921.

Means of Measuring or Specifying the X-Ray Dose Given

. N. Ernest Dorsey, Ph. D.
Washington, D. C.

BEFORE taking up the question of the measuement or specification of the x-ray dose given, it is desirable to consider in some detail what we mean by dose. By doing so we will in some measure avoid the perplexity and misunderstanding that might otherwise arise from the fact that the word dose has, unfortunately, been used to denote several quite different quantities. Quantities, which it seems to me, it is most desirable to keep distinct.

The Dose

Turning to Murray's Dictionary of the English Language we find that dose is defined as "A definite quantity of a medicine or drug given or prescribed to be given at one time." This is the primary definition of the word, and I believe, it is the one that is universally used when applied to an actual medicine or drug.

Some of the medicine may be eliminated unchanged,, the remainder may be distributed very unequally among the various types of tissue, being much more concenrtated in some than in others, and only a portion of it will be expended in producing the therapeutic effect primarily desired. This distribution and the efficiency with which the medicine acts may depend upon the manner of administration. Nevertheless, the word dose is used to denote simply the amount of a specified medicine that is administered to the patient in a certain manner.

Related Problems

It is of much scientific interest, and often of great practical importance to know in what way the medicine is distributed throughout the system, to know how much of it is appropriated by a particular tissue, to know the manner in which it reacts with the tissue, and to know the net efficiency with which it acts, that is, to know what proportion of the amount that is taken up by the tissue is actually effective in producing the changes desired—the remainder being expended in producing changes of other kinds. All of these mattesr are of importance and are included in the field of biological research: among biologists I class the physician and the surgeon.

As a result of such investigation it may be found that only a small portion of the material administered is actually effective; nevertheless, the word dose will still be used to denote the amount that is given to the patient.

Applications

This does not mean that such investigations are of no practical value. Far from it. They throw light upon the manner in which the medicine acts, they help to explain unusual reactions, they may indicate the advisability of using a dose of a different kind or of administering it in a different manner. They are of great value in deciding what dose shall be prescribed, but they have nothing to do with the means of measuring or specifying that dose. However, the dose may be changed as the result of such investigations, it is the amount that is given to the patient in a specified manner, This is as it should be. It accords with the ironclad rule of every careful experimenter, that what is actually done and observed must be kept plainly distinct from what is deduced, inferred, or calculated. The former are facts not open to discussion, while the latter should be carefully scrutinized and criticised by all, and may well require numerous changes as our knowledge increases. When they are kept distinct, the records of the former are of permanent value; when they are confused or when the latter only are given, the record is of but temporary, or even of doubtful value, it is essentially incomplete.

The use of the word dose to denote the amount of an agent that either is given to or is utilized in a particular way by a specific portion of tissue, as distinguished from the amount that is delivered to the patient, is discordant with the long established meaning of this word and so tends to confusion. In addition, it involves the tacit assumption that the amount that is concurrently received by other tissues or utilized in other ways is of no significance. This assumption is a serious one; no matter how sound it may today appear to be, investigations of tomorrow may prove it to be invalid.

The Unfiltered X-Ray Dose

The dose of a drug can be specified very simply; such a quantity (by weight or volume) of a specified drug is to be given in a certain way and at specified intervals. But when a physical agent, such as x-rays, is employed, the specification is not so simple; a greater number of physical factors have to be specified if the dose is to be completely determined.

Physical Factors

A beam of x rays consists of numerous trains of waves proceeding from the target of the x-ray tube. These waves are of exactly the same nature as those that produce in us the sensation of light. Like all other trains of waves, at least two quantities are required in order to specify the effects they can produce at any point. They are (17) the average amount of energy that the waves bring up to the point in a given time, and (2) the wave-length, or frequency of the waves. The first, the rate at which the waves bring energy to the point (not the speed with which energy is carried but the total amount that is brought up per unit of time), may be regarded as a measure of the quantity of x-rays that reaches the point in a unit of time: it corresponds exactly to the intensity or brightness of a light and is appropriately called the **intensity** of the x rays at this point. The second, the wave-length, may be regarded as determining the **quality** of the radiation; in the case of light, differences in wave-length determine the differences in color. The essential difference between light and x-rays is the difference in wave-length, the waves of light are over a thousand times as long as those of the x-rays that are commonly used. It is common knowledge that the effects produced by light vary with the wave-length, or color, of the light, and that this variation is determined by the material upon which the light acts. Ordinary photographic plates are insensitive to red light, certain others are quite sensitive to it. Similarly we should expect the effect of x rays to vary with their wave length, and that the extent and the nature of this variation will depend upon the nature of the material upon which the effect is produced. But in advance of experiment we are not justified in making any forecast regarding the extent of this variation in any specific case; it may be negligently small, or it may be very great.

One phenomenon depending upon the wave-length of the incident x-rays, the emission of characteristic radiation, has been carefully studied, and we are now able to speak with confidence regarding this emission. But of the chemical effects produced by x-rays, and the manner in which these effects vary with the wave-length we know but little. Until this field is well explored the biologist will do well to bear in mind the possibility that these effects may depend upon the wave-length.

The total quantity of x-rays given to the patient will depend not only upon the intensity of the rays but also upon the **duration** of the exposure and upon the size of the **area** exposed. The effect produced will depend upon the particular portions of tissue that are permeated by the rays.

The physical factors that have to be fixed in order to specify the dose completely are (1) the intensity of the radiation, (2) its quality, (3) the duration of exposure, (4) area exposed, and (5) the tissues that receive the radiation.

Factors of Record

What observed factors should be recorded in order to ensure the complete specification of the dose? The duration of exposure and the size of the exposed area can be readily determined and recorded. The tissues that receive the radiation will be fully specified if, in addition to the size of the exposed area, its position, and the shape and direction of the beam of rays are known. The last two will be known if the distance and direction of the focus from the center of the exposed area are known. These also serve to fix the quantity and the quality of the radiation reaching any portion of the patient, when the intensity and quality of the radiation reaching the surface is known. There remains to be determined only the intensity and the quality of the rays that reach the surface. How can these be definitely specified?

In the research laboratory homogeneous radiations, radiations in which all the waves are of the same length, can be obtained and measured by various laboratory methods. In daily practice this is impossible. In practice you use one of a very limited number of methods, and you use the radiation that you thus get, modified to a greater or less extent by the interposition of filters. This radiation is not homogeneous and often is very heterogenous. An exact specification of the distribution of the energy among the several wave-lengths can be made only after an elaborte investigation, an investigation that it is practically impossible for the practitioner to make. He is thus thrown back upon indirect means for specifying the equivalent quality and the quantity of the radiation administered.

This indirect means is found in the conditions controlling the production of the radiations. Tubes of the same type, excited by the same means, to the same voltage, and carrying the same current will emit radiations of the same kind and intensity. Here is found the practical method for specifying these factors. State the type of tube used, the means used for exciting it, the voltage or spark gap at which the tube is run and the current that passes through the tube. Subsidiary investigations of a purely physical nature will determine the intensity and the wave-lengths of the radiations that are emitted under these conditions.

Such subsidiary studies of the Coolidge tube when excited by a constant voltage, and when excited by the interrupterless machine with rotating commutator have already been made. These studies should be extended to other kinds of excitation. Until this is done a completely satisfactory interlocking of the results obtained with different tubes and different kinds of excitation will not be possible; but an approximate interlocking, at least insofar as the more pronounced effects are concerned, can be obtained by a less elaborate investigation, such as the photographic studies carried out by Dr. Shearer[1], and the ionization measurements described by Krőnig and Friedrich.[2]

The facts that must be recorded in order to specify completely the unfiltered x-ray dose are (1) the means used for exciting the tube, (2) the type of tube, (3) the voltage applied to the tube, or the spark gap, (4) the current through the tube, (5) the distance from the focus to the skin, (6) the duration of the exposure, (7) the size of the exposed area, (8) the position of this area of the ray passing through its center. If the patient is exposed to radiation that is scattered from extraneous bodies this must be considered also.

Significance of the Several Factors

Although it is readily seen that the factors enumerated in the preceding paragraph serve to fix the dose quite definitely, the significance of the several factors is not always appreciated. A knowledge of the means used for exciting the tube is of importance because it determines in large measure, frequently completely, whether the voltage that is applied to the tube remains constant or varies, and how it varies. In this way it exerts a marked influence upon the quality of the radiation emitted.

The type of tube is important for several reasons. The efficiency of production; i. e., the intensity of the radiation that is emitted under specified electrical conditions, varies from one type of tube to another. In general the quality of the radiation that is emitted depends in part upon the material of which the target is made. The nature of the discharge through the tube depends upon the type of tube, and may markedly modify the periodical variation in the voltage across the tube, thus affecting the quality of the radiation. Hence unless both the means for exciting the tube and the type of tube used are known, the other electrical conditions will not serve to determine unambiguously the quality and the intensity of the radiation emitted.

The voltage applied to the tube determines the velocity of the cathode particles and in this way the quality of the emitted radiation. This radiation is never homogeneous even when the voltage is a steady, constant one. Increasing the voltage increases the intensity of all the radiations that were emitted at the lower voltage and adds to them new radiations of shorter wave-lengths. Usually the voltage applied to the tube is not constant, but varies over a certain range, and the radiation that is emitted is a mixture of the heterogeneous radiations corresponding to the several voltages. Only a single value of the voltage is actually measured. The spark-gap measures the maximum value of the voltage, the kilovoltmeters that come with the apparatus are usually calibrated to read either the maximum value of the voltage or what is known as the effective voltage; but other calibrations are not impossible. The particular voltage that you measure should be specified.

For definite voltage conditions, the current through the tube determines the intensity of the radiation. If you double the current you double the intensity.

The radiation proceeds from the focus in straight lines. The further you recede from the focus the larger the surface over which the radiation is spread; the intensity varies inversely as the square of the distance from the focus. The distance of the focus from the skin is required for the determination of the intensity of the radiation administered, and with the size and position of the area exposed determines the tissues that receive direct radiation.

When the intensity is given, the duration of exposure fixes the total quantity of radiation per unit of area that is delivered at the point considered. So long as the duration of exposure is short as compared with the time required for any of the biological responses to become significantly effective, it is probable that the resultant biological effect of the radiation will depend upon the duration of exposure only insofar as it determines the total quantity of radiation administered; i. e., other factors being the same, the effect will depend solely upon the product of the intensity by the duration. But when a biological response (e. g., a recuperative reaction) reaches a significant value before the exposure is completed it is to be expected that the duration of exposure will take on an added importance; in this case the effect produced, other things being the same, will not depend solely upon the product of the intensity by the duration, but also upon the values of the individual factors composing the product; a higher intensity for a shorter time will in this case not be biologically equivalent to a lower intensity for a longer time, even though the product of the intensity by the time is the same in both cases. For this reason it is desirable that the duration of exposure be explicitly stated.

The size of the area exposed is of significance from several points of view. It is the patient and not merely an isolated portion of pathologic tissue that is treated; other things being the same, the quantity of radiation administered to the patient is directly proportional to the size of the exposed area. In their passage through matter, x-rays are scattered, very much as light is scattered in its passage through milk glass. Consequently the interior of a mass of tissue traversed by x rays, as well as the tissues surrounding this mass, will receive radiation that has been scattered from other portions of tissue. Within certain limits, the amount of this scattered radiation reaching a given portion of tissue will depend upon and increase with the size of the exposed area.

In general the larger the exposed area the greater will be the amount of normal tissue that is exposed; the exposure of normal tissue should not be overlooked in the biological evaluation of the treatment.

Quantitative Results

Having completely specified the dose prescribed or given, it is very interesting and of much importance to know how to combine the various numerical factors involved so as to obtain (1) quantitative estimates of the fundamental physical factors involved, and (2) biologically invariant relations. By a biologically invari ant relation I mean such a combination of various factors as serves by its numerical value to specify completely the biological reaction concerned, irrespective of the values of the individual factors involved; however, the values of the individual factors may vary, the biological effect remains unvaried so long as the value of the combination remains unchanged. Such an invariant, within certain limits, is the product of the tube current by the duration of exposure; within these limits,- so long as the number of milliampere-minutes remains unchanged, other things being the same, the biological reaction remains unvaried however the individual values of the two factors may be changed.

These estimates and relations are not directly concerned with either the specification or the measurement of the dose, but rather with the correlation of different doses, and with the choice of the dose that shall be prescribed. They are, however, of such interest and importance that it is desirable to speak briefly of them in this connection.

The fundamental physical factors, other than those very readily determined, such as time, with which we are here concerned are the intensity of the radiation and its distribution among the several wave lengths. The latter can be completely determined only by an elaborate research carried out under the same electrical conditions as exist during the treatment; I doubt if complete data of this kind is available for any of the conditions that are met with in practice. On the other hand, the gross intensity of the radiation emitted by a tube when excited in a given manner and to a given potential is quite amenable to investigation, and has been determined for the Coolidge tube when excited by a constant potential, and also when excited by means of an interrupterless machine. It has been found that the gross intensity at any point is measured by the expression

$$\frac{iV^2}{D_2}$$

where **i** is the current (milliamperes), **V** is the maximum voltage (or spark gap), and **D** is the distance from the focus to the point at which the intensity is measured. This expression mul tiplied by the duration of exposure **(t)** measures the total x-ray energy per unit of area that is delivered at the point considered.

Other tubes and other modes of excitation that occur in practice should be similarly investigated. Also the way in which the emission from one tube excited in a given manner compares quantitatively with that from a tube of a different type, or from the same tube excited in a different manner should be compared. For example, we know that the intensity at a point of the radiation from a Coolidge tube excited at a constant voltage is measured by the expression just given; that is the intensity **(I)** is

$$I = K\frac{iV^2}{D^2}$$

where K is a constant determined by the efficiency of the tube under these conditions, and by the sizes of the units in which the various quantities are measured. Similarly, when the Coolidge tube is excited by an interrupterless machine the intensity is

$$I = K_1 \frac{iV^2}{D^2}$$

but unless the efficiency is the same as before, K_1 will differ from K. I do not recall any data that will suffice to determine the ratio of K_1 to K.

In order to determine the intensity of the radiation at a point within the tissues it is necessary to know the effective absorption and scattering produced by the tissues through which the radiations pass. These also must be determined by subsidiary investigations in which are used radiations that are excited under the same conditions as occur in practice. In applying the results of such investigations it should be remembered that the distribution among the several wave-lengths of the radiation that has been transmitted through any layer of tissue differs from the distribution that existed before such transmission.

Another quantity, which should by subsidiary investigations be related to the thickness and nature of the surrounding tissue and to the factors that determine the dose, is the ionization of the air within a small, thin walled chamber that is inserted within the tissues after the procedure of Krőnig and Friedrich.[2] What this ionization measures is not the intensity of the x-rays that enter the chamber. The observed ionization is the sum of that resulting from the action upon the air of the entering x-rays, and of that caused by the action of those high speed electrons that are expelled from the walls of the chamber and, possibly, the surrounding tissue and enter the chamber. For a suitably constructed ionization chamber this sum may possibly be approximately proportional to the amount of x-ray energy that is absorbed per unit of volume by the neighboring tissues, but of this I am not entirely sure.

Whatever physical quantity this ionization may measure, the observations of Krőnig and Friedrich indicate that, in as far as local biological effects are concerned, the ionization thus measured by them is a biological invariant for a given type of reaction. An invariant that holds for radiations of very widely different qualities.

Another biological invariant, one associated with the unfiltered radiation from the Coolidge tube excited by an interrupterless machine has been determined by Dr. MacKee.[3] Using small areas of approximately equal size and upon the arm, he has determined the invariant for the so-called "skin unit" or "epilating dose." He found that whenever he obtained this characteristic reaction by such means the quantity

$$\frac{itV}{D^2}$$

had the same value; viz., 9/16 or 0.563 when the current is expressed in milliamperes, the time in minutes, the spark-gap in inches, and the distance in inches.

This invariant does not indicate that the intensity of the radiation varies as V, and that the therapeutic effect is independent of V and, therefore, of the quality of the radiation, but that for this reaction under these conditions efficiency of the radiation decreases as V increases. This is at once seen when we compare this invariant with the expression that measures the total energy delivered per unit area. If we denote the latter by the letter e, and the invariant established by Dr. MacKee by the letter E, then we have

$$e = K_1 \frac{itV^2}{D^2}$$

$$E = \frac{itV}{D^2}$$

From which it is evident that

$$E = \frac{e}{VK_1}$$

That is, for this reaction the efficiency of the energy of the specific mixture of radiations so furnished is inversely proportional to the maximum voltage. If you double this voltage you must apply twice as much of the x-ray energy in order to get the same reaction. For radiations of a different quality, a different mixture, none of these relations will necessarily apply. This, however, does not minimize their practical value. The corresponding invariant for the other modes of excitation and tubes that are used in treatment, and the invariants for other biological reactions should be determined.

If with the same equipment the biological invariant is found to be the same (not necessarily to have the same value, but to be of the same form) for several kinds of biological reactions, then, and only then, will one be justified in regarding this "skin dose" as a suitable unit in which to express the dose employed for producing these reactions.

The Filtered X-Ray Dose

The introduction of a filter produces numerous changes in the radiation administered. The filter not only reduces the intensity of the radiation and profoundly changes the quality of the radiation by absorbing the longer waves more strongly than the shorter ones, but it may add to the radiation its own characteristic radiation. Also it scatters the radiation passing through it and thus acts as a secondary source of radiation, very much as ground glass scatters the light passing through it and thus becomes a secondary source of illumination. There are thus two sources of radiation to be considered (1) the focus of the tube, (2) the filter. The first is a point; the intensity of the radiation received directly from it by any point varies inversely as the square of the distance from the focus to that point. The second is an extended surface having an effective brightness depending upon its distance from the focus of the tube. Viewed perpendicularly, the intensity of the light received from an extended bright surface depends upon the brightness and the area of the surface and upon the distance of the observer from it. As the observer recedes from the surface the intensity decreases at first much less rapidly than the inverse square of the distance; the rate of decrease gradually approaches that of the inverse square of the distance and becomes equal to it when the observer has receded to a distance that is great as compared with the dimensions of the surface. Consequently the presence of the filter modifies the manner in which the resultant intensity varies with the distance from the focus; and the extent of this modification depends upon the distance of the filter from the focus and from the patient.

Hence when a filter is used, the specification of the dose should contain, in addition to the factors considered in connection with the unfiltered dose, a statement of (1) the material of which the filter is made, (2) its thickness, or better its weight per square centimeter, (3) its distance from the focus of the tube, and (4) its area.

The gross energy carried by x-rays, emitted under practical conditions and filtered as for therapeutic use, should be determined; the effect of the filter as a secondary source of radiation should be studied, and biologically invariant relations should be determined.

In the determination of bio logical invariants for filtered radiations a beginning has been made by Dr. Schmitz.[4] In the April issue of your Journel he records values for an "erythema skin dose" obtained by him at three voltages, the focal distance and current being the same for all. The filter was of aluminum 10 mm. thick, the peak voltages varied from 108 kilovolts to 140 kilovolts (6.5 in. to 9.5 in.), a Coolidge tube excited by an interrupterless machine was used. These results, when corrected for a printer's error, indicate that for large values of D the invariant for the E. S. D. is

$$\frac{i\ t\ V^{4\ 7}}{D^2}$$

If D is not large, the denominator may be less than D^2 on account of the filter acting as a secondary source of radiation.

Summary

In the interest of consistency and precision confine the term "dose" to its original use to denote what is given to the patient.

Make use of such theories and subsidiary observations as may be available and applicable in deciding what dose shall be given.

Specify the dose by stating the various factors that determine the quality and quantity of the radiation that is administered to the patient.

Having thus specified the dose, interpret it in terms of such theories and subsidiary observations as may be available and apparently applicable to the case.

Care should be taken to keep the interpretation of the dose—its value in erythema dose, pastille reading, Krőnig and Friedrich's ionization unit, etc—dis tinct from the specification of the dose itself.

The physical characteristics of the various types of x-rays employed in therapy should be determined in terms of the instruments and the electrical quantities involved.

Additional biologically invariant relations between the electrical quantities should be determined.

*—Read at the Mid Annual Meeting of the Radiological Socity of North America, Boston, June 1921.

1—Shearer, J. S.: Amer. Jour. Roent genology, 1915. Larkin, L. P.: Amer. Jour. Roentgenology, 6:448, 1919.
2—Krőnig and Friedrich: Physikalische and biologische Grundlagen der Strahlentherspie.
3—MacKee, G. M.: Amer. Jour. Roentgenology, 6:602, 1919.
4—Schmitz, H.: Jour. Radiology, 2:55, 1921.

Discussion

DR. HENRY SCHMITZ, Chicago: The paper of Dr. Dorsey is certainly a highly scientific one. It is very interesting and important for therapeutists. There is not anything that Dr. Dorsey has said with which I should differ. There are various things we should keep in our minds. In the first place, as Dr. Coolidge has probably found out, we should remember the differentiation of dose. Dose is the amount absorbed. It is made up by the intensity of the x-ray current, the time duration and the application divided by the volume. Now this volume is, of course, in our equations a unit and consists of 1 cc.; in other words, if I have these three factors, I know exactly what may happen in a 1 cc. dose. When the distance is increased from the focus conditions necessarily become entirely different, due to the absorption and radiation in the tissues; in other words, if we apply this to a carcinoma of the uterus it becomes necessary for us to determine the exact distance of the tumor area from the focus, the tube. We know under general conditions the skin is 35 cm. from the tube, but the cervix necessarily lies at least 10 cm. farther from the tube; that is, instead of being 35 cm. it is 45. We have made a great many measurements in women in order to determine the difference in the distance of the tube from the uterus. We found in the lean, small patients that the diameter from the posterior surface of the abdomen to the posterior skin surface averages about 16 cm. In these 16 cm. we estimate that the cervix usually lies 10 cm. beneath the anterior surface. Another patient will measure 18 and others 20 and 22, with a few exceptions above 22. We went about regardless of the results obtained by other methods, inserting the measuring chamber in the vagina. It was found that at the plane where the cervix was located, necessarily whatever the instrument measured at that point would be the dose that was given at this point of the cervix. We came to some very remarkable conclusions. If we used a voltage of 90,000, with 5 milliamperes of current, filtration 10 mm. of aluminum and 6 mm. of sole leather, a focal distance of 35 mm. from the skin surface and a diameter of 25 cm. we found that the intensity of the dose in the cervix through the anterior skin was about 30 per cent. on the average, sometimes 25 and sometimes 28. The posterior field is only 5 or 6 cm. beneath the skin and you have a difference of 50 per cent. of the skin dose, using a new machine. In patients who have a diameter of 20 cm. the result was more unfavorable. In patients having a diameter of 25 cm. the dose brought to the cervix was reduced to about 50 per cent., while in patients with a diameter of 20 cm. it was reduced about 40 per cent.

Now the question arises, what is the real cancer dose; what radiation must we use to get results? We once believed that carcinomatous tissue was twice as sensitive as normal skin; in other words, if you applied a skin dose under these conditions, then you were practically using the cancer dose at the skin. This was found out by considering superficial carcinomata. Take a cancer of the breast on the anterior chest wall, the depth is not very great, especially if it is not very extensive. Under these conditions it was found out that if you wished to bring about a decrease in size and an absolute disappearance of the cancer it required 90 per cent. of the skin dose. That does not mean that in each and every instance you could make the cancer recede. I do not wish to enter into a discussion on something on which we might find exceptions. If we applied the proper skin dose, we were still losing 10 per cent. of the skin dose under the most favorable conditions and 50 per cent. under unfavorable conditions. The question now arises, what is the skin dose? Unless we get an exact definition for skin dose and know how to obtain it, our results necessarily must vary and that is the one great question which we must answer. I will not dwell on this point. The methods that are based on ionization are the only methods in my opinion which will give us the solution of the problem. However, it would be entirely wrong to expect every therapeutist to use the ionization method in the determination of the dose. If we do exactly as Dr. Dorsey has told us, know exactly the voltage, know exactly the type of apparatus with which we are working, use always the same tube, the same filter, the same focus, same skin distance, and the same field, then the results which have been determined by the ionization method must always be the same. Unless we do this we will always get different results and we will always have failures, but if we follow out Dr. Dorsey's method in studying details in obtaining our dose, we will always be correct.

*—Read at the Mid-Summer Meeting of The Radiological Society of North America, held at Boston June 3rd and 4th, 1921.

Recent Developments in Deep Therapy Technique-Facts and Fancies

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We think it has been proven beyond the shadow of a doubt that both x-ray and radium have a definite field of usefulness in the treatment of malignant growths. In the consideration of this subject, we want to try to come to a little clearer understanding about several things, viz., the objective for which we strive in using these agents in treating malignancy; second, the method of their action; third, the kind of cases suitable for this kind of treatment; fourth, the results which can be obtained in the various types; fifth, the essentials of proper technique.

The object of radiotherapy is fourfold as defined by Finzi (1). The first is to prevent dissemination. Due to the value of the rays in damming up the lymphatic channels and in rendering malignant cells incapable of reproduction, we are able to use these agents for this purpose. The second object in the use of this kind of therapy is to kill the growth in situ. The third is to render an inoperable case operable, and the fourth is to render the patient more comfortable in cases where they have been pronounced inoperable.

Method of Action

The action of the x-ray and radium in the treatment of malignancy depends almost entirely on the destruction of the growth. Destruction of the growth by these agents is in direct ratio to the power of reproduction of the cells in the growth. That is, the more rapidly the growth is growing, the more easily will it be affected by radiotherapy; so that cases which have been of long duration necessarily require more severe treatment than do those of recent origin. The histological effect of the exposure of the tissues to radiotherapy is shown by a direct action upon the capillaries in the growth. After exposure to radiant energy the endothelial lining of the small capillaries becomes badly swollen, increasing to such an extent that the lumen of the vessels becomes entirely obliterated, resulting, under proper treatment, in an endarteritis obliterans. Another action is that upon the cells of the growth itself. This is shown, first, by the effect on the nuclei. There is a dense, cloudy swelling of the nuclei with a little later a rupture of the nuclear membrane, followed in due course by cloudy swelling of the entire cell. Shortly after this, the cell itself disintegrates and disappears, probably being carried away by the phagocytes. The last cells in the growth to die are those supplied with the most abundant nourishment. This means that the nests of cells placed between the branches of arteries which are almost surrounded by a rich blood supply, are the last to yield up their vitality. It is from these cell nests which have not been destroyed by the treatment that we get our local recurrences. After destruction of the cells of the growth, we have them replaced by conective and fibrous tissue; so that the parenchyma of the growth is destroyed and we have left behind a mass of scar tissue. Tissue which has thus been treated does not respond very well to later treatment, consequently, it is very important for us to administer sufficient treatment to completely destroy the growth at as early a date as possible after beginning the treatent. Previous treatment of a growth by means of caustics also renders the treatment by radiotherapy more difficult. It has been a matter of clinical observation that when infection is present in a malignant growth, treatment by radiotherapy seems to spread the disease instead of destroying it. This is due, in our opinion, to the fact that radiotherapy minimizes leukocytosis, breaking down the barrier which nature needs in combatting infection. Consequently, when a patient with a growth is presented for radiotherapy and which has infection present, it is necessary for us to rid the growth of the infection before we begin the treatment.

Due to the fact that malignant growths spread through the lymphatic channels, especially the carcinomas, it is only reasonable for us to use the same precaution in administering radiotherapy that the surgeon uses in his treatment, viz., that we should try to block off the danger of metastasis through the lymphatic channels. This can be done effectively by the application of radiotherapy to the growth itself in sufficient doses to kill it and at the same time administer a dose to all the surrounding lymphatic channels sufficient to cause their obliteration. Since lymphatic tissue responds rather easily to radiotherapy, this blocking off can be done without destruction of the superimposed skin. By this method of attack, one will find that the recurrences following radiotherapy in properly selected cases are reduced to the minimum.

The kind of case suitable for radiotherapy must be well established so that we will not assume to do the impossible. We have divided these into three main classes: first, those in which radiotherapy is preferable, including epithelioma of the face and lip and certain types of mouth cancer, cancer of the cervix and lympho-sarcoma; second, those cases in which radiotherapy is optional, cancer of the tongue, cancer of the penis and cancer of the breast; third, those cases in which radiotherapy is the last resort, viz., in all inoperable cases of malignancy. There should be preoperative treatment in all malignancies and postoperative treatment in all cases.

Technique

During the earlier history of x-ray therapy, technique was largely a matter of individual experience and observation. Due to the type of apparatus which was employed there was no possibility of standardizing the technique. During the last few years, however, certain changes have been made in the mechanical methods of producing x-rays which lead us to think that standardization of technique will soon be an established fact. Mechanical changes which have been made are due to two important things; first, the invention of the so-called interrupterless transformer which gives us a constant unvarying output over long periods of time; second, the invention of the Coolidge tube which is so made that we can actually duplicate results day after day, producing the deep penetrating rays of certain definite quality of penetration and of certain definite volume. As early as 1914, I had realized the value of high voltage for producing x-rays, coupled up with heavy filtration, in order to shut out the rays which we did not desire to use. By this technique it is possible to get the maximum dose into the growth with the minimum amount of skin reaction. This technique proved so valuable in my hands that I have continued to use it constantly in all deep therapy. I soon found that it was possible by employing this technique to give doses which under other technique were unheard of and absolutely out of the question. In fact, my technique for the past seven years has been the employment of not less than a ten-inch spark gap, measured between two points, and not less than six millimeters of aluminum as filter.

Recent publicity given to the so-called advance in deep therapy, as outlined by the Germans, calls for reconsideration of the matter of deep therapy technique. Certain points which have been brought out by this publicity are extremely valuable while others have doubtful value. The valuable points are the fact that a small ionization chamber has been devised which can be introduced into the vagina or rectum during deep therapy of the pelvis, so we have a way of measuring the actual dosage which enters the tumor instead of measuring the dosage received by the skin and estimating the dosage received by the tumor. This little refinement in mechanical measurement of the quantity of x-rays received in the tumor makes it possible for us to definitely estimate the lethal dose for cancer cells. By estimating the lethal dose for cancer cells then the purpose of our treatment becomes more firmly fixed, viz., that we should try to kill all the cancer cells found in the patient's body. The second point of value that has been emphasized is the fact, which has long been proven by the biologist, that cancer cells are more easily affected at the first treatment than they are at later treatment; that is, after exposure to radiation the cells develop a certain amount of immunity. Theoretically then, we should attempt to administer the lethal dose to cancer cells at the first treatment. Whether it is possible to do this without overwhelming the patient's power of resistance and practically killing the patient on the table, is a question which is open to argument. We are inclined to think that in America we shall be compelled to give the single massive dose broken up into several short periods of treatment alternating with periods of rest, but the dosage being completed in a two or three day period.

Another advantage in the technique advocated by the German clinicians is the use of a greater anode skin distance. In America, it has been customary to use an average anode skin distance of nine inches, while the German average anode skin distance is thirty-five centimeters, or fourteen inches. (6) This means that the ratio of the dosage received by the skin and the tumor is considerably changed by employing a greater distance, so one can actually deliver a larger volume of x-rays to the tumor with less skin reaction than he can by using the closer distance. For instance, suppose that the tumor to be treated lies four inches below the surface of the skin and we use an eight-inch anode skin distance, the total anode tumor distance would be twelve inches. Under the technique of using a fourteen-inch anode skin distance, the anode tumor distance would be eighteen inches. Using these two distances as illustrative of the difference in time required to get the same dosage into the tumor, we have the following formula: using the twelve-inch anode tumor distance as a unit one, and comparing it with the eighteen-inch anode-tumor distance, it will be found that it requires 2.25 as much time—all other factors being equal—to get the same dosage into the tumor at the greater distance than it does at the lesser distance. In order to estimate the difference in dosage received by the skin we would use the factors eight and fourteen. Since the quantity of rays varies inversely with the square of the distance we would have the following formula: 8^2=64, 14^2=196.˙.64 : '96 : : 1: 3.06. This interpreted means that the skin dosage at the greater distance—all factors being the same, including time, would be approximately one-third of what it would be at the lesser anode skin distance; which would mean that we have a margin of safety of two-thirds which we could employ in giving additional dosage to the tumor, but since at the greater distance it requires 2.25 as much time to get the same dosage into the tumor we would actually have only a margin of .75 which could be used in getting additional dosage into the tumor. For the sake of simplicity we are disregarding the filtration of the rays by four inches of body tissue. When this is utilized through two or more ports of entry we can readily see how much greater dosage can actually be delivered to the tumor by the greater distance.

By using the greater anode skin distance, a larger port of entry can also be employed, so that the secondary rays generating in the tissues themselves will be considerably greater than when a smaller port of entry and a closer distance is used. To quote from Leonard B. Loeb (2): "We can then safely assume that the amount of chemical change produced in the tissues by the action of these radiations per cubic centimeter of tissue is directly proportional to the total number of ions produced in that cubic centimeter. And we may therefore at once proceed to compare the relative activities of the various types of agents on the basis of their ability to produce ions in a given number at a given place. In doing this I will first show how this number varies with the different factors entering into the exposure.

"1. The total number N of ions produced per unit volume depends on the number of ions formed per cubic centimeter per second I and on the number of seconds exposure T, i. e., N = I X T. (This holds well within reasonable limits. Where exposure time becomes so long that elimination of reaction products by the body as well as marked physiological changes can take place this no longer holds, e. g., in comparison the action of gamma rays from 200 mg. of radium for one hour with that of 4 mg. of radium for 50 hours).

"2. The quantity I will vary directly with the quantity of radiation emitted by the source per unit time, i. e., I is proportional to the quantity Q. In other words, the ionization will depend directly on the quantity of radium used, or on the milliamperage going through the x-ray tube.

"3. The quantity I will further depend on the total number of ions produced per second by the radiations per unit of radiating substance, or radiations, used. Thus we know that the 13.6×10^{10} alpha particles of radium produce 2.56×10^{16} ions per second, per gram of radium when absorbed. The beta particles produce 9×10^{14} ions per second while the gamma rays from one gram of radium produce 13×10^{14} ions. The total number of ions produced by the x-rays from a Coolidge tube operated at about 90,000 volts, with 10 milliamperes possibly yields about 4×10^{17} ions, assuming that the efficiency of the x-ray tube is 0.2 per cent in producing x-rays and that each electron in the tube giving a homogeneous x-ray pulse would in matter give 3.5×10^{3} ions. This is an assumption which so far has not been accurately checked experimentally. It is here that some physical work must be done in order to enable one to compare x-ray ionization more rigorously with the radium rays. The value of 3.5×10^{3} was found by Rutherford's pupils for slow beta rays whose velocity in order of magnitude with the number of ions to be expected from energy considerations. It is possible that the number of ions estimated above may be in error by a marked amount. This error will make the ionization higher than it really is by a factor which depends on the homogeneity of the rays, and which with the data before me I am unable to estimate.

"4. The number of ions per cubic centimeter per second formed in a given region will depend on the fraction of the total radiation from the Q units of radiation used which strikes the area considered. This fraction is determined directly from the solid angle subtended by the area in question at the source. It can be computed from the ratio of the area cut out of the surface of the sphere surrounding the radiating source at the place considered, by the cone whose apex is the radiating source and whose base is the area radiated, to the total surface of the sphere for the rays from radium, or to the hemisphere for the case of the x-rays. To a sufficiently close degree of approximation it is given by the area A of the region to be treated divided by $4\pi R^2$ for the radium rays, or $2\pi R^2$ for the x-rays, where R is the radius of the sphere, i. e., the distance of the area from the radiating source."

The filter employed in the German technique is not less than one-half millimeter of pure copper. This has the same filtering quality as twelve millimeters of aluminum. Of course this well cut out a larger percentage of the rays than will six millimeters of aluminum, so that in using the same spark gap we are now using we will be compelled to increase the time of treatment considerably in order to get the same volume of rays into the tissues. The research work done by Professor J. S. Shearer (9) has proven beyond the question of a doubt that increasing the filter without increasing the voltage to care for it cuts off a very large percentage of the rays emitted from the Coolidge tube. In fact, according to him, in no case would twelve millimeters transmit half as much as six millimeters; consequently, when we are continuing to employ the same voltage under the newer technique that has been previously employed with less filtration, you can readily see that the time must be increased many fold. In fact, three millimeters of aluminum transmits 13 per cent. of the wave length .45 Å, while six millimeters of aluminum transmits only 2 1/3 per cent of wave length .45Å. We do not have the figures at hand but you can readily see from this that twelve millimeters would transmit a very small percentage of the same wave length. Theoretically, the technique suggested by the German clinicians has attempted to overcome this difficulty by employing a materially greater voltage. The facts in the case are, however, that the symmetrie outfit when operated according to the instruction of the manufacturer furnish only a parallel spark gap of twenty-four centimeters or what would be equivalent to 9.6 inches. The Veifa outfit, however, at its maximum output has a capacity of twelve and a half inch parallel spark gap. (3) measured between blunt points.

Professor Wm. Duane of Harvard (4) has proven that the product of the voltage applied to the x-ray tube into the wave-length of the shortest x-rays produced is constant and equivalent to 12,360. Since the shorter the wave-length the more penetrating the ray is, this law is the fundamental basis of the modern high tension, short wave-length x-ray therapy.

From this evidence we can readily perceive the folly of increasing the filtration to the extent of one-half millimeter of copper unless we increase the voltage to correspond. In other words, if we do this, we are simply fooling ourselves and are not getting the dosage which we think we are getting, but if one wishes to combat malignancy in a scientific manner by means of the newer technique, one cannot escape the importance of the facts mentioned above.

This accounts for the extremely long period of treatment employed by the Germans together with the fact that in America we ordinarily employ five milliamperes of current while the Germans use from one to two milliamperes. The difference in the quantity of rays passing through six millimeters of aluminum filter to the tumor and the quantity passing through a half millimeter copper filter accounts for a considerable amount of the difference in the time factor employed by the Germans as contrasted with that employed in America.

There is another factor, however, which enters into this time element. In America it is the common custom to employ five milliamperes of current into the tube while the Germans usually employ only one or two milliamperes of current. As you will see, this would increase the time factor five times if only one milliampere was used or two and one-half times if two milliamperes were used, all other factors being the same. This leads us to think that practically speaking, some Americans have been using the same dosage for a period of years that is now being heralded as something entirely new.

The points in the reported German technique which have been misleading are those in which they mention the enormous voltage and the amount of dosage used. It is not generally understood by American physicians that our method of estimating the voltage is vastly different from the method used in Germany. In America, in estimating the voltage passing between two points, the root mean square (r. m. s.) voltage is used, (5), which means that for a ten-inch spitting spark, roughly speaking, 100,000 volts is required. In Germany, the peak voltage method of measurement is used, so that in order to make our voltage reading correspond to theirs, we should multiply the American voltage by 1.4 which will give us the equivalent German reading. For example, by the American measurement, a ten-inch spitting spark between two points, would be equivalent to about 100,000 volts, multiplying this by 1.4 would give us 140,000 volts which is almost 50 per cent. difference to the German equivalent. This voltage as reported by men who have recently visited German clinics and have seen the treatment actually being administered, is the maximum voltage which is actually used in clinical work; consequently, the German clinical technique employs no higher voltage than that which some of the American radiologists have been using for a number of years.

The whole problem then resolves itself into the matter of shooting a lethal dose into the cancer tissue without destroying the superimposed structures. I feel that it has been definitely proven that this can best be accomplished by the employment of high voltage current combined with radium used in the hollow viscera, or even as needles inserted into the tumor itself. In this manner we should expect the maximum percentage of good results.

Summary

The technique recommended in the above description must be adopted very cautiously by those who have made sufficient study of x-ray therapy to thoroughly understand the principles involved. One of the chief factors involved in this technique, it appears to me, is the fact that we must step up our voltage to produce a shorter wave-length which is of greater penetration in order to correspond to the increased filtration employed. That is, I cannot see any advantage gained by employing the equivalent of twelve or thirteen millimeters of aluminum as filters and using only a nine-inch spark gap which has already been proven, is scarcely sufficient to penetrate six millimeters of aluminum. When using this extreme dosage the patient must be thought of as well as the condition for which he is being treated, so that the patient must be prepared for treatment a day or two by rest in bed, elimination and alkalinization. The patient then must have the greatest aftercare. We feel that it is impractical to deliver a lethal dosage at one sitting if we want to have the patient live after we get through with the treatment, so in our opinion the lethal dose should be administered, spreading it over about three days time. This leads us to the conclusion that it is going to be almost impractical to use this technique in the office. Practically all of this treatment must be administered in the hospital. Its chief usefulness would appear to be for malignancies involving the pelvic viscera and in deeper structures of the trunk of the body.

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Discussion

DR. G. E. RICHARDS, Toronto, Canada: I regret that I have not my lantern slides with me to show while discussing this paper on deep therapy. I shall give you a resume of the work we have been doing and the conclusions we have allowed ourselves to draw.

We have been working a little better than six months with an apparatus which gives us a full measure 12 inch spark gap between blunt points, the ordinary blunt points used in this country. This is the measurement taken when the tube is running. For the first three months of that period our spark gap was measured about 11.5 and the last three months it was a little better than 12. We have averaged it up and called it 12. Our filtration has been one sheet of ordinary photographic glass. We are using 11x14 plates. There was a filter of 10 mm. of aluminum below the glass. The object of the glass was first of all to protect the tube from puncture and secondly, the glass is equivalent to 1 mm. of aluminum for our purpose. We have eliminated all the other filters and are merely working with the equivalent of 12 mm. of aluminum. Our skin distance has been 10 inches throughout. We have passed 5 ma. of current through a standard Coolidge tube against the advice of Dr. Coolidge with no damage to the tube. I changed the tube at the end of three months in case something would happen to the tube, but nothing happened. We run our apparatus in periods of 10 minutes, then rest the tube for 10 minutes and then another 10 minutes of exposure until we deliver our total dosage. Our total dosage will perhaps work out somewhat as follows: In 60 minutes exposure we get a very nice reddening of the skin with no discoloration; in 70 minutes we get discoloration; in 75 minutes in one case in which I have that exposure we got a burn of the first degree with sloughing, which healed in six weeks without further trouble. So much for technique. The results have been encouraging and in two or three instances I felt that we could be enthusiastic, especially in cases of sarcoma in which we have gotten apparently very much better results than anything we ever obtained before. We had 15 cases of sarcoma under treatment, of which I think 8 have disappeaed and have given no evidence whatever of recurrence. Those include osteosarcoma of the ilium, osteosarcoma of the mandible, the small round cell sarcoma arising in the neck. We have two cases of primary sarcoma of the lung. Of these we have one case which has disappeared for more than four months and one still under treatment. We have one case of secondary sarcoma of the lung and one case each, severe cases, of sarcoma of the tibia and of the femur. The last series of cases have been uniformly good. We have a case of carcinoma of the pancreas, which is to me of great interest. This was a case diagnosed by the x-ray. On the basis of the x-ray report operation was undertaken and the diagnosis poven correct. Sections were made and reported by the pathologist as adenocarcinoma. After three series of treatment extending from September of last year to March of this year, during which time we gave three series of intense treatment, the mass disappeared and the patient has gained 45 pounds in weight and is now back in business. When the treatment was undertaken he weighed 91 pounds, so he now weighs more than normal. I do not want to use the word "cure" in connection with this case because I realize the fallacy of speaking of cures in so short a time. From radiographic standpoint the stomach area is normal.

We have several cases of carcinoma of the side of the neck with good result. We have six cases of carcinoma of the uterus with apparent improvement and several other cases which make one feel enthusiastic. The chief thing I would like to say would be to describe two cases in which we had fistula. One was a case of carcinoma of the pancreas. In this case the carcinoma was primary in the pancreas and proved at operation. It involved the pyloric end of the stomach. I gave him the same intensive radiation that we gave the previous case of carcinoma of the pancreas. In no case have we administered intensive radiation all in one day. We gave the following treatment: The first day he received four areas, one anterior, one posterior, and one on each side. A perfectly normal skin reaction followed. An erythematous skin reaction followed the second dose. This all subsided within ten days. At the end of the fourth week he was taken with sudden severe attack of vomiting in which he vomited up a piece of tissue with blood and pus. He died in 24 hours. No post mortem could be obtained and there fore we have no means of knowing what happened. We believe the whole mass sloughed and not sufficient resistance had been given by nature to take care of such an occurrence as ordinarily happens in an inflammatory change.

The second case was carcinoma of the oesophagus of which we have treated two. In each case complete relief in swallowing occurred. These cases wee both completely obstructed. In each case at the end of six weeks the patients could swallow ordinary foods, such as thick soups with pieces of toast, tea and toast, etc., just as easily as I could. In one case the skin reaction subsided after six weeks. At the end of that time without any warning or without previous hemorrhage a piece of carcinomatous tissue sloughed out and the patient died of hemorrhage before any medical relief could be obtained. Sur geons have told me that they have had the same thing happen and they did not feel it was necessarily due to the effect of the treatment. I cannot help feeling it was due to a disintegration of the cancer tissue.

*—Read at the Mid-Summer Meeting of The Radiological Society of North America, held at Boston June 3rd and 4th, 1921.

The Treatment of Naevi

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"CAN a birthmark be cured?" Such is the query of surprise one often hears from the layman when the latter is informed a birthmark may be removed from a child without leaving a very noticeable, or, sometimes any scar at all. To the general public and to not a few medical practitioners, the birthmark is an enigmatical affliction that must be endured, the removal of which would be fraught with the gravest danger, or at least a disfiguring scar. The average layman regards it as the result of a maternal impression during the prenatal life of the individual concerned. Of course there is no scientific ground for this theory. It is not generally realized that many birthmarks do not begin to develop until varying periods after birth.

These popular and semi-popular impressions concerning naevi (from the latin, nascor, meaning to be born, hence birthmark) should be corrected for it is a crime against both society and the individual marked, to allow a child to grow up with a conspicuous, ugly and deforming birthmark, when the latter may be safely and usually painlessly removed during infancy, by methods which leave but little or no scar at all. As the child grows older the removal of the difficulty becomes less successful from a cosmetic point of view.

Just now our profession is waking up to the idea that it is better ethics to take the public into its confidence, and not hide its light under a bushel, as in the past. As medical men, we are naturally servants of the public, educated largely at the public expense, and it would seem to be our duty to properly, and in an ethical manner, give to the public the facts we have learned, when it is to be benefited thereby. Of course the trouble has always been, and may continue to be, that when the medical individual attempts to give the public this information, the latter is likely to be prejudiced, thinking it is for personal gain, and so leads to quackery. But if a recognized society endorses the information as in the case of the American College of Surgeons in the propaganda concerning cancer this difficulty can be avoided.

It would seem to be the duty of a society such as the Radiological Society of North America, to carry on some propaganda about cancer, and naevi as well.

As Darier remarks, "naevi would be more accurately described deformities of the skin, of embryonic or developmental origin, appearing at any age and taking a very slow course."

This definition would then include several dermatoses not ordinarily classed with naevi, such for instance, as ichthyosis, keratosis palmaris et plantaris, fibroma moluscum, v. Recklinghausen's Disease, adenoma sebaceum, syringocystadenoma and even so common and simple a disease as millia, etc. These we shall not consider in this paper, but confine our remarks to

1. Vascular naevi — including those derived from blood vessels known as angiomata, and those derived from lymphatics, known as lymphangiomata.

2. Non vascular naevi, which includes plane pigmented macules and patches, and raised soft and hard naevi, pigmented or non-pigmented, smooth or hairy.

It is rare to find an individual who has not a naevus on his body somewhere.

Vascular naevi are often present at birth, but by no means always, and they may develop a few days or weeks, or even years, after birth. They usually increase rapidly in size for a while, and then come to a standstill. Occasionally they go on and cause very serious and revolting deformities, particularly of the lips, cheek, eyelids nose, etc. There may then be great danger of serious haemorrhage from trauma. They are plane like the port wine stain, of any color from pink to livid blue, according as the unusually dilated vessels are superficial or deep; or they may be elevated, or tuberous cavernous. They more frequently involve the skin of the face and upper part of the body, but may involve any part, including the mucous membrane.

Occasionally they retrogress without treatment, and this fact seems to be deeply impressed on the minds of some of the profession for I have had many patients come to me with children with birthmarks, and they have stated that their physicians advised them to leave them alone, thinking they would go away of themselves in time. This is very bad advice, for most naevi do not spontaneously retrogress and many of them grow to very large proportions in a comparatively short time, so that they are very disfiguring or even dangerous. Treatment then cannot be expected to yield as favorable results as it might at an early stage. The younger the victim of the deformity, the more susceptible are the cells of the dilated and thickened capillaries to radiation, and the better the repair process.

Every physician and parent should be acquainted with these facts and just as in cancer, the earlier the naevus is treated the better.

If this plan were followed many children would be spared much sorrow, inconvenience and embarassment when they become older.

My first experience in the treatment of port wine stains was in 1903 when I used the Finsen-Reyn Lamp. A brief report of three of these cases in adults was made in an article entitled the "Finsen Light Treatment" printed in the New York Medical Journal and Philadelphia Medical Journal, August 20, 1904. We quote from this article as follows:

"Wine colored birthmarks are speedily and permanently removed by the Finsen Light and the treatment of three of these cases has given the writer much satisfaction, not to mention the gratitude and happiness of his patients. The reaction in some of these cases is slower in appearing than in others, not manifesting itself sometimes until forty-eight hours after treatment. Then the characteristic vesiculation about the border of the treated spot appears, while the centre becomes brown. After a few days the skin peels off and leaves an area exposed, which is several shades lighter than the original birthmark. This can now be treated again in two weeks, and an additional blanching takes place. If, however, it is not treated again for two or three months, it will be noticed that the spot continues to grow lighter for a considerable period. After a few treatments at intervals of a few weeks or months, the redness entirely disappears."

I have not had occasion to modify this dictum to any great extent since, except that in adults all the color does not usually disappear and the process is slow instead of being speedy.

Two of the cases mentioned had birthmarks involving the whole side of the face from forehead to mouth. They were almost completely cleared up, a pinkish, or, in places, a very white skin being left. One had had her face disfigured worse than ever by scars from electrolysis before she came to us for treatment. In both of these cases the blood could be easily pressed out by the diascope, and the color of the birthmarks was light red.

The third case was of much deeper involvement and the color was a dark bluish red. We only secured some diminution of color here, but the patient was not faithful with her treatment. Treatment was given as usual by the Finsen Light, by making compression with a quartz chamber with water flowing through it for 25 to 30 minutes, to an area about the size of a quarter or perhaps the size of a dime, according to the contour of the surface at the location of the area treated. It was necessary always to press the blood out of the area upon which the light was directed as Finsen had shown that the blood absorbed the ultra violet rays and prevented their further penetration. This method, it can be seen, consumed many hours of tedious work as the quartz chamber had to be held steadily in such a manner that the concentrated light from the lamp fell on the skin exactly perpendicularly, and just within the focal point so as to prevent actual burning.

In 1907 I imported a Kromayer (mercury vapor quartz) lamp and soon found that I could do this work much quicker. I obtained equally good results with pressure in five minutes so I have continued to use this lamp up to the present. It is essentially the same as has been manufactured in this country for the past few years.

In the use of the Kromayer Light the same technique of treating under quartz pressure with Finsen Light holds.

Although we have used radium in a number of cases of port wine stain since 1910, the Kromayer Light is still our instrument of choice and our results are for the most part satisfactory. Dr. William L. Clark in an article in the Therapeutics Gazette of May 15, 1916, endorses this method strongly and urges the use of ultra violet rays, filtered through blue quartz for an average of about 40 minutes to each area treated.

The elevated tuberous or cavernous naevi respond well to radium. Since 1910 we have used radium plaques for this purpose, crossfiring where possible. One of these plaques 2.5 cm. square, made in Paris, is supposed to contain 2 mg. of radium sulphate, one quarter pure, distributed throughout a varnish surface. Another contained 4 mg. one-half pure, distributed over a varnish surface 1.5 cm. in diameter.

A baby, ten months old, had a cavernous naevus of deep bluish red color on the nose, which protruded some distance and appeared to be about the size of a large cherry. It was soft and compressible, so that my finger on pressure on the end of the nose would sink into a depression about 1 cm. deep. On April 16, 1910, we applied a 2 mg. plaque with a filter of 1 mm. of silver and four or five thin sheets of paper one side of the angioma, for 12 hours, then immediately placed the radium on the other side for another 12 hours. In about two weeks there was a slight reaction and in two or three weeks more the angioma was thought to be smaller. A similar treatment was given 5 weeks later. The angioma continued to grow smaller and in a year's time one could scarcely see where the growth was. The girl is now ten and a half years old and there is no scar, deformity or any indication of any former growth on the nose.

We have treated several small naevi, mostly elevated and some cavernous in very young babies, at varying intervals since 1910 with one of these plaques, using in the more superficial cases, a filter of five or six pieces of thin paper and leaving the radium on seven or eight hours, with very satisfactory results. The naevi and temporary scar gradually fade away in these young cases until in one or two years there is not even a slight scar to indicate the site of the former growth.

When I visited the late Dr. Wickham in Paris, in 1908, he advised me to use a small amount of radium, even as little as .5 mg. in plaque for the treatment of plane vascular naevi. In the cases he reports in his book, he used much larger quantities. But I have found his advice to me good, and when later I tried large quantities of radium in tubes in these naevi, I was disappointed. My practice has been to give only one to three doses at intervals of 6 weeks to 3 or 4 months, not smaller doses every day, or every few days, as is frequently done, until the maximum is reached. I have been disappointed in this treatment, however, in several cases of large plane naevi both in children and in adults, and have found the quartz light much more satisfactory.

We have treated one case of lymphangiamatous naevus in a child one year old. It appeared as several waxy, whitish or yellowish white, deep hard permanent vesicles and scales at birth, on the chest. Its father and grandfather had similar lesions. Three applications of the radium with 1 mm. of silver and several layers of paper for about 17 hours, were used, several weeks apart. The growth disappeared in about 5 months. The child is now about 8 years of age and there is some slight pigmentation and telangiec tasis about the area treated. We got rather severe reaction from the first application of the radium and this caused the telangiectasis and pigmentation.

Spider Naevi and Senile Angiomas

Spider naevi appear on the face or hands about puberty or sometimes later. They are small red spots, about 1 mm. in diameter, with arborescent branches extending out about 1 to 3 mm. I have failed in these cases with both radium and ultra violet light. Electrolytic punture or dessication with Oudin spark has given the best results in these little naevi. The same treatment can be applied to the senile forms, which are little rounded red spots about 1 to 3 mm. in diameter. They appear any place on the body and often retrogress without treatment. It is seldom one is called upon to treat these. I have seen a large number of these develop suddenly all over the body and in two patients whom I had treated with the old x-ray deep therapy technique for uterine fibroid. Most of the spots retrogressed though some have persisted for six years. They have been erroneously regarded as beieng indicative of carcinoma of the abdominal viscera. Darier and others regard them as delayed naevi

Non-Vascular Naevi

1. Plane pigmented macules and patches—Naevus spilus.

We have had no success with light, radium or x-ray in these cases. Carbonic snow has yielded very fair results and dessication has also been of considerable value. Both these methods are painful and the latter can only be used under local or general anaesthetic. Treatment with them leave soft superficial white scars.

Raised Non-Vascular Naevi

Ordinary small or medium sized moles we have usually treated quite satisfactorily with electrolysis or dessication. If electrolysis is used it is preferable to have ten or twelve needles conveniently attached to the negative pole so as to save time. The needles should be inserted not more than 1 mm. apart, through the base of the growth, and should cover every particle of the area of the base so as to destroy the mole in its entirety to avoid great danger of malignancy.

I have seen several cases of carcinoma develop from moles which had been excised, and some from moles which had undergone some trauma. In treating non-vascular naevi one must be exceedingly cautious to destroy every cell of the growth at one sitting if possible. When electrolysis is used and the needles are all in place the positive pole is applied elsewhere on the body (I usually have the patient place a hand in saline solution connected with the positive pole) and 2 ma. of direct current are turned on for 2 minutes or longer. When this is complete I often change the position of the needles so that they enter the growth in another direction, being careful to destroy the outer border in its entire circumference. Usually the wound will heal in 2 or 3 weeks and there is no more trouble. The scar will gradually fade out during several months and in a year is not very noticeable.

I have also used radium in small quantity satisfactorily on moles.

In the larger, elevated, non-vascular naevi, it may be advisable to use a combination of radium and carbon dioxide snow, or dessication. The radium reduces the size and depth of the growth but will not affect the color if it is pigmented. Snow or dessication must be used for destroying the pigmented area later. If the mole or growth has numerous coarse hairs these can be permanently destroyed by radium, or electrolysis. In these cases of pigmented naevi we do not use the weak plaques but a sufficient number of radium needles to cover the area containing a substantial amount of radium, properly screened, for fairly deep action in the cutis.

Hard verrucose naevi usually appear during the first year. They are usually pigmented, more or less, but only exceptionally hairy. They are best treated with well screened radium, if very thick, followed by dessication.

We have not mentioned caustics, cautery, or excision in the treatment of naevi. We believe they are rarely called for. The field properly belongs to radiology and electrotherapy. Carbon doxide snow is the exception so far as caustics are concerned. Capillary naevi should not be treated by electrolysis, as irregular scars are left with red between, so that later treatment by other methods is not so satisfactory.

We have not found the x-ray to be a safe or effective method of treatment and advise against its use in naevi.

In Conclusion

1. There is great need of propaganda for the public as well as the general practitioner as to the advisability of properly treating at the earliest possible moment all naevi by radiological, electrical and carbon dioxide methods. The earlier the treatment the better the results. The right of the child to be spared the humiliation and embarrassment of disfiguring birthmarks should be insisted upon by this and similar societies.

2. Kromayer, or Finsen Light, gives best results in port wine marks.

3. Radium in small quantities over long periods of time gives satisfactory results in raised or cavernous haemangiomata.

4. Dessication of carbon dioxide snow can be used to best advantage in plane pigmented naevi.

5. Radium followed by carbon dioxide snow or dessication give good results in raised, verrucous, soft, and hard naevi, with or without hair.

6. Electrolysis or dessication are indicated in soft moles.

7. The tendency for moles and pigmented naevi to become malignant must ever be borne in mind, and thorough radium treatment be used preliminary to other treatment in indicated cases.

Discussion

DR. ALBERT SOILAND, Los Angeles, Cal.: It was a pleasure to listen to these two papers on such an important subject, by men who know their business and know what they are talking about. Those of us who are doing much therapeutic work know that approximately three fourths of our daily work deals with superficial conditions, malignant and otherwise, and I feel that we cannot emphasize this subject too strongly.

I was very much interested in Dr. Grier's presentation of his teatment of superficial lesions, particularly those around the eye, and while he is taking a rather strong attitude about using massive doses around the eye, I think he is on the right track and if we will follow him, I am sure we will see his good results.

I do not quite agree with his dogmatic stand that a specific number of treatments will always suffice. So many of these cases are not of the type which will respond to one, two, or three applications. Some of them will not get well no matter how much you give them. His pictures, however, show that he gets results, and I want to voice my respect for his method.

The question of moles is an important one. Aside from the pigmented appeaance of many of these, there is always a danger of potential malignancy. Like Dr. Stevens, I went through the Finsen light treat ment, and spent part of two or three seasons in the Finsen Institute. I was interested in his work on lupus. In this country, however, the people have not the patience to spend the necessary time with the Finsen method. We find that radium and x-ray will handle lupus just as well and in a much shorter period of time.

The main desideratum with naevi is the successful removal of pigments. Of all the agents which Dr. Stevens has enumerated, I believe that carbon dioxide snow used to its full effect is the best single agent we have to destroy pigmented naevi, provided they are not too large. The dessication method of Oudin is a wonderful help in treating the raised and non-inflammatory type of moles or naevi. In the inflammatory kind, those that are either malignant or potentially so, I believe should be treated with radiation.

It would take a long time to go over all the points Dr. Stevens covered. I believe we should all pay more attention to the complete destruction of our superficial lesions than we have heretofore.

DR. ROLLIN STEVENS, Detroit, Mich., (closing his part of the dis cussion): In reply to Dr. Grier's question as to what I mean by dessica tion, I follow Dr. Clark's method and simply use a very small hot spark around the mole, then all over the surface, and then run the needle into the substance of the mole in two or three places. Then the surface is cleaned off and the spark applied again and so on until the whole thing is taken away in one sitting. We use the monopolar method, but if you use the bipolar method you have to use a general anesthetic. You cannot use the bipolar method without it.

*—Read at the Mid-Summer Meeting of The Radiological Society of North America, held at Boston June 3rd and 4th, 1921.

Radiotherapy in Superficial Malignancy

G. W. Grier, M. D.

Pittsburg, Pennsylvania

THE value of radio-therapy in superficial malignancy is now so generally recognized and the method of treatment so standardized, that any extended remarks on this subject seem rather superflous. My reason for taking up the time of this body of expert radiologists with such a timeworn subject is to emphasize or rather re-emphasize, for all I have to say has been published by many authors, the importance of certain fundamental facts in the treatment of superficial malignancy. The secret of success in this work lies in the following points:

1. Use a destructive dose to the point of tissue necrosis throughout the lesion.
2. Apply all this dose in such a short period of time that there will be no chance for tissue reaction between treatments.
3. Do not use any filter because the large dose necessary to produce this necrosis, with filtered rays, will produce an obliterating endarteritis deep down in the tissues and a consequent roentgen ulcer which will not heal.

This is a summarization of the massive dose method of treatment of superficial lesions and is the logical sequence of the Coolidge tube.

The first case treated in our laboratory according to these ideas was treated by the author on April 4, 1915. The patient was a charity case referred from the wards of a Pittsburgh hospital. This woman had a large epithelioma of the nose. We gave her 5 ma. for 10 minutes at 8-inch skin focus distance, using a 6½-inch parallel spark gap, and no filter of any kind. This dose was repeated on the second day following and we then "stood pat." In about a week she returned with the most violent x-ray reaction possible, and a friend with her who spoke sufficient English to inform us that we had "ruined" her. We had our misgivings also, but discreetly held our peace. In due course of time the reaction subsided, and the wound healed with a negligible scar and has remained well since. We have used this same technique ever since with such variations as I shall specify.

In order to prevent recurrence it is necessary to expose a small margin of healthy skin or mucous membrane entirely around the lesion, say ⅛-inch or slightly more. If this is not done, recurrence will take place in the edge of the scar. No uneasiness need be felt about exposing this edge of healthy skin as it will heal up with the rest of the lesion. Tissue necrosis will, of course, result from the treatment and the resulting ulcer will heal up by granulation. Healing will be facilitated by keeping the lesion clean by means of sterile dressings, frequent cleansing with antiseptic solutions, or the application of antiseptic to the wound is sure to end disastrously. Under no circumstances must it ever be dressed with wet antiseptic dressings, or any kind of ointment. This is a good rule to follow where any skin surface has received anywhere near a maximum dose of x-rays. It is necessary to warn the patient not to put anything on the sore and not to pick the scab off. Otherwise, the wide variety of home remedies which will be used, from olive oil to turpentine, is really startling. We have been mystified many times to understand why the wound would not

Figure 1 shows character and extent of lesion usually cured by one treatment.

exposed to the open air as much as possible. If an attempt is made to keep it covered by any sort of a dressing, the traumatism incident to changing the dressing will pull off part of the scab each time the dressing is changed and delay the healing. After tissue destruction has taken place, the main object is to get scab formation as soon as possible and to keep each scab on until it comes off itself. The wound, of course, will be infected and pus will discharge freely. Any attempt to keep this wound bacteriologically heal, only to find later that the patient had been carefully removing the scab daily and applying peroxide of hydrogen, boneset tea, or some other pet cure-all. If the proper dose of rays has been administered, the only further thing to be done is to leave it absolutely alone.

The selection of a proper dose for each lesion will, of course, require a certain amount of judgment and experience. Our standard treatment as enumerated above consists of 50 ma. minutes at 8-inch skin focus distance, 6½-

inch parallel gap and no filter. We give from one to four of these treatments, allowing an interval of one day between treatments or the treatments may be given daily. There seems to be no logical reason why the treatment should not all be given at one sitting, varying the time factor only. We have made several tentative trials at this change in technique, but not very successfully, and each time have reverted to the method of treating every other day up to four treatments. Our difficulty in giving the dose all at one sitting has been to judge correctly the length of the treatment necessary to replace two, three, or four treatments on alternate days. One treatment of 17 minutes seems to give the same result as two 10-minute treatments given on alternate days, but beyond this we have made no progress. The interval between treatments should not be more than two days, or the effect will be different. If the treatments are spaced a week or two apart, this technique will not be satisfactory; and if the lesion does heal by this method, the percentage of recurrence will be much larger. We have had this experience many times. The successful x-ray treatment of malignancy seems to depend on giving a knockout blow at one time, and apparently this method of treating every other day has the same effect as if it were all given at one sitting. However, if a sufficient time is allowed to elapse between treatments for the tissues to recover from the effects of the previous treatment, the result will be entirely different. In order to treat successfully by this method it is necessary to examine the case carefully, decide how many treatments you are going to give, apply the treatments on alternate days and wait for the result. It is absolutely disastrous to give one treatment, wait the two or three weeks necessary for this treatment to take effect, and then if it is not enough give another treatment, wait again and so on. Whatever treatments are necessary must all be given close enough together that the effect is practically that of one treatment.

Figure 2 shows character and extent of lesion usually cured by two treatments.

The question of the number of treatments necessary is, of course, one of judgment, and occasional mistakes are inevitable. The smallest and most superficial of epitheliomata will yield to one ten-minute treatment. If the skin is ulcerated at all it is wise to give a second treatment of either five or ten minutes. An epitheliomata about the size of a dime with a crater one-eighth inch deep or more, with thick indurated edges will require three treatments; and a large deep rodent ulcer, or a fungating cauliflower like growth on the face or lip will require four. As a rule, lesions on the lip and hand require a little more treatment than those on the face. With these two exceptions, it is our rule not to give more than four of these treatments at one time. Occasionally, a very large, old, or indurated growth will not entirely respond to this treatment, and at the end of four or six weeks, there will be a little edge, or some other more resistant part of the growth which has not disappeared. It will then be necessary to give another destructive dose to this part in the same manner as at first, using the number of treatments that the remaining lesion seems to require. The line has to be drawn somewhere as to how many of these massive treatments may be given, and in our experience four is about the limit except on the lip or hand where two or three more may be given.

As before stated, no filter of any kind should be used. If the amount of treatment given is small and a filter is used, the lesion may heal but the percentage of recurrences will be fairly large. If a large amount of treatment is given so as to produce an x-ray burn, and in this technique without a filter a burn of some degree always occurs, if a filter has been used it will be very difficult to get this burn to heal. The x-ray burn produced in treating skin malignancy without a filter up to the four doses described will always heal in from six to eight weeks. In treating malignant ulcers with very deep hard edges, the logical thing seems to be to use a filter so as to get penetratinfi rays to affect this hard deep lesion. This is entirely wrong although it seems to be the natural trend of the radiologist's mind, and it took us three or four years to get it out of ours. A large percentage of our recurrences are due to this fallacious reasoning. Never use a filter when treating on epithelioma because it has thick hard edges. These edges are malignant and the purpose is to de-

Figure 3 shows character and extent of lesion usually cured by three treatments.

stroy them and this can be better accomplished by the large quantity of soft rays that have an escharotic effect than by the more penetrating filtered rays that go on through. Treatment can be facilitated in this kind of cases by using fulguration with the high frequency spark over the indurated edge before the rays are applied. Fulguration is a great aid to radiation in any instance where a large amount of superflous epithelium has to be destroyed. With the proper kind of a high frequency coil and by using an ordinary cambric needle as the sparking point, this fulguration can be done without any anaesthetic whatever. It is painful, of course, but it can be borne. We have treated several cases of superficial epitheliomata by fulguration alone, but a good percentage of these have recurred and we believe it is always wise to supplement this by x-ray treatment.

Since April 1915, we have treated 315 cases of superficial malignancy by the massive dose method in our laboratory. Of this number thirty-six have been treated by my associate, Dr. Geo. C. Johnston, 257 by myself, and twenty-two cases have been treated by the two of us jointly. Practically the same technique has been used in all. In these cases the lesions were mostly about the head and face. A few were on the hand, back, chest, or some other part of the body.

When treating areas that are habitually covered by clothing, a little smaller dose should be given than to exposed areas. Lesions on the hand and lip will require more than other places. Treatment of carcinoma of the lower lip should, of course, always be supplemented by radiation of the glands beneath the jaw and in the neck whether they are palpable or not. Out of twenty-three cases of carcinoma of the lower lip, we have had nineteen cured, two failures and two recurrences which were referred to the surgeon. We believe these results are much better than can be obtained by surgery. In addition, the deformity from this treatment is negligible, but very disfigur-

TABULATION ACCORDING TO LOCATION

		Cured	Recurred	Failed
Epithelioma Nose	73	73	..	..
" Face	53	53	..	..
" Eyelid	48	41	6	1
" Forehead	24	24	..	..
Carcinoma Lower Lip	23	19	2	2
Epithelioma Ear	22	22	..	..
" Temple	18	18	..	..
" Neck	8	7	..	1
Rodent Ulcer Temple	7	5	..	2
Epithelioma Upper Lip	7	7	..	..
Leukoplakia Lip	7	7	..	..
Carcinoma Hand	6	6	..	..
Rodent Ulcer Ear	5	2	..	3
Carcinoma Eyeball	4	4	..	..
" Scalp	4	4	..	..
Rodent Ulcer Forehead	3	2	..	1
Carcinoma Cheek	1	1	..	..
" Back	1	1	..	..
Ca. Nodule in Scar	1	..	..	1
	315	296	8	11

ing where successful surgery has been done.

In treating about the forehead or scalp, if the disease involves the periosteum, the treatment will not be successful. Likewise on the ear if the cartilage is involved. In lesions about the eyelid, it is wise not to use any larger doses than are actually necessary since the amount of ectropion resulting will be directly proportional to the amount of tissue destruction. However, unfiltered rays should be used. All of our recurrences in epithelioma of the eyelid have due to the use of rather small doses of filtered rays, and one of these cases has recurred four times and is still unhealed at this writing over four years after the case was first seen. In carcinoma of the eyeball, we have used one-fourth of the standard treatment, without filter, repeated every other day for four treatments and then wait for results. We have already reported three cases successfully treated by this method and since then have had two more, one of which is not included in this report, but which has been entirely well for two months at the time this is written. One case of melanotic sarcoma of the eyeball is now under treatment. It is improving, but has not responded in the very satisfactory way that our carcinoma of the eyeball cases have.

Out of 315 cases treated, 278 were cured after the initial course. Eighteen recurred and were cured by subsequent treatment, making a total of 296 cures out of 315 cases, or about 9 per cent. Eight cases recurred after additional treatment, and in eleven cases treatment was not satisfactory and had to be abandoned, making nineteen unsuccessful cases out of 315, or about 6 per cent.

Figure 4 shows character and extent of lession usually cured by four or more treatments.

Percentage of Cures

Healed after initial treatment	304	..	96%+
Recurred after initial treatment	26	..	8%+
		278	
Cured by radiation after recurrence...	..	18	..
TOTAL CURED.	..	296	94%—
Failed to heal after initial treatment...	11	..	..
Failed to heal after recurrence	8	19	6%+
TOTAL......		315	

Quite a large percentage of the recurrences were apparently due to the fact that they had been treated by filtered rays.

Recurrences

Where filter was used.......	14	..
Where no filter was used...	12	26

Analysis of 12 cases where no filter was used:

Only 1 treatment given......	2	..
Two treatments given, 1 month apart...............	1	..
Treated by fractional doses over long period previous to our treatment	2	..
Successive recurrence in one case previously treated with filter	3	..
Rodent ulcer involving cartilage of ear................	1	..
Treated by regular technique, no filter..................	3	12

Of the cases of recurrence that were treated without a filter in nine out of twelve cases, a logical cause for the recurrence was noted. Of the three remaining cases, I have found since this table was compiled that in one of them the recurrence was in the edge of the scar and palpably due to the fact that too small a margin of healthy tissue had been included in the original treatment. This leaves only two cases out of twenty-six recurrences where the regular technique was used and where there was not a logical reason for the recurrence.

Use of Filters

No filter used in....	241	..	76%
Filter used in part of or all treatments..	74	..	
		315	
Recurrences—			
No filter used in....	12	..	46%
Filter used in part of or all treatments..	14	..	54%
		26	
Failures—			
No filter used in.....	5	..	46%—
Filter uhed in part of or all treatments.	6	..	54%-|-
		11	
Cures—			
No filter used in...	228	..	77%—
Filter used in part of or all treatments.	68	..	23%-|-
		296	

Of the eleven failures, one case of carcinoma of temple may have been luetic, although Wasserman was negative. She was turned over for anti-luetic treatment, but never came back. One case of carcinoma of the temple we cured by radium after x-ray had failed. This may have been due to faulty technique in the x-ray treatment. One case of carcinoma of the lip had been treated by an amateur radio-therapeutist for five months, apparently with fractional doses. This case healed up under a massive dose, but recurred five months later and the recurrence would not heal by x-rays, or radium needles, and we turned him over to the surgeon, but he never appeared for operation.

In three cases of rodent ulcer of the ear, failure was apparently due to the fact that the cartilages were involved. These cases were all cured by operation.

One case carcinoma of forehead eroded into the frontal sinuses and treatment was not effective, although the lesion became very much smaller; in fact, healed up to the place where the bone was involved. This patient was an old lady seventy-five years old, she came about 200 miles for treatment, the surgeon refused operation, so we advised her to abandon treatment. She is still living and the lesion is slowly advancing.

One case of rodent ulcer beneath lower jaw recurred after being treated with filtered rays and would not respond to further treatment. He was cured by operation.

One case of subcutaneous recurrence in the scar following healing of a rodent ulcer was treated by large doses of filtered rays. It broke down and would not heal. We supposed it was a recurrence of his rodent ulcer and had him operated. The pathologist failed to find any evidence of malignancy in the tissue removed, and our opinion now is that the ulceration was a chronic roentgen ulcer following massive treatment with filtered rays.

Our experience with malignancy inside the mouth has not been so happy as that of cutaneous lesions or lesions on the lip. Previous to our acquisition of radium,

Radium Cases

	No. Cases	Cured	Im-proved	Died
Ca. Alveolar Process	7	1	2	4
Ca. Cheek......	4	1	†1	2
Ca. Tongue.....	3	‡1	..	2
Recurrent Ca. Lip after Op..	1	..	..	1
Ca. Middle Ear.	2	..	*1	1
Ca. Lip & Cheek	1	..	..	1
Ca. Tonsil......	1	..	..	1
Leukoplakia Chk	1	1	..	..
TOTAL	20	4	4	12

†Operated later.
‡Operated first.
*Still under treatment.

FAILURES

		Apparent Cause Failure	Final Result
Carcinoma Temple.....	1	Involvement too extensive	Patient abandoned treatments
Carcinoma Temple.....	1	Treated with filter at long intervals	Cured with Radium
Carcinoma Lip.........	1	Treated for 5 mo. previously by small doses	Referred to surgeon
Carcinoma Lip.........	1	Involvement too extensive	Abandoned treatment
Rodent Ulcer Ear......	3	Cartilages involved	Operated and all well
Carcinoma Forehead...	1	Involvement into frontal sinuses	Abandoned treatment on our advice
Rodent Ulcer Under Jaw	1	Treated first with filter and recurred	Operated, now well
Epithelioma Entire Lower Lid.........	1	Very extensive involvement. First treated with filter, recurred 3 times	Still under treatment
Ca. Nodule in Scar of Rodent Ulcer......	1	Numerous treatments with filter caused deep Roentgen ulcer	Operated, now well
	11		

we always refused to treat these lesions as we felt better results would be obtained by operation with cautery than by any x-ray treatment that could be applied. In the last three years, we have treated twenty cases of malignancy in the mouth with radium; Of this number we have only four cases living and well today. We have two more almost well at this writing in which we have hopes of obtaining a cure. One of our cases now well (carcinoma tongue), we had operated before we used radium, so we do not know where the credit belongs in this case, whether to the operation, or to the radium. We believe that some of our failures in these cases have been due to insufficient dosage. We first began giving these cases from 200 to 300 milligram hours, and are now giving 750 milligram hours at the initial treatment. We believe the latter dose is also probably too small. It is even more important in these cases than in cutaneous lesions to give an overwhelming dose at the first sitting. One of our greatest difficulties has been to find methods of keeping the radium in contact with the lesion for a long enough period of time. In our first cases treated we attempted to have the patient hold the radium in contact, but we soon found this was impossible. We now have the dentist see these cases with us in consultation and if he is able, he devises some method of attaching the radium to the teeth, or to a plate if the patient has one, or to modeling compound made to fit. In carcinoma of the tongue, in two or three cases we have resorted to suturing the radium in position. One of these cases healed up and remained well for about five months, but the lesion recurred and the man subsequently died. In lesions about the tonsil, we have been able to keep the radium in position by means of a tonsil clamp in several cases. On the whole, our experience with radium in cancer of the mouth has not been particularly satisfactory. We believe this is largely due to the difficulty in keeping the radium in contact with the lesion for a long enough period of time. This problem is made easier in some instances by the use of radium needles, but there are, of course, many places about the alveolar process where the introduction of needles is not possible. Probably if a dosage approximating that used in cancer of the uterus were used in the mouth, something like the same result might also be obtained.

Discussion

DR. A. F. TYLER, Omaha: I want to speak about two points mentioned by Dr. Grier because I think they are important. The first is, where we have the superficial lesion with a ragged, hard edge to use fulguration with the x ray to destroy that hard margin; also in the cases where I depended on fulguration alone to destroy the ragged edge, I found, as Dr. Grier said, that I was disappointed because I had a large percentage of recurrences. So wherever I use fulguration to destroy the hard margin of the superficial lesion I go ahead and treat it with radium and x ray just as though I had not used fulguration in connection with it.

The Doctor said that when the cartilage of the ear was involved he has been terribly disappointed and has recommended that case to the surgeon. I think that is true, though I have had several cases where the cartilage was involved with ultimate recovery if you give them time enough to repair.

DR. G. W. GRIER, Pittsburgh (closing his part of the discussion): There are one or two remarks I would like to make on Dr. Stevens' paper before closing the discussion on my paper. I have had the same experience as Dr. Stevens as to the use of radium in vascular naevi, that is, the cavernous naevi respond very nicely to radium treatment but the results from the use of radium in the port wine stains have not been very satisfactory.

In regard to the treatment of moles, I do not quite understand what Doctor means by dessication. Is it the same as you mean by fulguration?

There are two methods of treating moles, one consisting in introducing the needle into the tissue and passing the high frequency spark through it and the other is to let the spark jump from the end of your needle through the lesion. I use this second method a great deal in the treatment of moles. In the treatment of moles it is a very satisfactory procedure to spark these lesions with the high frequency spark until they are turned white and then turn around and give a big dose of radiation. I use the x-ray because I feel I am a little more master of it. I do feel that it is very dangerous to use anything like that on a mole, that is fulguration, carbon dioxide snow, unless you follow by radiation, because you are apt to stir the thing up and change it into a very malignant sarcoma. I have seen several of those cases in young people and they are very beautiful cases.

I think perhaps Dr. Soiland misunderstood my purpose in having a dogmatic method of treating these cases. You have to know how much treatment you are going to give a case before you can see what results you are going to get. In order to demonstrate the method, I said one, two, or three treatments. As a matter of fact often the treatment will be subdivided, that is, we will use one treatment ten minutes, the second five or ten, and third, five. You have to have pretty well in mind how many treatments you are going to give before you start and you have to be dogmatic so as to have some basis to work from.

*—Read at the Mid-Summer Meeting of The Radiological Society of North America, held at Boston June 3rd and 4th, 1921.

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The Annual Meeting

THERE is every indication that the forthcoming annual meeting, program of which is printed elsewhere in this issue, will be the most notable event in the history of the North American Society. The program, covering four days, gives assurance of a wide range of practical information of a scientific nature. Indeed, that program is so extensive as to be of very great value and assistance to every medical man be he especially interested in radiology or not.

It is hoped, therefore, that every member of the Society and all other radiologists will make a special effort to attend. The sincere wish is expressed that medical men generally will also attend and take part in the discussions so that all may profit from the interchange of ideas and by a fresh viewpoint on the problems which confront the radiologist and the medical man more strictly speaking.

No effort is being, or will be spared, to make the annual meeting one of the most constructive and instructive events of medical history. Large attendance will be but fitting recognition of the time and labor given by those appearing on the program and the officers who have attended to the tedious details incident to such a large and comprehensive scientific meeting.

A Research Bureau

QUESTIONS growing out of exploratory work in deep therapy, new apparatus and appliances designed to deliver unusually high potentials, physiological factors, biophysics, and numerous other matters of major importance, emphasize every day the need for a properly constituted research program of some sort.

These are problems the responsibility of which should not be abandoned entirely by the profession and left to manufacturers however willing they may be to investigate them.

There are so many sidelights on the practical, or perhaps more correctly speaking, the medical side that no manufacturer, unless he maintain a ruinously large organization consisting of competent medical radiologists and physicists, can hope to provide the data which is so vital to the development of the medical application of radiology.

No argument is interposed against the proposition that manufacturers should maintain research departments. But there is a very distinct line of cleavage between the field of exploration to be covered by such departments and the field the radiological profession so sorely needs.

As it is, these questions are being studied in a haphazard way by individual radiologists at their own cost in time and money. There are a number of men in the profession who realize the importance of delving deeper into the medico-scientific application of x-rays, radium and electro-therapeutics and they are giving the results of their labors freely and gladly to all radiologists. Witness the broad character of the program of the annual meeting.

However, an organized effort in this direction through The Radiological Society of North America in conjunction with all other agencies, professional, scientific, medical and manufacturing will serve to coördinate all such activities and give the direction and impetus necessary to rapid, extensive and constructive advance of the radiological profession.

A Licensing Board

THE question of licensing x-ray technicians is one the radiological profesison must answer in the no distant future. The best interests of radiology demand it. The conscientious technicians themselves are beginning to demand it. And the medical profession at large will soon come to insist on it.

It is purely a matter of fiction, of course, that lay technicians operating commercial laboratories can render that high quality of diagnostic service which the professional radiologist, can render. The one at best is a photographer, however expert he may be in that line. The other is a man who has paid the price of time and effort for medical schooling so that he may bring to his work specific knowledge of anatomy and disease.

These comments are not founded on a criticism of the lay technician. Quite the contrary. He is a very valuable and efficient factor in the practice of medical radiology. And if he is at all sincere he much prefers to operate under the direction of a competent medical radiologist than otherwise.

Because the technician is so closely identified with the radiological profession, it is probable the latter, in sheer self-defense if for no other cause, will have to provide a means of examining and licensing the former during the period of service under a competent medical radiologist.

Such a method, if handled vigorously and intelligently, ought to serve as a means of dividing the sheep from the goats, so to speak, and eventually go a long ways toward eliminating those who have so little regard for the interests of the public as to attempt diagnosis and treatment without any knowledge of what they are about.

State Medicine

IT is impossible to read "Trailing the Robin Hoods of Medicine", appearing in the October issue of "Century Magazine' over the signature of Mr. Glenn Frank, editor, without experiencing mixed emotions and confused cerebrations.

Briefly Mr. Frank begins his discussion with a statement to the effect that Johns Hopkins Hospital, wittingly or unwittingly has proved its capacity for making front page news by its recent action on the question of fees—a circumstance of which he disposes as "a case of much ado about nothing, an incident that is important only as it may attract public attention to a much broader issue, the problem of an adequate and statesmanlike organization of the medical service of the nation."

That surely is a correct statement of the case. The mere incident of fee fixing by any single hospital however large or small is purely a matter of local interest. But when, as in the case under consideration, the incident assumes such importance as to involve the principle or well established custom by which the whole medical profession gains its livelihood, then every person, layman and scientist, professional man and business man is vitally concerned. That is true of the precedent set by Johns Hopkins because of the eminent place it occupies in the medical affairs of the nation. And Mr. Frank has very well stated the crux of the matter in a manner that is extremely pungent, one might say almost epigrammatic.

Because the national health question is so urgent no thinking man, the medical man least of all, will be heard to voice objection againt the conclusion which Mr. Frank uses as the premise of his argument. Indeed, the whole question is so important that it intimidates many otherwise courageous men. Its consequences are so vast, its possibilities so tremendous that the average person evades the subject as fit only for a super mind.

That is why The Journal views Mr. Frank's effort to set down some of the more important phases of this question with more than passing interest. Were it not ludicrous to do so, The Journal would be heard to offer an earnest prayer that some super-intellect, perchance Mr. Frank's, be released of all human frailties for a spell that it might travel unhampered in the far reaches of space, time, and the complications of human affairs indigenous to every community, hamlet, town, county, state or other subdivision of the nation. And to that prayer should be added the wish that there be confided to Mr. Frank the majestic intellect of a superman, the wisdom of the Incarnate, because under that sort of an arrangement the medical profession would not be obliged to formulate any vision of its obligation to society: the rock of ages could be blasted for it by Mr. Frank.

There is no ridicule in this picture. The thing sought to be demonstrated is the utter futility of hoping for a collective intelligence that is larger than individual intelligence. That is the fundamental weakness in Mr. Frank's argument. Let his own words bear him witness:

> "When we get around to the organization of a real health service for the nation, if we ever do, we shall be forced, I think, to an agreement upon the following things as essential:
>
> "First, the virtual elimination of the private practice of medicine, with the substitution of a national health organization in which all doctors shall be servants of the state, with all or a basic part of their income guaranteed. We shall be forced to this if we apply intelligence to the health problem not as a socialistic theory, but as a social necessity. Here are some of the considerations that will force us to this conclusion.
>
> 'Today doctors locate for practice exactly as tailors locate for tailoring, in search of a privately profitable future."

It is somewhat difficult, if not impossible to harmonize such a conclusion with the previous statement that "The average surgeon is much more priest than profiteer," that "money is probably the incentive to expertness more rarely than we think," and that "money may be the incentive to vast effort in many enterprises, but it is rarely the dominant incentive in the arts or sciences."

One of two conclusions is inescapable: either Mr. Frank intended to confine his adulatory remarks to surgeons, or that his indictment of the present medical system is pure sophistry and not founded on fact. To say the least, it is mighty poor logic which permits the assertion in the one instance that the profit motive does not influence the medical profession in any appreciable degree, and in the other, that "Today doctors locate for practice exactly as tailors locate for tailoring, in search of a privately profitable future." That constitutes a dilemma both horns of which no man can hold honestly very long.

Discussion of such an important question should not be conducted on a hair-splitting basis. But it would seem no more than sensible since the question of profit, or more correctly the profit motive, is bound to assume such large proportions in any fair and intelligent consideration of a national health program, to define the word profit. Money is not the only form of profit. The dictionary gives a much broader definition. Among other things it includes, gain, advantage, accession, of good, benefit, service avail, utility, welfare, weal, improvement, proficiency" as well as "The amount of money obtained by the sale of commodities above the cost of purchase or production; pecuniary gain; emolument."

There is a scriptural passage reading "man cannot live by bread alone," which applied literally or strictly, may be offered as recognition of the fact that the profit motive is of paramount importance to the individual man. And while this is neither defense of tradition nor a plea for the money grabber in the medical profession or out, it is seriously contended that it is sheer nonsense to deny the profit motive in trying to formulate the future conduct of our medical affairs. On the contrary, the profit motive must be admitted as an essential and forceful factor in human affairs. The question at issue is one rather of directing that motive into channels which insure a large social service.

It would be the utmost folly to concoct a national health program which did not take account of economic and social conditions. It would also be nonsensical to adopt a national health program which did not provide sufficient elasticity to permit the characterization and direction of human ambitions. Consequently, any organization of medical science for the national welfare must contain both the opportunity and means for developing in the individual what may very properly be called a social mind.

That is the thing Mr. Frank is struggling for, when he says:

> "A quit-claim deed to immortality is awaiting the physician, surgeon, or statesman who can think of health in terms of a nation instead of a patient, and who can effect the beginnings of a national health program that will insure to every man, woman and child in the United States the full and continuous benefits of the best in medical science and service."

Viewed in the abstract, the social mind may seem about as Utopian as was ever offered by a radical socialist. But there is a very wide difference between the collective mind on which our socialistic and communistic friends lean so heavily, and the individual social mind which offers some hope of relief from the present chaos, indirection, drift. What is that difference? Just this: The collective mind sought to be invoked by those obsessed with the state-making dream is blindly worshipped inversely as the cause instead of the effect: it is looked upon as a force outside ourselves which somehow may be called into use to do our work for us. Tersely, the state-making dream is a binding passion for men who have sensed a break-down of authority in our social and economic life; but it is bound to fail, in fact has already failed ingloriously in Russia, because it is not bound up with a common discipline for motives which do not recognize geographical boundaries.

Contrast that sort of a situation with a deliberate attempt to develop the individual mind according to a high conception and large vision of the social welfare, a constant and consistent effort to utilize the manpower of the nation in achieving the health and happiness of all the people. There is something tangible about that. It reduces the problem to one of individual relations, and immediately one can think of a thousand practical suggestions touching the milk supply in this locality, the water supply in that, segregation and hospitalization of persons suffering from communicable disease, motherhood and employment, the care of children born out of wedlock, health certificates as a condition precedent to marriage, the daily challenge that is flaunted in the face of our educators by clamorous men and women whose self-sufficiency is destroyed because the things they learned in school do not interpret life as they find it. And these represent but an infinitesimal fraction of the practical problems which enter into a comprehensive and statesmanlike health program.

Probably these are some of the thoughts which surged in Mr. Frank's mind, disturbed his mental poise, and provided the motive vivendi which impelled him to remove the medical profession from its priesthood. Let him speak for himself:

> "Let us play with this idea for a moment, tracing out some of its implications. It is a ticklish subject to discuss if the writer wishes to preserve a reputation for careful sanity. Merely to set down in their relation and in proper perspective suggestions that have been made by the more creative minds in the profession is enough to brand a writer as the irresponsible architect of a private Utopia, if not a dangerous citizen of communistic leanings.
>
> "First of all, I think, we need a fresh, comprehensive, and fearlessly truthful critique of the medical profession, its ethics, its equipment, its fee system, its limitations, and its possibilities. Here and there courageous critics are arising in the ranks of the profession, but it is too much to expect that any practicing physician or surgeon will cast 'discretion' to the winds and give us the fundamental critique that we must have before the mind either of the nation or the profession will be opened to a sympathetic consideration of a truly national organization of medical service that will mean a decided break with most of the traditions."

Here again are irreconcilable statements and diametrically opposed conclusions. On the one hand the more creative minds of the medical profession are making suggestions which a writer desiring to maintain a reputation for careful sanity would not even set down; on the other "It is too much to expect that any practicing physician or surgeon will cast 'discretion' to the winds and give us the fundamental critique that we must have before the mind either of the nation or the profession will be opened to a sympathetic consideration of a truly national organization of medical service that will mean a decided break with most of the traditions."

Just what does Mr. Frank mean? Can we find in his own words the "decided break with most of the traditions" to which he refers? It would seem so. Let him repeat:

> "When we get around to the organization of a real health service for the nation, if we ever do, we shall be forced, I think, to an agreement upon the following things as essential.
>
> "First, the virtual elimination of the private practice of medicine, with the substitution of a national health organization in which all doctors shall be servants of the state, with all or a basic part of their income guaranteed * * *"

Speaking with the utmost friendliness and candor, the suggestion is crudely put. Mr. Frank has not justified it either in fact or theory.

Perhaps The Journal's opinion can be demonstrated by a conscientious effort to understand the fundamentals involved in this proposition. This Journal has no desire to stumble into the same pitfall by criticising another man's opinion and failing to support that criticism by sound logic.

First off, it is absolutely indisputable that anything like a deliberate organization of the medical profession for rational health service on a national plan, will have to be predicated on the socio-economic habits and requirements of the whole people. It will have to take cognizance of the structural contretemps of those two cohesive and articulate units of society ordinarily designated as labor and capital. It will have to be equally cognizant of, and just with reference to, the welfare of that great surging majority usually differentiated by careless thinkers as the common people. It will have to be and do all this: and yet somehow it will have to avoid the overwhelming and iniquitous condemnations of the intellectual on the one hand, and the perilous discomfiture and ill-mannered resentment of the thoughtless on the other.

That sounds like one of those spectacular oracles about which men theorize but which they never hope to see reduced to practice. It may be that was the spirit which led our contemporary into the animadversion that the science of medicine is incapable of reduction to specific plan for national well-being except through that peculiar over-all influence sought to be vested in governmental agencies by socialistic and communistic dogma.

Such a disposition of the national health problem is unworthy. It begs the question completely and is bound to fail because it does not recognize the fact that there is no mind for the solution of human problems except the human mind. In short, it is sheer reversion to absolutism without even the precaution of providing the absolute.

There is a social instinct running through and vitalizing the medical profession which makes it necessary to look beyond purely scientific motives in any thorough discussion of a national health program.

The great bugaboo which frightens a good many strictly ethical practitioners is the fear that scientific standards are being lowered to a purely commercial basis. That, of course, must not happen. But once and for all the fact may as well be admitted that while the medical man, speaking by and large, is striving to live and conduct his practice on that strictly scientific plane which conforms to the oldest and most sacred traditions of his profession, under present social requirements he finds it absolutely necessary to apply certain business principles and methods to his contact with the human family in order to prevent his falling into utter disrepute and becoming a social charge instead of a promoter of social welfare. Somewhere, therefore, between the two extremes of purely scientific abandon, on the one side, and the cold commercial instinct, on the other side, lays the course of the medical man. For of all men who are human, he must be human: he must take the good things from all in order to give good advice and helpful ministrations to all.

So far as the medical profession is immediately concerned, its real problem now is to enter the whirlpool of events from a fixed starting point impinged on the national health, and endeavor to emerge as soon as possible with a clear conception of the job which confronts the science of medicine from both a preventive and curative aspect.

Specific analysis for the purpose of arriving at the causes which produce the effects men see, should enable the medical profession to do that. True, it may prove an invidious task. It may not even eventuate in a perfect understanding of the methods by which an adequate and statesmanlike organization of the medical service of the nation is to be achieved. But it should lay the foundation on which the superstructure of a national health program may later be reared; and it should prove conclusively not only that the medical profession realizes its responsibilities, but that it is trying earnestly, intelligently and honestly to discharge them in such a way as to safeguard the public health.

Such an effort will mean a lot of grubbing. It will mean the segregation and classification of the whole faltering and bewildering mess of business, professional, scientific and social life. It is bound to prove an enormous job. But in no other way can a deliberate health program on a national scale be devised.

This sort of an undertaking is no sinecure. Other men will shun it and beg to be let alone in the pursuit of their selfish interests. Such an undertaking will have to deal with the slumbering passions of more than a hundred millions of people and find some way to loose the claw-hand of incontinence, bestiality, and moral leprosy from the throats of the third and fourth generations.

But when the records of human activity are charted under the exact scrutiny of analysis a priori, it will be found that civilization, or human progress, if you prefer, has moved forward and backward in a series of cycles, each beginning and ending with individual motives. It is axiomatic, also, that the individual must underwrite the collective welfare.

That is why it is contended that individual motives and incentives hold out the only latent promise of a large social service. Perhaps that does not constitute a pretty picture. For men generally try to shift responsibility for the things they don't like. That is why there is so much talk about business administration in government affairs and government operation of this and that in the interest of all the people. Men are simply trying to get from under a load they ought to carry, a load which, in the last analysis, they must individually carry. It's so much easier to curse the government because it is the representative of all the people, than it is to do the thing itself.

There is nothing in that. The medical profession is a social unit. Because of its inherent characteristics it is being constantly called upon to give exact account of its doings, its limitations, its possibilities. Assuredly, it has shaped its course to fit surrounding conditions. It has had to do that. But it should not be criticised unduly for doing the self-same thing every other social unit has done, and is doing every day under the press of expediency.

The weaknesses of the medical profession are not exclusively its property. They can be observed any day, in business, in politics, in government. That is why men generally are coming to believe, in fact do believe, that society must evolve within itself new ideals, new standards, new methods—they recognize in a vague sort of way that all professions, all sciences, all business, not excepting political government, should proceed in an orderly manner toward the accomplishment of some definite, constructive purpose—toward the precise performance of a large social service. These are the birth-pains of a social mind.

Medical science lays very close to men's lives. It is not to be wondered at that it should be called upon for a large measure of performance, a comprehensive understanding of its opportunities and purposes. What men are really trying to say is that medical incongruities must be eliminated, that the science of medicine must comprehend the science of health; that its purpose is prevention as well as cure.

All this, because for every failure of medical science to function in the discharge of exact social standards, for every day lost by men and women through preventable causes, the public pays an unjustified and unjustifiable toll. There is the inevitable conflict. Labor must justify its wage. Capital must justify its return. Business must justify its service and its charges. And the science of medicine must justify its conception of the national health according to the needs of all the people by deeds and not words.

These are the conflicting emotions with which Mr. Frank struggles. And in sheer desperation he grips his bootstraps with clenched hands in a supreme effort to lift himself bodily out of such an inglorious predicament. Let him speak for himself:

> "In the final summing up of the case, the length of time required in the preparation for the practice of medicine, the number and quality of men who serve upon medical faculties, the physical equipment of laboratories, and the like, are all to a greater or less degree, determined not by what the institution needs, but by what the institution can pay for. In a state based upon intelligence instead of upon expediency and drift, these things would be determined only by the health needs of the nation. However large the necessary funds they would be supplied by taxation and not wait upon the whims of philanthropists."

That is about as pure a piece of sophistry as it is possible to rig up. The question of expediency is always paramount in politics. A large majority of our reputable medical schools is state owned and operated. One of the very real problems which confronts the medical profession today is the question of convincing politicians that there is need for adequate appropriation to make those schools somewhere nearly responsive to our health needs. With political higgling fresh in their minds, the members of the medical profession will not view with any degree of assurance Mr. Frank's appeal to their cupidity in the following words:

> "This system of yearly service would, many doctors believe, mean a larger average income for doctors and a general saving for the people."

There is, of course, something grandiloquent about such a statement. The profession will get more, and the people pay less, a happy arrangement surely, if true.

Obviously, there is nothing in either of these propositions except the battered makeshift of a broken promise. What Mr. Frank sees, of course, is the undisciplined strut of a lot of men in every walk of life, men who might be made to serve the social welfare more fully by the introduction of some order and purpose into their contact with human affairs. What he does not see, however, is the impossibility, the utter futility of imposing any confidence in the collective mind as the guardian angel of our lives, and health and happiness, until the individual minds which constitute it have developed a social character. It is simply one of those vicious circles which wastes its force in a struggle to super-impose the will of the few on the lives and habits of the many.

That is probably the reason why Mr. Frank proposes putting all doctors on the payroll of the state. It is always easy, when writing an indictment of existing conditions, to suggest that the cure may be found in the mere addition of a few paltry millions of dollars to an already suffocating tax burden. That is false logic—at best a mortgage of the future plastered on the present with interest thrice compounded in circumlocution, in inefficiency, and in disinterested administration. In laying taxes, there is something so big, so inclusive, that the average person finds it impossible to resist an impulse to demonstrate that he is everything but a misanthropist. He wallows in the splendor of public spiritedness until his own tax bill arrives: then turns to rend the government instead of cursing his own folly—about as ludicrous a performance as can be conjured by the most imaginative mind.

Taxes are the constant nemesis of even our most astute political statesman. Government operation of public utilities, shipping board excesses running into the billions, aircraft follies whose stench was so great the whole truth will never be known to a voting public, and dozens of other spoliage systems ad nauseum—all fresh in the minds of thinking people, make one hesitate about committing the national health into the hands of a political organization. But it would be taking undue advantage of Mr. Frank to drain the last drop of bitterness from the cup of wormwood and gall from which the whole world is drinking its excesses in the form of taxes. That may be left to the people of Russia. It is sufficient to call attention to the incident social loss in stifled enterprise, thwarted ambition, and collective iniquity, a loss which in some way the medical profession must find the power to retrieve out of the present physical and mental social waste.

Having declared the pages of Century Magazine open to a full and free discussion of this matter much may reasonably be expected from Mr. Frank in future.

Mindful of its public responsibility as an instrumentality of the medical profession, The Journal bespeaks Mr. Frank's sincere coöperation in proving out a national health program which will be both comprehensive and statesmanlike, and which will not jeopardize the public welfare by unsexing the medical profession.

National Board Medical Examiners

THE National Board of Medical Examiners has just completed the first five years work and with it the trial period of its usefulness. The principle which this board has stood for, namely, the establishment of a thorough test of fitness to practice medicine which might safely be accepted throughout this country and abroad, has been widely accepted. Since this board was organized by Dr. W. L. Rodman, in 1915, eleven examinations have been held. These examinations have been conducted on the plan of holding at one sitting, a written, practical and clinical test for candidates with certain qualifications, namely, a four-year highschool course, two years of college work, including one year of physics, chemistry, and biology, graduation from a class A medical school and one years internship in an acceptable hospital. These examinations have covered all the subjects of the medical school curriculum and have been conducted by members of the board with members of the profession resident in the place of examination appointed to help them. Such examinations have been held in Washington, Philadelphia, New York City, Boston, Chicago, St. Louis, Rochester (Minnesota) and Minneapolis. During the war a combined examination was held at Fort Oglethorpe and Fort Riley. There have been 325 candidates examined, of whom 269 have passed and been granted certificates.

Starting with the endorsement of the Council on Medical Education of the American Medical Association, American Medical College Association and various sectional medical societies, the recognition of the Army, Navy and Public Health Service Medical Corps of the United States and certain State Boards of Medican Examiners, the certificate is now recognized. Also by twenty states as follows: Alabama, Arizona, Colorado, Delaware, Florida, Georgia, Idaho, Iowa, Kentucky, Maryland, Minnesota, Nebraska, New Hampshire, New Jersey, North Carolina, North Dakota, Pennsylvania, Rhode Island, Vermont and Virginia, the Conjoint Board of England, the Triple Qualification Board of Scotland, the American College of Surgeons and the Mayo Foundation of the University of Minnesota.

There has been such a wide-spread demand for an opportunity to secure this certificate by examination, that the board has now adopted and will put into effect at once, the following plan: Part 1, to consist of a written examination in the six fundamental medical sciences: anatomy, including histology and embryology; physiology, physiological chemistry, general pathology, bacteriology, materia medica and pharmacology. Part 2, to consist of a written examination in the four following subjects: medicine, including pediatrics, neuropsychiatry, and therapeutics; surgery, including applied anatomy, surgical pathology and surgical specialties; obstetrics and gynecology; public health, including hygiene and medical jurisprudence. Part 3, to consist of a practical examination in each of the following four subjects: clinical medicine, including medical pathology, applied physiology, clinical chemistry, clinical microscopy and dermatology; clinical surgery, including applied anatomy, surgical pathology, operative surgery, and the surgical specialties of the diseases of the eye, ear, nose and throat; obstetrics and gynecology; public health, including sanitary bacteriology and the communicable diseases.

Parts 1 and 2 will be conducted as written examinations in class A medical schools and Part 3 will be entirely practical and clinical. In order to facilitate the carrying out of Part 3, subsidiary boards will be appointed in the following cities: Boston, New York, Philadelphia, Minneapolis, Iowa City, San Francisco, Denver, New Orleans, Baltimore Galveston, Cleveland, St. Louis, Chicago, Washington, D. C., and Nashville, and these boards will function under the direction of the National Board. The fee of $25.00 for the first part $25.00 for the second part and $50.00 for the third part will be charged. In order to help the board the Carnegie Foundation has appropriate $100,000.00 over a period of five years.

At the annual meeting held June 13th, of this year in Boston, the following officers were elected: M. W. Ireland, Surgeon General, President; J. S. Rodman, M. D., Secretary-Treasurer; E. S. Elwood, Managing Director.

Mr. Elwood will personally visit all Class A schools during the college year to further explain the examination, etc., to those interested. Further information may be had from the Secretary-Treasurer, Medical Arts Building Philadelphia.

Errata

The article appearing in the September, 1921, Journal of Radiology entitled, 'The History and Development of Radium Therapy," by Dr. C. H. Viol, should have stated that this paper was prepared in June of 1920 and publication was delayed until September, 1921.

Official Program Annual Meeting

Chicago, December 7, 8, 9, 10—Sherman Hotel

Announcements

There will be a general business session at 7:00 P. M. December 6, at the Sherman Hotel. Reports of officers, counselors and committees.

Wednesday Morning, December 7th

9:00—Short Business Session.

9:30—"The Planning and Equipment of a Modern X-Ray Laboratory," Dr. Hugh J. Means, Columbus, Ohio.

10:00—"The Radiologist in Small Communities," Dr. Ulysses S. Kann, Binghamton, N. Y.

10:30—"What is X-Ray Diagnosis," Dr. Donald S. Childs, Syracuse, N. Y.

11:00—"The Standardization of Absorptive Powers of the X-Ray by Salts of the Various Metals," Dr. Leoen J. Menville, New Orleans, La.

11:30—"Team Work With the Pathologist," Dr. H. E. Robertson, University of Minnesota.

Wednesday Afternoon, December 7th

1:30—"Organ Stimulation by Roentgen Rays," Dr. Wm. F. Petersen, University of Illinois, Chicago.

2:00—"Differential Microscopical Diagnosis of the Effects of Irradiation," Dr. A. S. Warthin, University of Michigan.

2:30—"The Biological Reaction of the More Penetrating Radiations," Dr. Guilleminot (Faculté de Médicine, Paris).

3:00—"Some Observations on the Systemic Effects of High Voltage Roentgen Irradiation," Dr. James Thos. Case.

3:30—"Biological Determination of X-Ray Dosage," Dr. Francis Carter Wood, Director Crocker Institute, New York City.

4:00—"The Effects of X-Rays on Inherited Characteristics. Practicability Demonstrated by Record of 100 Cases," Dr. James W. Mavor, Ph. D., Schenectady, N. Y.

4:30—"Radium and X-Ray Therapy in Malignancy: Indications, Contra-Indications, Limitations and Recent Developments," Dr. A. U. Desjardins, Mayo Clinic, Rochester, Minnesota.

5:00—"Preoperative Radiation Treatment of Malignancy," Dr. Carl Ballard, Omaha, Nebraska.

Wednesday Evening, December 7th

Joint meeting with Cook County Medical Society and Chicago Roentgen Society.

Thursday Morning, December 8th

9:00—"The Use of Radium Needles in Treatment of Cancer," Dr. Chas. F. F. Bowen, Columbus, Ohio.

9:30—"Treatment of Carcinoma of the Breast by Surface Application of Roentgen Rays and Radium, Supplemented by Imbedding Radium," Dr. Russell H. Boggs, Pittsburgh, Pa.

10:00—"The Penetration of X-Ray into Tissues," Dr. Henry Schmitz.

10:30—"Treatment of Neoplasms of the Tonsil," Dr. Douglas Quick, New York City.

11:00—"Focal Infection of the Throat by X-Ray as Compared With Surgical Removal of Tonsils and Adenoids," Dr. W. D. Witherbee, New York City.

11:30—"Radiotherapy of Diseased Tonsils," Dr. Robt. H. Lafferty, Charlotte, North Carolina.

Thursday Afternoon, December 8th

1.30—"The X-Ray Treatment of Tonsils With the Conjoint Use of Ultra-Violet Radiation," Dr. A. J. Pacini, Washington, D. C.

2:00—"Clinical Observations in Radiotherapy of Uterine Cancer," Drs. Donaldson & Knappenberger, Kansas City, Mo.

2:30—"Roentgen Treatment of Malignant Tumors," Dr. Roscoe Smith, Lincoln, Neb.

3:00—"Our Method of Roentgen Deep Therapy of Malignant Tumors," Dr. Wintz, Erlangen, Germany.

3:30—"Some of the Less Common Uses for X-Ray Therapy," Dr. G. E. Richards, Toronto General Hospital.

4:00—"Unsolved Problems and Debatable Points in Short-Wave Therapy," Dr. Leo E. Pariseau, Montreal, Quebec, Canada.

4:30—"Preliminary Report on Results Obtained in Heavily Filtered X-Ray Treatments of Inoperable and Recurrent Cancer of the Female Breast," Dr. E. H. Merritt.

5:00—"The Treatment of Epithelioma of the Lip by Electro-Coagulation and Radiation," Dr. Geo. Pfahler.

Thursday Evening, December 8th

Banquet and conferring of Honorary Degrees.

Friday Morning, December 9th

9:00—Business Session.

9:30—"Positional Anomalies of the Gastro-Intestinal Tract," Dr. M. J. Hubeny, Chicago, Ill.

10:00—"Duodenal Bulb Deformity in Relation to Symptoms and Chemistry of the Gastric Juice," Dr. A. W. Crane, Kalamazoo, Mich.

10:30—"Some Errors in the Roentgen Diagnosis of Duodenal Ulcer," Dr. Russel D. Carman, Rochester, Minn.

11:00—"Diagnosis and Classification of Gastric Ulcers," Dr. Lewis Gregory Cole, New York City, N. Y.

11:30—"The Effect of Chronic Appendicitis on Intestinal Motility," Dr. A. W. Erskine, Cedar Rapids, Ia.

Friday Afternoon, December 9th

1:30—Business Session.

2:00—"The Treatment of Fibromata of Uterus by Roentgen Ray," Dr. Mary Elizabeth Hanks, Chicago, Ill.

2:30—"Control of X-Ray Therapy in Hyperthyroidism by Basal Metabolism Test," Dr. H. M. Jones, University of Illinois.

3:00—"Basal Metabolism, Hyperthyroidism and Radiotherapy," Dr. Harvey W. Van Allen, Springfield, Mass.

3:30—"The Physical Foundation of Deep Therapy," Dr. Vierheller, Frankfort University.

4:00—"Present Deep Therapy Construction Problems," Duane and Morrison.

4:30—"Dosage Factors in Roentgen Therapy," Dr. H. J. Ulmon, Santa Barbara, Cal.

Friday Evening, December 9th

8:00—"Development of Carpal Bones in the Feeble Minded," Dr. Rollin H. Stevens, Detroit, Mich.

8:30—"A Study of Hilus Pneumonia by Radiographic Examination," Dr. LeRoy Sante, St. Louis, Mo.

9:00—"The Information Gained from the Chest Examination of One Hundred Infants," Dr. Fred Hodges, Richmond, Va.

9:30—"Subphrenic Abscesses and Their Roentgenological Evidence," Dr. Leonard G. Crosby, Denver, Colo.

Saturday Morning, December 10th

9:00—Subject to be Announced. Dr. W. W. Wasson, Denver, Colo.

9:30—"High Speed Radiography," Dr. W. D. Coolidge, Ph. D., Schenectady New York.

10:00—"Pneumoperitoneum of the Female Pelvis," Dr. James G. Van Zwaluwenburg, University of Michigan.

10:30—"A Dental Phase of Radiology," Dr. Byron Darling, New York City.

11:00—"Urological Cases," Dr. E. C. Koenig, Buffalo, N. Y.

11:30—"The Gall Bladder," Dr. Robert A. Arens, Chicago, Ill.

Chest Radiography

IT would seem proper that before one begins the study of the pathology of the chest, he should first have an accurate technique. The same analogy would apply as in the physical examination of the chest without a knowledge of the various problems entering into it. I feel that the finest detail is necessary; and yet, some criticise by saying that we can have too much detail. My answer is, "If we are to study anything more than gross pathology, we must show all possible normal anatomy,"

There are numerous problems concerned with chest radiography, many of which I have attempted to describe in previous papers, and I will not enter into a discussion of those again at this time. May it suffice to say that all the factors which I shall describe, appear to be necessary.

In building up the technique, the first consideration should be given to the length of exposure. This should be between one-tenth and one-twentieth of a second, and it is now practical with the large equipments to use one-tenth as a routine.

Certain men have lately recommended one-fourth of a second—but if it is desirable to cut the exposure from two or three seconds to one-fourth of a second, why not go as far as possible with the present apparatus and at least approach the ideal? This time factor is especially necessary in children, and almost equally so in adults if we are to diagnose early cases.

Having established the time factor of one-tenth second as our basis for work, we are now ready for the other factors, and it now becomes necessary to select an emulsion upon which to register our radiograph in the shortest possible time. This requirement seems to be best filled by the duplitized films and the double intensifying screens, I do not care to enter into a discussion of films versus plates, but it does not seem that plates can meet the present requirements. The objections to screens in chest radiography are a heresy of the past.

Having selected our emulsion and with a definite time, the problem is now to pass the rays through the chest in such quantities as to properly expose the emulsion. This brings into question the exposure chart, and I do not believe that it is practical to give an exposure chart that will be accurate for all laboratories. We are all using different transformers with varying degrees of efficiency, with more or less loss from wires, and with tubes at varying distances from the transformer.

But there are factors entering into the amount of current which we can establish. All chests should be measured, as each inch of tissue requires a certain amount of current, and the eye is not accurate enough to estimate the size. By recording our measurements, with the exposure, and quality of the resulting film we can soon learn the proper exposure for any chest.

The tube is the apparatus to deliver certain rays through a certain thickness of chest and to register upon a known film in a definite length of time. It must be selected with care. There are various kinds of tubes, and various properties have been attributed to the various kinds; but there is only one really important point, and that is the focal spot. It is the lens of our camera.

The focal spot should be photographed, and it is much better to think of it in terms of millimeters-diameter, rather than fine, medium, and broad focus tubes. For instance, a fine focus Standard Type Coolidge tube has about the same diameter of focal spot as a broad focus Radiator Type Coolidge tube. Having tested our tube, we will find that an object six inches from the plate will be cast in sharp relief with the tube at varying distances from the plate, depending upon the size of the focal spot. Having measured our patient, we will then find that a chest of a certain depth will require a tube of a certain diameter of focal spot to be at a definite distance from the plate. This tube-plate distance will vary from thirty inches to five feet, depending upon the depth of the chest and the focal spot used.

Having selected our tube, and having the tube at a distance from the plate as regulated by the diameter of the focal spot and the anterior-posterior diameter of the patient's chest, and having the factors established as to the film and time; it now becomes a question of setting the machine for the necessary voltage and milliamperage to properly expose the emulsion. The milliamperage and voltage will have to balance, remembering that the lower penetration and the higher milliamperage gives a greater latitude, and usually tends to better contrast. The ordinary tube will stand this strain for a reasonable period of time.

By following the points outlined above, I feel it is possible for anyone to develop a standard technique suitable for his own use, and one which he can use routinely. The criterion of his accuracy will be the detail shown upon the film.

Plates are made or spoiled in the dark room, and this phase of the technique must not be overlooked. Over-development will cut out the necessary tissue detail, while under-development fails to bring out the desirable contrasts. Old chemicals and incomplete washing will make a short exposure impossible.

The position of the patient should, as a routine, be in the upright, though at times we may wish both prone and upright positions. The fluoroscope will be of aid in this respect, and often a special angle will be desired. Instruction of the patient as to his breathing and general coöperation adds considerably to the final result.

Finally, having produced the proper negative, we now come to the technique of studying it. We are dealing with the portrayal of the normal and pathological anatomy upon an x-ray film, and it is now beyond the scope of a technician, just as the transposing of stethoscopic signs into terms of pathology is beyond the scope of a technician.

Time and care are esesntial to the proper study of a chest radiograph, and I hardly need to add that it should be stereoscopic. Beginning with the normal anatomy, we observe the changes over into the pathological, just as the pathologist studies the change from the normal cells into the pathological proliferation. Having the proper film, by careful and prolonged study and observation of the bronchial and parenchymal structures we may hope in time to establish a basis of the pathology of the chest.

W. WALTER WASSON,
Denver, Colo.

Dental Film Holder

IN presenting this appliance I wish to state that it is not original with me, but I have been using it for the last year and find that I get very good results with it. Also it is easier for the patient than the old finger-holding method. Dr. J. DeVoine Guyot, in presenting his method in the August number of the Journal of Radiology, states that he is still using the old finger method for holding the film in the lower jaw. This appliance is equally good in either the upper or lower jaw.

The appliance consists of a small right-angle block of wood 2 centimeters wide and 2 centimeters high and 1½ centimeter long. The shape of the block is shown in the illustrations. There is a slot, for the insertion of the side of the film, cut in one side. The size of this slot will depend on whether the Buck or the Eastman film is used. The upper angle of the block which comes behind the film is made rounded so that the film in the roof of the mouth will not make a sharp angle but will better conform to the palate.

In using this holder the film is placed in the slot with the back to the vertical portion. The film is then placed in the patient's mouth as usual and the patient told to close his teeth on the horizontal part. This holds the film in position better than any other method that I have tried.

These blocks may be made up in a long strip and then cut to the desired length and in this way the cost need be but very little.

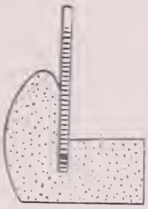


FIG. NO. 1

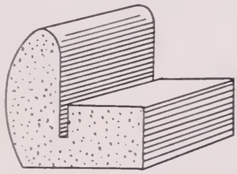


FIG. NO. 2

Fig. No. 1—End view showing the film in place.

Fig. No. 2—To show the slot across one side.

F. B. SHELDON,
Fresno, Cal.

NEW EQUIPMENT

International Precision X-Ray Apparatus

SUCH a great portion of the average practice of the medical radiologist specializing in deep therapy is of cancerous character, that the announcement of a precision x-ray apparatus by the International X-Ray Corporation holds an enormous interest because of the special features embodied in its construction.

For the benefit of those less familiar with the principle of deep therapy, it may be well to state two or three facts.

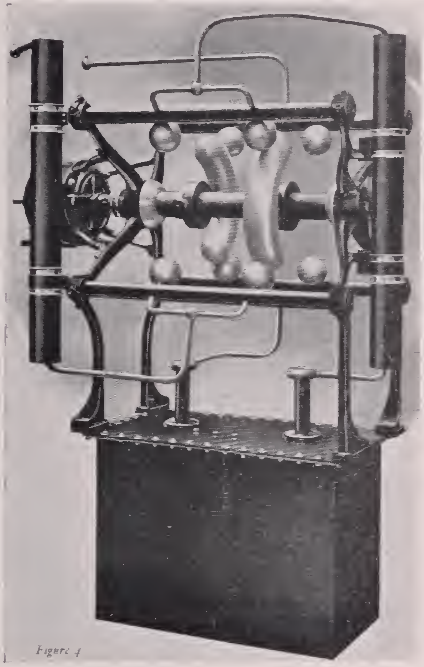
1. The higher the voltage the shorter the wave length.
2. The shorter the wave length, the harder the x-rays deflected from the target in the tube.
3. The harder the x-rays used, the further the tube may be set from the body, with greater penetration at the seat of malignancy and less possibility of burning the skin.

Thus stated, the reason for the demand by the radiological profession for apparatus with high potential capacity is obvious. Until lately, the highest average possible voltage that could be delivered ran somewhere around 138,000. The difficulty of mass dosage in deep seated malignancy without excessive erythema has been one of the very real problems of the profession. And since the treatment of skin cancer has been so successful, because in that class of cases, it has been possible to deliver sufficient dosage to destroy the growth, the question of effective treatment of deep seated malignancy has been somewhat discouraging. The answer seemed especially elusive unless voltage could be materially increased. For a long time that appeared to be a baffling situation. Manufacturers were unabe to develop machines capable of voltages in the neighborhood of 200,000.. The static accumulation, or more familiarly the "surge", stood out as a manufacturing bogey by burning out the transformer.

During the present year, however, the American Institute of Electrical Engineers completed its research and announced specific formulae for the application of the sphere gap principle to high potential apparatus; in other words, the standardization rules of that organization specify that it is permissible to use needle or point gaps on machines of 70 kilovolt capacity and the use of sphere gaps on machines above that capacity.

Following the principle of sphere gap construction clear through, the International X-Ray Corporation has developed a method of rectification, consisting of spheres and segmental toroids. Theoretically, it bears evidence of being a very decided improvement in mechanical construction of high potential x-ray apparatus, and which, if it works out in practice measurably with its promise, will aid medical radiologists in treating deep seated malignancies much more successfully than they are now able to do.

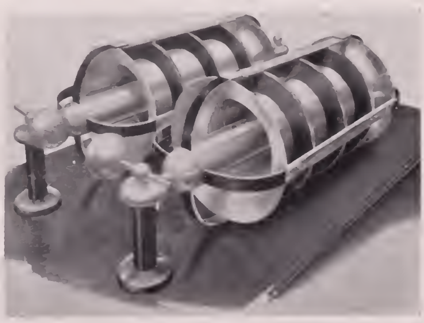
We have not enjoyed the opportunity of observing this particular piece of apparatus under test. However, it has been scrutinized very carefully by a number of the best electrical engineers and physicists in the country and pronounced as remarkably efficient. For the moment, we shall be obliged to rely on their judgment. But since the International Corporation is perfectly willing to enter into a written agreement with each purchaser of this apparatus guaranteeing the transformer for a period of two years, it is safe to assume, at least, that that company has conducted break-down tests to the point where it is perfectly willing to stake its future on the machine it is offering the profession.



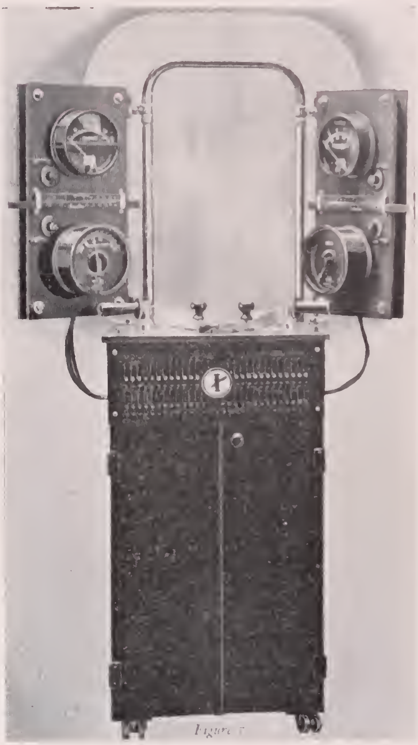
Briefly, it is claimed the sphere and segmental toroid method of construction which will be observed in the illustration entirely eliminates corona. There are eight spheres, all stationary. Two toroids of such segment to make it unnecessary to conduct any current through the shaft as is done in nearly all point gap rectifiers, are suspended from a revolving axis. Their respective points of suspension are at opposite position in the circumference of the revolution. The spheres are fixed in the four corners of a perfect square projected. Each of the segmental toroids operates within the circumference of the square of four spheres. The toroids are set at opposite ends of the revolving axis so there is no danger of arcing between the spheres. As the toroids revolve they come in contact with negative and positive spheres alternately. By this method, a constant flow of unidirectional current to the tube is maintained. There will always be room for argument concerning what actually happens in the sphere method of rectification, e. g., whether there is complete absence of static or whether the segmental toroids operating in the field of inducted energy following the actual spark over, pick up the static and carry it across to the next point of contact. What actually happens is not perhaps material to the radiologist so long as the machine operates successfully.

There are certain other features of this apparatus which it is believed should be commented on.

First: Two air condensors mounted on top of the x-ray machine cabinet. These condensors are built according to the specifications adopted by the American Institute of Electrical Engineers while doing research work on the sphere gap problem, and as nearly as can be determined from a study of the literature received, tie into the line in such a way as to protect the transformer against line fluctuation and possible surge, as well as dissipate the heat incident to continuous operation under extremely high voltage. See the accompanying illustration.



It will be noticed that there is a sphere gap between these two air condensors. The reason for this is given to provide a limit gap for the machine, and for the purpose of checking one crest measurement against the other. In passing, it may be of interest to know that this form of precision air condensor was devised by Messrs. Fortescue and Chubb under the supervision of the American Institute to enable them to correctly calibrate the sphere gap.



Second: The control board and meter panels are shown in the third illustration. The kilovoltmeter equipment appears on the left panel, and the ground potential milliameter and filament ammeter at ground potential may be observed on the panel to the right.

Conceding for the purpose of this discussion, that the International Precision Apparatus will actually accomplish everything in practice that is claimed for it in theory (and frankly, there is every reason for believing that it will work out satisfactorily in the hands of the profession because it is manufactured and marketed by a concern of extremely good repute) it brings into being one of the most radical achievements in electrical construction occurring in the science of x-rays for a long time.

Physicists have recognized for a long time that it is necessary to read the actual potential of the secondaries of x-ray apparatus in order to accurately measure dosage. The International machine measures this secondary potential by an actual registering voltmeter calibrated in direct reading kilovolts. This meter, it is claimed, is within one-half of one per cent. efficient so that no attention need be given to atmospheric pressures and other variables.

The action of this machine in actual field service and the success of radiologists as well as the manufacturer in demonstrating its advantages in deep therapy will be followed with manifest interest, first, because it is a complete application of the theory of precise measurement of high potential energy in the science of x-rays, and second, because it promises so much in a therapeutic way.

This machine will be on exhibit at the annual meeting in Chicago next month and will doubtless prove one of the pieces of apparatus of particular interest.

A Correction

MR. MONTFORD MORRISON, Consulting Engineer of the International X-Ray Corporation of New York, calls our attention to an inadvertent misstatement appearing in our discussing of the Victor Sphere Gap.

The statement to which he alludes was:

"A sphere gap measures peak voltage while a point gap measures average voltage."

The latter part of this statement, i. e.:

> "While a point gap measures average voltage," is incorrect.

All spark gaps have what is called time lag, that is to say, the voltage rises above the true spark-over value somewhat before spark-over actually occurs. This time lag is much longer in the spark gap than in the sphere gap, but the reading bears no relation whatever to what is known to engineers as the average voltage value.

The average value of a voltage cannot be determined by any measurement whatever until an entire half cycle has elapsed. Spark gaps cannot possibly spark-over at the end of the declining side of the half cycle and therefore to read the average of a wave starting at zero and ending at zero would be impossible by any gap measurement.

While this is purely a technical criticism it is worthy of publication because The Journal has no desire to mislead or misinform its readers nor becloud the discussion of such important questions with incorrect principles or a misapprehension of the facts. Such criticisms are very much appreciated and it affords us pleasure to accord Mr. Morrison the credit for setting us all right on this proposition.

Victor Stabilized Fluoroscopic and Radiographic Unit

THERE is considerable virtue in any appliance which stabilizes current flow in fluoroscopy and radiographic work. The Victor-Kearsley Stabilizer has proven so valuable in connection with the larger apparatus that the Victor Corporation has adapted the principle to the construction of a stabilized Fluoroscopic and Radiographic unit. With the stabilizer in the circuit the operator is not annoyed by voltage fluctuations which so affect tube current as to make specific technique more or less impossible.

With the stabilizer in the line the operator has perfect control of tube current at either the radiographic or fluoroscopic apparatus by means of a control stand which embodies auto-transformer control, filament control, circuit breaker, milliamperemeter, line volt meter, hand lever switch and foot lever.

The auto-transformer offers an unusual refinement of control, enabling the operator to select any back-up spark within the range of three to five inches.

The circuit breaker is another important feature, the design of which is to protect both operator and patient against dangerous shocks from accidental contact with the high tension current; at the same time protecting the apparatus itself against burn-outs.

The high tension transformer follows in design the same principles as are applied in the larger Victor X-Ray transformers, being of the closed core, oil-immersed type. It can be mounted on the wall out of the way, on the floor, or wherever greatest convenience demands.

The control stand being mounted on castors, can be moved about to the position most practical for the operator, in proximity to the radiographic apparatus or to the fluoroscopic apparatus. There is also provision by which a foot switch can be connected with extended cable to the control stand, thus permitting the operator to turn the current on and off while remote from the control stand.

The range of service offered in this outfit suggests its use in both the specialized laboratory and the physician's office for diagnostic work. It is practical and economical and is especially in demand where conservation of space is essential.

Tratado Practico De Radiologia. Dr. Carlos Heuser, Buenos Aires, Argentina, South America. La Semana Medica, Imp. De Obras De E. Spinelli, 1921.

THIS book is, as the name implies, a practical treatise of radiology containing two hundred illustrations and four color plates. The author takes up the subject in a practical way which is suitable for reference work, especially for those who are younger in the profesison.

The book is profusely illustrated, showing all the different angles and positions which are described by the author for use There are several illustrations showing little schemes original with the author for making the work easy and more accurate. Reference is made to the literature of all nationalities and descriptive material illustrating various technical devices and points in technique throughout the world.

The illustrations made from radiograms are practically all in the positive. Some of them might be open to criticism due to the fact that they have been retouched.

Anyone practicing radiology will find the book of great reference value.

A. F. TYLER.

The Combined Examination of the Urinary Tract by the Urologist and the Roentgenologist. Howard E. Ashbury, M. D., F. A. C. S., and Albert E. Goldstein, Baltimore, Md. Southern Med. Jour., Sept., 1921.

THE essay is based upon the study of 250 cases that came to the Urological Clinic of the Hebrew Hospital during the past two years, in which a combined study was possible; it outlines the method of procedure and basis of interpretation, wich saves time, the annoyance of repeated cystoscopies, and enables a prompt and accurate visualization of existing pathology. The deductions offer a fair example of the limitations of the two methods individually and a practical idea of the value of the combined study insofar as the reduction of the percentage of failures is concerned and the large percentage of proven correct diagnosis.

In all the cases studied, plain roentgenograms were made of the entire urinary tract, and then the cases were studied urologically, using all recognized methods of procedure.

Capacity in all cases was first determined with sterile water or salt solution. The administration into the renal pelvis of opaque solutions should be performed by competent urologists, who may use either the syringe or the gravity method, the syringe being used in these cases.

In the interpretation of the plain x-ray in urological cases, they necessarily divide themselves into those giving positive x-ray findings and those giving no radiable evidence of disease on the plain x-ray plate; the latter far exceeds the former, and include a large percentage or non-radiable calculi, of uric acid composition. These are located principally in the bladder.

Of the 250 cases studied, 152 or 60.8 per cent. demonstrated pathological lesions in the urinary tract, and ninety-eight or 39.2 per cent. demonstrated no urological lesions. The plain x-ray gave evidence of disease in fifty or 32.7 per cent.

Out of a total of forty-six urinary calculi, forty-one or 89.1 per cent. gave evidence on the plain x-ray plate; five cases in which no evidence of shadow was seen on the plain x-ray plate were vesical calculi and were diagnosed by cystoscopy and cystography. It is interesting to note that all the ureteral calculi that were diagnosed gave a definite shadow in the plain x-ray plate which is contrary to the published statistics.

One hundred and forty-eight cases or 97.3 per cent. gave evidence of disease by the urological method. One hundred and four or 61.7 per cent. were positive from the urological findings and forty-four or 38.3 per cent. were doubtful. The forty-four doubtful cases were finally diagnosed by the combined method, leaving only four cases as undiagnosed.

The entire 152 cases which presented pathology were verified by an operation of some character. In the four undiagnosed cases exploratory operations were advised, and pathological conditions were demonstrated at the operation.

Conclusions

1. By the combined method of examination our results show only 1.6 per cent. of failures.

2. Urological lesions were demonstrated frequently by aid of the x-ray where they were doubtful in the two examinations individually.

3. In over 50 per cent. of the cases in which the plain x-ray was negative pathological conditions were found by the combined method of examination.

4. The plain x-ray findings should in all cases be verified by the urologist before a conclusive diagnosis is given.

5. The combined method is the ideal procedure for the diagnosis of urological conditions.

A New Form of Stereo-Fluoroscope. A. M. Tyndall, D. Sc., (Prof. Physics University of Bristol) and E. G. Hill, M. Sc., (Bristol) in Journal of Roentgen Society (British); Vol. 17, No. 68, Page 122.

IN this device the authors have created a practical stereo-fluoroscope which requires but one tube and that may be either the ordinary gas or Coolidge tube. The principle is that instead of two separate tubes or a single tube with two targets, this ordinary tube with a single target is made to occupy two positions under continuous excitation. This is accomplished by mounting the tube on a suitable holder which is rocked to and fro actuated by an eccentric on a revolving disc. The excursion of the tube is made variable but the most efficient amptitude was determined as being about one inch. The disc is energized by an electric motor and the speed does not appear to be important: as low as 10 r. p. s. was quite satisfactory. Onto the shaft that moves the tube a geared wheel is attached, which is connected by a chain drive to a revolving shutter. The disc of this revolving shutter is of a diameter of four and one-half inches and from it is removed a segment equal to one-quarter of the disc. The observer looks through two "eye holes" and with this shutter revolving the right and left eye is alternately covered and free; this in synchronism with the position and the image on the screen, as is determined the position of the target. A chain drive is considered essential to prevent these factors getting out of phase with a consequent loss of the stereoscopic effect. The authors state that the device is simple, cheap, and satisfactory.

L. K. POYNTZ.

X-Ray Treatment of Two Cases of Otosclerosis. J. H. Douglas Webster, M. D., M. R. C. P. E. (London, England), in British Journal Archives of Radiology and Electrotherapeutics, No. 253, Aug., 1921.

OTOSCLEROSIS is one of the most difficult and obscure problems of modern medicine. Although over ten theories have been advanced in explanation of it, yet the real cause is unknown or at least disputed. Because of the chronicity of the malady a true estimate of the value of any method of treatment is difficult. The majority of the cases, being advanced, show permanent bone changes at the stapes-foot and therefore are quite unsuitable for radiotherapy. It is only in early cases that results may be looked for. Being of such an insidious nature, however, and almost symptomless in the early stages, few cases are detected early enough. The writer then reviews the various theories and alleged causes that are claimed to precipitate the condition. However, it would seem that the association with osteo-malacia and rickets is rather common. After a somewhat exhaustive description of the pathology, he summarizes it "The main point for the present purpose is that the pathology of the condition suggests that in the early stages it should be amenable to radiation treatment."

Jaulin in 1908 appears to have been the first to try radiation in otosclerosis and showed improvement in six of the ten cases treated. The difficulties of the technique are great. Professor Siebenman of Bâle has advocated treatment in both early and late cases: in the early cases as improvement can be hoped for, but the late cases to arrest the progress of the disease.

Because of the beneficial effects obtained by ovarian radiation in osteomalacia claimed by Wetterer, he suggests its use here, and while no glaring achievement is claimed, yet he argues if one could stop an otherwise inevitably progressive condition, this justifies the effort. He cites two cases, one a man of thirty-seven with a his tory of fifteen years in which the condition was arrested and the other a woman of twenty five who showed a most gratifying improvement. The paper is completed by a rather extensive bibliography.

L. K. POYNTZ.

Some Effects of Rádiotherapy Upon Fibrous Tissue. Reginald A. Morrell, M. R. C. S. (England), L. R. C. P. (Lon.) (London, England). British Journal Archives Radiology and Electrotherapeutics, No. 253, Aug. 1921, Page 78.

THE cases treated were ex-soldiers and as the whole hospital team watched them carefully, the results reported are authentic. The successes were due to the relief of the ill-effects of fibrous tissue formation formed chiefly as a result of operative procedure, rather than the original injury, therefore more amenable to treatment because of the fact that this fibrous tissue was not yet old. Too few cases have been treated to justify any generalizing, but sufficient to warrant further investigation, as radiotherapy can be made even more useful to the surgeon especially where post-operative sequelae are likely to be pain or limitation of movement or function because of the necessary extensive dissection of the subsequent fibrous tissue formation. He divides the cases into four groups and cites case histories to illustrate each group.

In the first division were scar formations subsequent to brachial-plexus injuries. In these cases cyanosis, numbness of the hands and fingers and limitation of movement of the shoulder were relieved by a series of four to six applications after physiotherapy had not been successful.

Group Two: Cases of involvement of the sciatic nerve. Following operation, nerve stretching, and galvanism, the symptoms were not relieved. After the first application there was relief in some of the cases although further applications gave still greater relief. Two failures are reported but both were fibrositis, presumably, from septic focus.

In group three were cases of tendons caught in scar tissue. Following surgical freeing they were rayed and the rapidity and degree of their relief appears to be rightly attributable to the raying, as similar cases not rayed showed less fssatiactory results.

In group four one case is cited of a painful nerve bulb and scar over the ulnar nerve. Two treatments gave relief. A third treatment was unfortunate in causing an undesired erythema which had no permanent ill-effects. The scar was left supple and there was no pain, even on deep pressure. Four other cases of painful superficial scars were not relieved by radiotherapy. However, they did respond to percussion with a rapidly vibrating interrupted faradic current.

He comments here that a certain depth of tissue seems essential for the securing of results with radiotherapy. The technique he uses is a 16-inch coil, a Coolidge tube passing 3 ma. with a 9-inch S. G., through 3 mm. of Al. at a 14-inch distance. The dose delivered to the skin was ½-B. as checked up by the Corbett-Tintometer. Treatments were given at intervals of three days.

L. K. POYNTZ.

The Radiography of Pictures. André Chéron (From the proceedings of the French Academy) from the Journal of the Roentgen Society (British), Vol. 17, No. 68, Page 120, July, 1921.

THE first investigation of pictures by means of the roentgen ray appears to have been attempted in Germany in about 1914. Following this, Heilbron of Amsterdam and the author (in France) have obtained some surprising results. To obtain a good radiograph of a painting there are two essentials. First, both the support and the "sizing" must be transparent. Second, a varying density of opacity of the pigments is also necessary. Usually, the backing being wood or canvas, is readily transparent in both ancient and modern paintings, but the old masters used a sizing comparatively transparent. Its composition appears to be chiefly calcium carbonate and glue, while in moderns the size is almost exclusively white lead with a greatly increased radiopacity. In the pigments white has always been of heavy mineral origin, chiefly lead or zinc, while bitumin and black are transparent to the rays, whereas in certain colors, formerly of mineral origin, the modern school has replaced these by vegetable or analine colors; for example, mader-root. The old pictures lend themselves more to radiography as they show the transparent backing with the contrasting pigments while a modern with an opaque backing and homogeneous colors, shows practically nothing. So that this method may provide a guide to the age and authenticity of a picture. It will also show the nature and extent of any restorations, as it is almost certain that the pigments of the different periods will vary sufficiently to allow of their detection, but possibly the most interesting is the light that is thrown on the genesis of the picture; as modified or completely changed by the author during this creation.

L. K. POYNTZ.

Notes on Certain Lesions of Bone. Walter Overend, M. D., and T. Dallas Overend, B. A., (Oxon) M. R. C. S., L. R. C. P., in British Journal Archives of Radiology and Electrotherapeutics, No. 253, August, 1921.

FIVE interesting cases are described and illustrated by seven radiographs. The first, a boy of eight, received an injury to his right arm and was sent for examination of a hard swelling of the humerus which was considered probably a sarcoma. Radiograms showed a bone tumor with a central opacity with many opaque lines radiating from it and interlacing. The radiological diagnosis of calcifying chondroma was made. A section later confirmed this x-ray diagnosis.

The second case: A boy of ten developed a fusiform swelling of the lower right fibula following a kick six weeks previous. A clinical diagnosis of tuberculosis was made. The radiographs showed the shaft of the fibula enveloped in a sheath of periostitis more than double the width of the normal bone. There was excessively marked irregularity of the edge over an extent of about three inches. X-ray diagnosis of congenital syphilis was made, or a possible periosteal sarcoma. The clinical tests indicated syphilis and the therapeutic test was applied, which confirmed the diagnosis of syphilis and re-examination some weeks later showed a disappearance of the irregularity, but the periostitis persisted. The author comments that such excessive periostitis in children is typical of congenital syphilis.

Case three was that of a man fifty-eight years of age sent in with a provisional diagnosis of periosteal sarcoma. Radiographic examination showed a tibia characteristically bent with a chronically ossifying periostitis with probably cyst formation in the upper tibia. An x-ray diagnosis of osteitis deformans of Paget's was made.

Case four was an early case showing a similar pathology. Here the author comments on the etiology of Paget's disease and stated that radiological examination has not found any change in the dimension of the pituitary fossa in osteitis-deformans, although the clinoid process may be thickened. The cause is still obscure, and may be from focal infection, as from pyorrhoea or a specific infection. The present case showed focal infection of the teeth. The author refers to articles by Arbuthnot Lane, Robert Jones, and Frank Romer (Lancet, Jan. 8th and 15th, 1921), but these cases are of traumatic origin whereas true Paget's disease is of obscure origin.

Case five was a man of sixty-eight showing intermittent claudication although x-ray examination showed artheroma of the popiliteal and posterior tibial arteries. Relief was obtained by radiant heat.

L. K. POYNTZ.

Radium Technique in the Treatment of Malignant Diseases of the Skin. Douglas Quick, New York City. Archives Dermatology and Syphilology, Sept. 1921, p. 322.

THE literature on radium treatment of malignant diseases of the skin is abundant. This paper is written to describe the technique which has been built up in the Memorial Hospital in New York City. It is largely the work of Dr. H. H. Janeway.

Skin lesions are so accessible that they are easy to treat. The important factors to be considered are (1) the selection of proper filters, (2) the accurate approximation to the lesion, and (3) the dosage.

The pathology determines the kind of ray to be used. For practical purposes emanations are obtained in sealed capillary tubes. These are unfiltered or filtered, according to ray desired in the treatment. The bare or unfiltered tube permits the utilization of all the beta and gamma radiations. A tube of .2 mm. of aluminum removes only the softer beta rays and a few of the gamma; a silver tube removes nearly all of the beta rays and the softer gamma rays; a millimeter of platinum removes all of the beta and a large percentage of the softer gamma rays. These filters are not the only ones that can be used, but they are the most practical ones, and handle all types of skin lesions.

The conditions illustrating the use are lupus, vernal catarrh, new and small lesions, such as moles, papillomata, or rodent ulcers. The ingenious use of adhesive, paraffin and modeling compound and other devices add to the adaptability of the emanation needles. The numerous methods to accomplish the most crossfiring protection are interesting and skillful. Sterilization is by boiling. Cavernous angiomas and metastatic melanomas may require the embedding of needles, which become encysted and cause no harm, or slough out if the surface is infected. E. W. R.

The Rentgenographic Study of the Accessory Sinuses, With Special Reference to the New Technique for the Examination of the Sphenoid Sinuses. George E. Pfahler, Philadelphia. Annals of Otol. Rhin. and Laryng., p. 380.

DUE to the fact that the sinuses contain air, the roentgen examination is very satisfactory. Size, outline, position, and the condition of the walls and the septa can be demonstrated. Exudate can be determined, but pus, mucus and blood cast the same shadows. Bone changes are demonstrable. By comparison with the corresponding side, differences are noted. The normal must be kept in mind if both sides are affected. A poor plate may appear abnormal. If all sinuses are abnormal, the detail of the skull must be used for comparison. Absence of sinuses will appear differently than sinuses opaque from disease. There is no better way to determine the condition of the ethmoids To the rhinologist the great advantage is to locate the exact size, the septa, and the exudate.

Tumors of the sinus are either primary or secondary. If primary, they are usually sarcoma. In addition to exudate, there is always a destruction or expansion of the walls of the sinus.

All the sinuses should be examined. Three antero-posterior views are obtained with the patient lying down. The first view is made by directing the vertical ray at an angle of 35 degrees with the plane of the gabella and the external auditory meatus. The second passes through a line connecting the external auditory meatus and the external canthus. The third view is taken with the central ray passing immediately below the level of the mastoid process and directed toward the maxillary sinuses. These views show best the frontals, sphenoids, ethmoids, and maxillary sinuses. Lateral views are also made, either flat or stereoscopic. It is important to get the depth and thickness of the frontals.

Dissatisfaction has been expressed with the ordinary methods for demonstrating the sphenoids. To obviate this a new method has been devised. Films are placed in the mouth, backward against the pharynx. Only the outlines of the sphenoid sinuses are obtained; all extraneous shadows are avoided. The films must be cut to fit the mouth and pharynx, about 2 by 3 inches, square at one end and curved on the side fitting the pharynx. To obviate secondary radiation and hard rays, double screens and metal beneath the film are used. A special carrier has been devised to make this posible. The patient sits with the chin on the head-rest. The target distance to the top of the head is 18 inches. A 3-inch cylinder is used, a 4-inch spark gap, and an exposure of 8 seconds, with 30 milliamperes.

The roentgenogram produced demonstrates the outline and size of the sphenoid sinuses side by side, the septa, and exudate if present. The ethmoids may be seen also. This technique in conjunction with the antero-posterior positions gives accurate and satisfactory evidence of the sphenoids. E. W. R.

Further Report on the Use of Radium, the X-Ray and Other Nonsurgical Measures, Combined With Operations About the Head and Neck. Joseph C. Beck, Chicago. Annals of Otol, Rhin. and Laryng., June, 1921, p. 425.

SINCE 1904 several papers have been presented on the same general subject and the same treatment with uniformly poor results. The following list of pathologic conditions about the head and neck are carefully reported case by case, numbering in all sixty-two. They are:

1. Carcinoma, epithelioma, adenocarcinoma
2. Sarcoma
3. Endothelioma
4. Papilloma
5. Angioma
6. Lymphangioma
7. Fibromyxoma
8. Neuroma
9. Chloroma
10. Fibroma
11. Adenoma
12. Lymphoma
13. Lipoma
14. Cystoma
15. Epulis
16. Osteoma
17. Verruca
18. Rhinophima
19. Leukoplakia
20. Paraphinoma
21. Syphiloma
22. Keloid
23. Tuberculoma
24. Exostosis and osteitis
25. Hematoma
26. Abscess

The forms of treatment employed were:

1. Surgical.
3. Radium (surface and deep).
2. X-ray (surface and deep).
4. Surgical diathermia.
5. Cautery.
6. Lysins and chemotherapy.

Conclusions

Comparing his cases before radium and x-ray treatment were in vogue, there was a higher percent of cures.

In order to determine the toxemia in the blood following the radiation of malignant disease, certain investigations are being made. There is a difference between this intoxication and that produced by the rays acting on normal tissue.

The earliest posible diagnosis of malignant disease with thorough early operation, without x-ray or radium treatment either before or after operation, would be to the best interest of the patient.

The greatness of x-ray and radium in the possibility of curing malignancy is recognized, but it has not been demonstrated by sixteen years of experience. However, the effort to cure malignancy by these means will go on.

Following up and reporting cases is of the most importance.

In nonmalignant conditions every effort should be made to determine the value of x-ray and radium, because there is much to gain and nothing to lose.

There is no question but that radium is the method of choice in treating angiomata. In eighteen cases results were uniformly good.

E. W. R.

Radium Plugs for the Dissolution of Orbital Gliomatous Masses Developing After Excision of the Globe. Burton Chance, Philadelphia. Amer. Jr. Ophthalmology, September, 1921.

THIS case was reported in June, 1921, and is still alive. In a condition apparently hopeless the eyeballs were excised in November, 1920. Following the removal of a gliomatous mass there was a recurrence of the malignancy. In the recurrent mass tubes of radium encased in non-corrisive steel were buried. Each contained 10 mg. of radium sulphate. In the left orbit he inserted nine of these tubes, in the right five small tubes and one large. These were left in for twenty hours.

Radium emanations were not used, as they have been found uncertain in action. The radium salt permits the entire radiant effect when buried. If applied to the outside, one-half of the effects are lost.

There is no personal knowledge of recoveries from this condition, but this patient, only four years of age, is alive and apparently well, without signs of recurrence.

E. W. R.

The Radium Treatment of Goiter. D. T. Quigley, Omaha. The Medical Herald, Sept. 1921, p. 225.

THE following group of cases have gone over a year since receieving treatment:

Kind	No. Cases	Improved	Cured	Dead	Not Improved
Simple	7	4	1	1	1
Exophthalmic	23	14	12	1	0
Malignant	3	0	1	2	0

..The table is self-explanatory. The results were prompt and decisive. There was no shock or risk of operation. Primary ligation should be dispensed with in favor of radium treatment. Na patient with simple or toxic goiter should be submitted to operation without first being given the benefit of radium treatment.

Radium-X-Ray Therapy of Carcinoma Uteri and Uterus Bleeding. Frank S. Bissell, Minneapolis, Minnesota Medicine, June, 1921.

Radium and roentgent ray have been accepted in the treatment of malignancy. Surgeons now often advise substitution of it for operation. Even the best operators show a high operative mortality rate. The most careful statistics give a clinical cure of but 3 to 10 per cent. of all cases presenting themselves, a high immediate mortality, and so many disagreeable sequelae that there is but little to justify its continued employment.

In radiation therapy all cases can be treated; there is no operative mortality. The local disease can be eradicated and the metastases attacked. Statistics cannot be safely quoted because the use has been too recent and the technique changing. Yet the literature is full of cures reported, relief obtained. The future is promising for improvement.

The inoperable and hopeless cases are improved without discomfort or shock. Bleeding and foul discharges cease. There is assured a period of improvement, and in the end a shorter and less painful death.

The combined surgical and radiation therapy has been generally followed. Time will tell the value of it. Preoperative radium combined with roentgen therapy should be used in many more cases. This destroys and inhibits the cell activity. Operative wounds may be used at times for placing radium nearer the cancer source.

An operator should not touch a case unless he can remove all of the cancer mass. Fulgerating a mass to destroy a part of it accomplishes no purpose. Radium will do as much. Case reports show bad effects from combined surgical and radiation therapy.

Also, some reports show excellent results from radium and x-ray combined.

Microscopic studies show the action of radiation to be due to the inhibition of cell proliferation. The function of cell reproduction ceases and round cell infiltration follows, replaced in time by dense scar tissue. Nests of typical cancer cells may remain included in the sclerotic tissue and under proper conditions again become active. To combat this danger of recurrence, six months of active treatment and a period of rest should be followed again by intensive treatment.

The word cure for cancer of the cervix should not be used. Symptomatic cure is more applicable. Sufficient time has not elapsed.

Statistics accumulating are encouraging. Scherer and Keley have treated 218 cases with x-ray and radium, and they estimate 10.5 per cent. greater success than in operation.

Bumm reports 108 cases, five inoperable, and recurrences to date of but 15 cases. Doderlein reported symptomatic cures in 31 out of 153 cases. Twelve of these had been classified as inoperable.

There is much justification for substituting radiation therapy for surgery, but the roentgenologist is loath to assume the responsibility alone. But he insists that in all cases in which both are used, intelligent radiatio ntherapy be followed.

Conclusions

Combined radium and x-ray therapy is the treatment of choice in all cases of cancer of the cervix.

In early cases, conservative surgery followed by radiation is justifiable, but probably the latter alone will prove equally efficient.

In carcinoma of the fundus surgical results have been so good that these cases should all be submitted to operation. As in all other cancer cases, however, the patient should be given the added benefit of post-operative radiation.

Radiation should be accepted as a specific in the menorrhagia due to myoma or fibrosis or those of unknown etiology.

E. W. R.

Linitis Plastica. E. P. Palmer, W. W. Watkins and H. P. Mills, Phoenix, Arizona Surgery, Gynecology & Obstetrics, September, 1921.

LINITIS Plastica under many names has been known since 1854, when Brinton first studied it. It affects any part of the intestines, chiefly the stomach. There is a thickening of all the walls, but mainly the submucous connective tissue, with atrophy of the mucous membrane. Slow stenosis occurs in the stomach, with the most marked change at the pylorus. A tumor in the epigastric region with symptoms of food stagnation and the absence of pain, hemorrhage and early vomiting, characterize clinically the disease.

There are two forms, localized and diffuse. It is also classified as benign or malignant. Morrison states that 50 per cent. of the cases are malignant. It occurs in adults only between forty and sixty years, and about twice as often in men as women.

The histopathology is that of sclerosis, and in all probability it is malignant, although there is much dispute concerning this point.

Linitis plastica resembles scirrhous carcinoma and chirrotic syphilis of the stomach, and frequently has been mistaken for both. In linitis plastica the onset is slower and the symptoms less severe; in fact, there are few until stagnation occurs. Carcinoma is more rapid and severe in its course. Pain, vomiting and hemorrhage are usually greater.

Syphilis occurs in younger patients, and a history or the Wassermann help to differentiate it.

The roentgen examination offers the best means of recognizing the lesion, although it may be difficult to exclude carcinoma or syphilis.

The roentgen ray characteristics are those of a filling defect with a relatively smooth inner margin and with peristalsis absent from the area involved. The pylorus may be either gaping or obstructed. On the fluoroscopic screen the stomach is small and drawn upward. It lacks expansibility. Early obstruction may occur in which the stomach becomes dilated. It may take the microscopic examination to tell the real pathology.

The treatment is surgical only. Gastrectomy is advisable and has given satisfactory results.

E. W. R.

The Crystalline Lens. Drs. Cohen and Levin. Ophthalmic Literature, p. 146, June, 1921.

TWENTY-FOUR cases on radium treatment of cataracts are reported. Only the gamma rays were utilized, all the others being filtered off. Brass, photographic paper and guaze were used for filters. The radium came within two centimeters of the eyelid. The application lasted about two hours.

The authors conclude that (1) the application of radium to the eye is harmless; (2) the opacity of the lens improves; (3) treatment by radium in nowise interferes with subsequent surgical treatment if necessary; (4) it is desirable to submit a large number of early cataracts to radium treatment.

E. W. R.

Fractures of Transverse Processes of the Lumbar Vertebrae. George F. Davis, Chicago Surgery, Gynecology and Obstetrics, p. 272, Sept., 1921.

FRACTURES of the transverse processes are frequently overlooked. With the improvement in x-ray technique, with the aid of dupletized films, intensifying screens and the Bucky diaphragm, many cases of sprained back are found to be due to fracture of the transverse processes.

Study of the embryology and the anatomy clear up many points in the etiology. Ossifying centers help to determine the lines of fracture in the young. Practically all of them occur from direct violence and are due to the broad attachment of the powerful muscle, the quadratus lumborum. in the majority of the cases reported the age was past thirty-five and the etiology was due almost entirely to the pull of the quadratus upon a fixed spine, pelvis and ribs.

;Backache is the chief symptom. This is persistent, and relieved only by complete relaxation in bed. The disability may be removed in two or three weeks, but it usually continues a long time. Besides, pain, muscular rigidity and localized tenderness are present.

The x-ray examination may show a linear fracture with the fragment in good position. Gross displacement even of ribs may occur. Especially may a lumbar rib be found loose. Osteoarthritis is common. X-ray will of course show the fracture. Many were overlooked before its use and refinement of its use.

Conclusions

Indirect violence plays the most important role in fractures. The occurrence is noted in patients of advanced years, beyond the time when ossific centers play a role. The condition is often associated with osteoarthritis.

E. W. R.

Bone Atrophy: An Experimental and Clinical Study of the Changes in Bone Which Result From Non-Use. N. A. Allison and Barney Brooks, St. Louis Surgery, Gynecology and Obstetrics, Sept., 1921, p. 250.

THE exact nature of bone changes due to non-use is not fully known. Paralysis, inflammation and injury causing non use bring about fragility and more permeability to the roentgen ray. It has been thought that certain trophic changes or inflammation caused these changes. The assumption is that non-use accounts for most of the change, and that it is the architecture of the bone that is changed rather than the tissue itself. Bone should be looked upon as connective tissue in which is laid down an intracellular matrix. The physical qualities are due to the matrix alone. Non-use will slow down the process of bone growth in the young, but will not cause it to cease altogether. The difference between normal growing bone and bone changed by non-use has not been established.

Bone regeneration is a process which must be considered independently of bone growth.

This experimental study was carried out to determine the effect of non-use of bones as it concerns:

1. X-ray photographs.
2. Gross and microscopic anatomy.
3. Chemical composition.
4. Breaking strength.
5. Growth, and
6. Regeneration.

It was found that the changes in the bones of dogs were identical with the changes in human bones.

In these experiments in which non-use was produced by nerve paralysis, injury to joints and simple fixation, the changes in the bones were the same. The degree of atrophy was in direct proportion to the time of non-use. The rapidity of atrophy was the same for simple fixation as for a nerve injury or injury to the joints. There is no assumption that any disease plays a part other than from non-use. In a patient with ischemic paralysis of a leg there was no evident atrophy after a period of four months.

Bone absorption is an active process and the circulation of the blood is necessary to its progress. The tissue characteristics do not change with atrophy. Only the amount of bone present changes. This affects the size, shape, thickness, length, weight, and accounts for the changes in gross anatomy, x-ray photographs, breaking strength, and chemical composition.

E. W. ROWE.

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President The Radiological Society of North America, 1921.

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Radium in the Treatment of Epithelioma of the Lip

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THERE is probably no field in which the possibilities of radium therapy are more important than in epithelioma of the lip. Of all the epidermoid carcinomas it occupies at once the most conspicuous and accessible location. It is, comparatively, very frequent in occurrence. Very early in its course it causes subjective symptoms and leads the patient to seek advice. Of all forms of cancer it offers least excuse for failure to make a correct early diagnosis. So strongly do we feel about this that I will say frankly we are, in most instances, opposed to a biopsy as an aid to diagnosis. The appearance is quite characteristic to any one familiar with epithelioma. At the Memorial Hospital no case is referred for treatment without the opinion of the combined attending staff or a number of its members. We therefore feel that the clinical diagnosis is adequately confirmed, once it is reviewed by a number of men all well trained in the diagnosis of cancer. While we favor the taking of tissue for examination, as a general rule, we feel that most cases of lip epithelioma are exceptions, for various reasons. Many cases present themselves at a stage when the doing of a biopsy would mean the removal of a very appreciable percentage of the growth, virtually a partial excision. These growths are surrounded by a zone of lymphocytic infiltration during their early stages so that removal of a section is very liable to interrupt this and open wide the channels of dissemination. The proceedure is distinctly painful for the patient unless an undue amount of monipalation is carried out to render the area insentitive. The removal of a small neoplastic nodule from the surface of the more advanced lesion is of course another matter and can do no harm. The question of monipalation is one which I think has not received proper consideration. Since this is one of the lesions which we are permitted to see at an early stage, more frequently than with most malignant diseases, we should not handicap our favorable opportunity by permitting several men to squeeze and massage it for the purpose of satisfying what frequently appears to be idle curiosity. If the disease is localized to begin with it has little chance of remaining so after the usual examination in the average clinic.

True epithelioma of the lip, that is, the lesion beginning on the vermilion border of the lip, is always epidermoid or spuamous cell epithelioma.

Basal cell epithelioma may involve the lip, but, if so, it is always by extension from the skin surface beyond the mucocutaneous junction: this should not be classified as true epithelioma of the lip. This extension occurs much more frequently from the skin of the upper lip and, as is well known, squamous cell epithelioma primary on the upper lip is relatively rare.

As is true of epidermoid carcinoma elsewhere, that of the lip presents two distinct types, the nodules: the base is but slightly infiltrated, giving the impression of a lesion set upon the lip rather than invading it. The ulcer may be of considerable extent, frequently covering the greater part of the mucosa of the lip or even appearing as isolated islands of ulceration. Their chief characteristic is this early extension at the expense of the mucosa with deeper infiltration only in the later stages. This type responds readily to surface radiation. Glandular involvement is rare until the disease has progressed to the point of invasion of the deeper structures of the lip.

Figure I.—Superficial papillary type of epithelioma of the lip before and after treatment by surface radiation.

superficial papillary and the deeply infiltrating ones. These present in their early stages marked differences both histologically and clinically. They also offer considerable difference from the standpoint of prognosis. The superficial papillary type early in the disease presents an ulcer of varying size frequently covered by a crust which drops off and reforms periodically. If this crust be removed carefully the surface of the ulcer will be found covered by small characteristic neoplastic

The deeply infiltrating type is characterized by a relatively small area of surface ulceration at first. The ulcer is always deep in its infiltration with raised indurated edges and may be crateriform in appearance with central sloughing. The growth progresses by invasion of the deeper structures in a more or less spherical manner so that on palpation it presents a well circumscribed globular tumor. In this type the surface ulceration gives no indication of the extent of the disease.

It is a much more malignant growth than the superficial papillary type and is often more difficult to influence by radiation. Extension to the cervical nodes is earlier and more frequent.

The surgical experience with cancer of the lip has been relatively favorable when we compare the results with those obtained in epidermoid carcinoma elsewhere. Ewing (1) quotes Fricke as placing the cures at 60 per cent and Steiner at 70 per cent for a five-year period. He also notes that surgical experience emphasizes the necessity of a bilateral neck dissection. Ribtwenty or 95 per cent remained well five years. Of twelve cases showing metastases in the nodes only six or 50 per cent remained well five years. In a series of 516 cases operated upon Broders (5) was able to trace 306. Of the group traced 182 or 59.5 per cent were living and 169 or 92.8 per cent of the living were free from disease. The average duration of the post-operative period was 7.76 years. One hundred and five patients with metastases were operated upon and of these sixty-nine were traced—twelve were living and of these ten were free from disease for periods ranging from

Figure II.—Papillary type of epithelioma of the lip before and after treatment by surface radiation.

eray (2) reports ninety-six operative results, with two deaths, and so apparently cured although not all of these have passed even the three-year period. In a series of 200 cases Dollinger (3) reports 158 primary lesions in which operation gave 70.7 per cent free from disease for three years and 69.6 per cent for five years. In a report of thirty-three cases Bloodgood (4) found twenty-six or 78.7 per cent well five years. In twenty-one of these cases no metastases were found in the lymph nodes removed and of this group 3.29 to 11.73 years. No patient with extension to the deeper cervical lymph nodes or to more than one group of nodes was known to be alive. Von Bonsdorff (6) places the three-year cures at 80 per cent and has made the further interesting observation that 90 per cent of recurrences occur before the end of the third year. The difficulty of tracing post-therapeutic lip cases is especially great because many patients cannot be impressed with the seriousness of their condition and disappear from observation immediately the lesion or wound is healed. For this reason statistics are only approximately correct and it would be by no means fair to classify as unfavorable all patients who failed to report their condition subsequently. However, a fair approximation would seem to place the results as about 70 per cent clinically free from disease for a five-year period.

Such results would be excellent were they not obtained at the expense of such sacrifice of tissue. It is true that the radical surgical proceedure, with a seven-out-often chance of winning, is but a slight sacrifice in dealing with a disease which is so fatal. It is also true that, as long as we offer such a proceedure as the final word, the average layman will hesitate to accept it until his best chance is lost. While it is no fault of surgery that he hesitates it is nevertheless human nature.

The surgical proceedure itself is open to criticism on two points. In dealing with the primary growth the usual method is the V-shaped excision. While this is termed a deformity of no consequence it is nevertheless an uncomfortable deformity in most instances, especially if an adequate operation has been done. The base of this excision is upward whereas the broad spreading infiltrating base of the neoplasm is downward. When we consider the two types of lip epithelioma it is at once evident that the greater amount of tissue is sacrificed in dealing with the less malignant of the two forms and it is undoubtedly the hesitancy on the part of the surgeon to make a sufficient sacrifice in many cases that accounts for so many local recurrences in the scar. To say the least, the method is both awkward and unscientific.

Figure III.—Infiltrating carcinoma of lip before and after treatment by surface radiation.

In dealing with the cervical nodes the routine bilateral block dissection is followed as the orthodox proceedure. This surgical viewpoint has been forced by the fact that a much higher death rate ensues once metastases have become firmly established in the glands. Bloodgood's report of twenty out of twenty-one cases, in which no metastases were found in the nodes after removal, remaining well five years is indeed strong evidence in favor of early block dissection of the neck. Only 50 per cent of his cases with glandular involvement remained well five years. In Broder's (5) statistics, of 516 cases operated upon, the regional nodes were removed in 499 cases or 87 per cent. Of these, glandular metastases were found in only 105 or 23.38 per cent. In other words, 344 patients or 76.6 per cent—at least nearly that number, allowing for some failures to demonstrate existent metastases—were operated upon unnecessarily. If every case with cancer of the lip is to be subjected to such a blanket rule an appalling number of unnecessary operations must be undertaken. The method does seem unscientific.

Would it not be better to attempt to ascertain whether the death rate would be increased by separating those cases in which metastases are most liable to occur from those in which they probably will not occur. We know that the superficial papillary type of growth is much less liable to extend to the nodes. We know also that age and rate of growth are factors of consequence.

After classifying the cases in this manner would it not be possible also to ascertain whether the death rate would be increased by following an expectant plan of treatment and reserving our surgery until a definite node is palpable. It is true that the co-operation of the patient is necessary for the period of observation, but I believe with proper instruction and adequate follow-up through social service work the number of losses or mistakes can be reduced to a negligible percentage. According to Von Bonsdorff's statistics, this would not mean frequent examinations for the remainder of the patient's life.

Figure IV.—Infiltrating epithelioma of lip before and after treatment by a combination of surface and interstitial radiation.

By intelligent co-operation on the part of the patient it is possible to palpate the involved node in the average neck before its capsule is perforated. In this stage the node performs a conservative function. It demonstrates the direction the metastasizing is taking through the lymphatic channel and holds the disease in check until it can be intelligently dealt with. It has been my experience that a dissection at this time reveals usually only one or two nodes involved. It is rare that a chain of nodes are found involved until late in the disease. This seems true of all cervical metastases of intra-oral epidermoid carcinoma. The mode of dissemination itself is a factor in favor of conservatism. I believe we are now fairly well agreed that cancer cells do not grow along the lymphatic channels like a vine along the ground, but that extension is by embolism.

If we add to our expectant plan of treatment of the nodes the use of the physical agents as well, it seems to me we are approaching the problem in a much more scientific manner.

In our work at the Memorial Hospital we have therefore divided the treatment of epithelioma of the lip into two distinct parts

PART I.

Treatment of the Primary Lesion.

The primary growth in the lip lends itself admirably to the application of radium and in the treatment of this part of the disease we feel very strongly that surgery occupies no place. The location is such that surface radiation can be applied from three sides and for this we employ the method previously described by the late Doctor Janeway (7). It is to Doctor Janeway also that we owe practically all of our present technique in the treatment of this disease.

A mould of the lesion is made of dental modelling compound held in place by the teeth, and care taken that it fits well down into the bucco-gingival groove inside and extends well beyond the limits of the lesion externally. This mould is then taken to the laboratory where, with a heated tool or gouge, furrows are made in it into which filtered tubes of radium are placed. These tubes are then sealed in place by pouring over the surface some melted paraffiin. For filtration we employ tubes of 0.5 mm. silver which removes approximately 95 per cent of the total radiation. These tubes are sunk into the mould to a depth of 4 mm. in order to give a more equal distribution of radiation and are so arranged that one tube is available for each sq. cm. of surface to be covered. Care is taken that the tubes extend well

Figure V.—Dental modelling compound applicators with and without radium tubes sealed in place.

beyond the palpable borders of the growth. With this method an excellent cross-fire is obtained. The rigid mould conforms accurately to the contour of the lesion and since it is made to fit between the teeth it must remain exactly in place. For lesions of ordinary size a dosage of 60 to 65 mc. hrs. per sq. cm. of surface is employed, but if it is very extensive this is slightly reduced because of the curved surface and amount of additional cross-fire. The most important point in applying radium in this manner is to have the tubes extend well beyond the limits of the growth in all directions.

This method of radium application is employed in practically every case of lip cancer. For the primary papillary type of growths and for many of the deeply infiltrated ones it is all that is necessary. Usually one application is sufficient to effect a complete regression of the growth. In certain deeply infiltrating recurrent growths as well as primary lesions of similar type it is necessary to supplement this surface application by burying emanation in the substance of the neoplasm. For this purpose small glass capillary tubes 3 mm. in length and 0.3 mm. in diameter containing not more than 1 mc. of radium emanation are inserted interstitially by means of fine trocar needles, and left in situ. The use of 1 per cent novacaine as a local anaesthetic

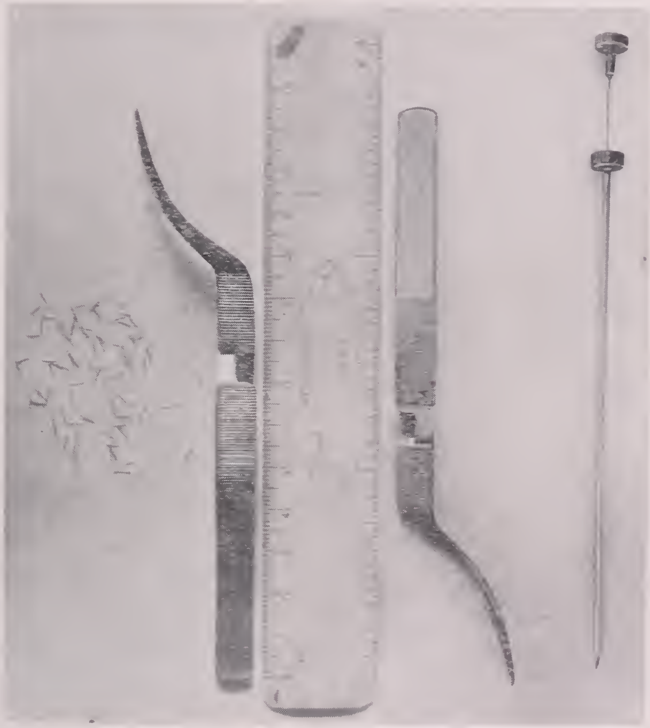


Figure VI.—Showing tubes of unfiltered radium emanation and the trocar needle used for burying them interstitially.

renders the proceedure painless and simple. Emanation buried in this manner decreases in value at the rate of approximately 15 per cent per day so that a very prolonged radiation is effected. Since the capillary tube removes little more than the alpha rays the full intensity of both beta and gamma rays is obtained in the most inaccessible portion of the growth. One mc. of emanation gives a total radiation equivalent to about 132 mc. hrs. We have had no ill effects from the small glass capillary tubes as foreign bodies, but I believe it is always wise to employ surface radiation first, even though an interstitial application is contemplated from the beginning. The external radiation renders the possibility of dissemination of malignant cells, by the trauma of introducing the needles, much more remote.

PART II.

Treatment of the Cervical Nodes.

As suggested before we have taken a very conservative position in the treatment of the cervical nodes and as time goes on we feel more strongly convinced that this has been advisable. The chief criticism I feel we should make of ourselves is that in the earlier part of our work we did not follow up external radiation as vigorously as should have been done. During the past year we have endeavored to radiate all necks externally. For the more favorable cases we have used radium, for the remainder x-ray, and in some a combination of the two agents. In those cases having no palpable nodes this has been with

Figure VII.—Pack and tray used for applying heavily filtered radium externally over the neck.

the idea of stimulating the protective defences in the lymphatics and destroying minute metastatic foci at a time when they are of least proportions. In cases where palpable nodes have already appeared it is done with the hope of rendering the disease in this location temporarily less malignant and therefore a safer operative risk. A considerable series of nodes studied microscopically suggests that this has been accomplished. I wish to make clear in this connection, however, that by external radiation alone we do not feel we have ever been able to not remove all of the possible avenues of dissemination. It does, however, remove one of nature's chief barriers, frequently at a time when such are needed most. Many patients are not physically able to withstand such an operation. If extension to the nodes be embolic, as most of us believe, then it is quite possible that a great deal of needless surgery, with its resultant surgical shock, may be carried out and still the one small dangerous focus left unnoticed, but probably stimulated to greater activity. In cases where no cervical nodes are palpable

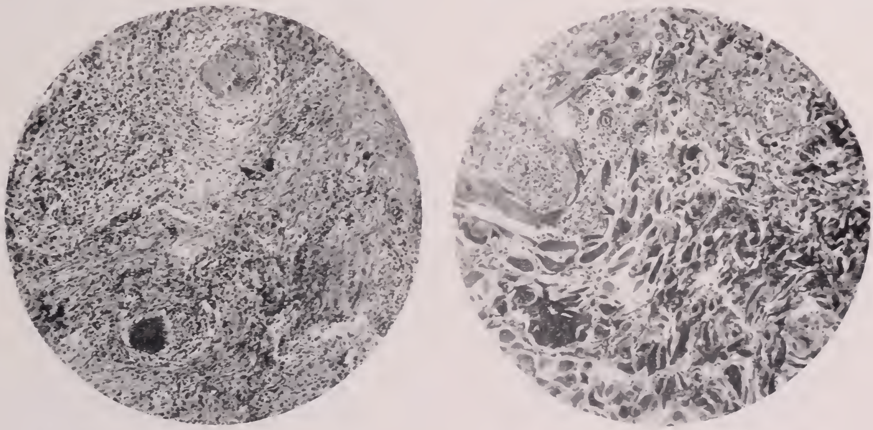


Figure VIII.—Microphotographs of four cases treated by external radiation over involved cervical nodes and followed by complete surgical dissection.

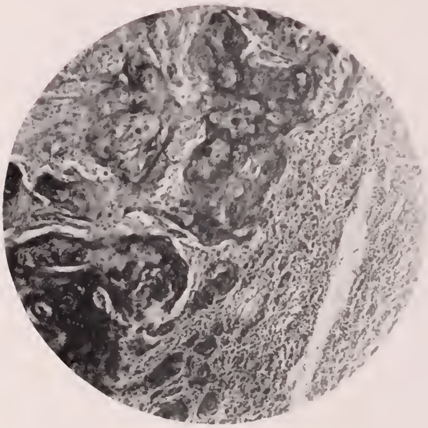
destroy, completely, fully developed epidermoid carcinoma in the cervical nodes.

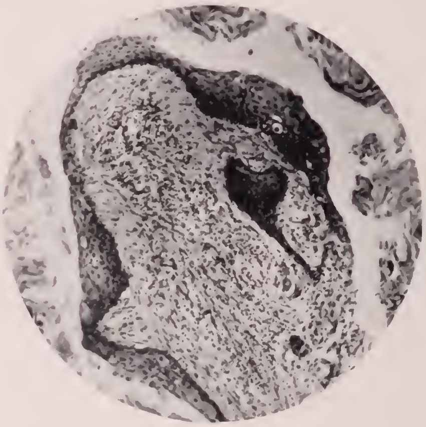
We feel that the cervical lymphatics perform a conservative function, representing one of nature's barriers to the disease, and that unless definite involvement is noted they should not be interferred with surgically. A very considerable percentage of cases does not develop metastases in the neck at all or until late in the course of the disease. This is more especially true in elderly patients. The routine block dissection as commonly practiced, does

our plan has been to apply external radiation and keep the patient under observation. If a palpable node which is clinically malignant and not simply inflammatory, appears we then do a complete dissection of that side of the neck under local anaesthesia, removing the entire chain of nodes and burying small doses of radium emanation well distributed in weak tubes at all suspicious points where the lymphatic channels are severed. By burying the emanation in this manner we get a very uniform radiation throughout the entire operative field, carried over a prolonged period and without appreciable gross destruction of tissues. Healing of the wound is complete before the intensity of the radiation becomes apparent.

In cases where the glandular mass has perforated its capsule and is extensively invading surrounding structures, such as the sterno-mastoid muscle or the great vessels, it is better to bury radium emanation uniformly throughout the mass, in the same manner as previously described, and close the wound. With the parts exposed in this way accurate approximation of the radium can be made and nature's barriers are left intact. The metastatic mass thus left intact affords a support for the emanation tubes such as could not be obtained in any other manner. While we sometimes see remarkable clinical results follow the surgical removal of such masses, still, I believe that these are more or less accidental and that as a whole the results are very unsatisfactory.

I should like to emphasize the doing of the neck dissection under local anaesthesia. It does away with the danger of post-anaesthetic pneumonia, hemorrhage is better controlled, more careful work can be done and many patients may be cared for in this way who could not withstand a general anaesthetic.





Statistics of Treated Cases.

During the past four and a half years we have treated at the Memorial Hospital 162 cases of epithelioma of the lip. A considerable percentage were recurrent cases and many of these were very advanced. I am convinced that several cases would have been better off had no treatment been given. There comes a period in the course of the disease when we must recognize the fact it is even too late for the palliative use of physical agents.

In this series of 162 cases, ninety-two were primary without demonstrable cervical nodes, eleven were primary with nodes, and fifty-nine were recurrent.

Of the recurrent cases sixteen were recurrent in the nodes only, twenty-six at the local site only, and seventeen both locally and in the regional nodes.

Of the entire series 115 cases have been traced to date and forty-seven untraced. We have found it very difficult to trace many of our earlier cases because once free from evidence of the disease many patients feel they are then brought back only to satisfy the curiosity of the physician. More recently we have made a point to instruct the patient, or a responsible relative, in the gravity of the condition and this, together with a careful follow-up through our social service department, has been productive of much better results. While we ordinarily classify all untraced cases as having been victims of the disease, I do not feel that it is fair to extend this to the lip cases, altogether. Some of the trouble here is due to indifference on the part of earlier cases.

Of the 115 cases traced, 80 or 69.5 per cent are now free from disease. Of these sixteen are over three years duration and four over four years. The average period of freedom from clinical evidence of the disease is eighteen months.

Twenty-seven cases are known to have died and eight more are steadily becoming worse. In all, twenty-two neck dissections have been done following the plan previously outlined. Fifteen are now clinically free from disease for periods ranging from four months to four years, the average being eighteen months for the group. Six cases died at periods of four months to two years after operation; the average duration of life following operation being fourteen months. One case has recently recurred and is steadily becoming worse.

Of the ninety-two cases primary without palpable nodes at the time of admission nine, or 9.8 percent, developed nodes subsequently. Of these eight, or 90.2 per cent, are now, following combined radiation and surgical dissection, clinically free from disease for periods of four months to over four years, the average period being nineteen months. One patient died of recurrence nineteen months after the neck operation.

Of this series of ninety-two cases primary without palpable nodes at the time of admission, sixty-seven or 72.8 per cent are now known to be clinically free from disease. Two died of intercurrent disease and another died of apoplexy, although at that time clinically free from carcinoma. The remainder of the series have been untraced.

Conclusions

In our opinion the primary lesion in epithelioma of the lip should be managed entirely by the use of radium. For the average case surface radiation is sufficient while in a few of the more deeply infiltrating lesions this surface application should be supplemented by the use of radium emanation imbedded interstitially. tially.

The cervical nodes should be treated conservatively. External radiation to the neck is indicated at once in all cases admitted for treatment. Following this, cases without palpable nodes should be kept under observation after a sufficient period of external radiation. If nodes are present or appear subsequently, a complete unilateral neck dissection under local anaesthesia, coupled with the use of radium emanation in very weak tubes buried throughout the wound, is indicated. Dissection of the opposite side may be done subsequently if indicated by the presence of nodes. External radiation following operation is advisable in the majority of cases.

While the time factor is still too short to permit of comparison with surgical statistics, we feel convinced from our experience in this group of unselected cases that radium deserves the foremost place in the treatment of lip cancer. If properly applied it bids fair to produce results surpassing our present surgical statistics. These results can be obtained with a minimum of sacrifice on the part of the patient. Except in the event of a neck dissection, his daily work need not be appreciably interrupted. The resultant scar is in most instances scarcely discernible. By the conservative treatment of cervical nodes a vast amount of needless surgery can be eliminated. All of this tends to remove doubt and fear from the mind of the patient and promises to bring him for advice and treatment at an earlier and more favorable time in the course of his disease.

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DR. GEORGE E. PFAHLER, Philadelphia: I have been very much interested in this subject and I agree with all Dr. Quick has said. I believe it is a safe procedure to follow. During the past ten years it has been my practice in all primary lesions in which I could afford to lose a little tissue of the lip to destroy the lesion thoroughly and distinctly beyond palpable evidence of the disease by means of electro-coagulation and then apply radiation either by means of x-ray or radium and then follow by x-ray or radium treatment of the submaxillary region. Up to the present time every patient, so far as I have known or been able to determine, has gotten well, except one I am working on now, about whom I am a little doubtful. I still think he may get well, but it is the only case that has made me doubt the procedure.

One other point regarding the submaxillary glands, I believe thorough radiation followed by operation is a very satisfactory procedure, and one I have followed until the past year. During the past year I have been treating some of these lymph nodes by introducing radium needles into the lymph nodes. In that way we are carrying out the idea that Dr. Quick has expressed of walling off the lymphatics. You are not opening up the lymphatics or risking an extension of the disease by opening up the lymphatics. Time will prove whether it is successful. I believe it will be if we use enough radiation to destroy the disease.

In regard to the primary operation in which we cannot afford to lose any more lip—in other words, when the whole or even half of the lip is destroyed by disease—in those cases by very careful treatment with radium we can generally save what lip is left. That is a big help. In the smaller lesions in which we can afford to lose a small part of the lip, I believe preliminary electro-coagulation is of value.

Dr. Quick criticised my electro-coagulation in New York before the Academy of Medicine. I did not have a chance to answer him then, so I will now. He said it opened the lymphatics; that is just what it does not do. It seals off the lymphatics. Let a spouting artery come up before you, put on the high frequency current and you seal it off immediately. Then you have a certain reaction following, which shuts off all those blood vessels.

DR. ALBERT SOILAND, Los Angeles, Cal.: I want to compliment Dr. Quick on presenting one of the most complete papers on cancer of the lip that I have ever had the pleasure of listening to.

One statement in his paper regarding the sole use of radium in treating cancer of the lip, I think the x-ray should be included also, because before the days of radium there were thousands of cases of cancer of the lip treated and many successfully with x-rays alone.

In regard to the lymph nodes, we have had several cases where, after radiation of the lip had destroyed the visible lesions, radiation of the nodes had failed to reduce them in size, and we sent the patients to the surgeon. He found they were not metastatic, and that surgical removal was unnecessary. I think this is a point which Dr. Quick brought out and which we should also bear in mind.

DR. HENRY SCHMITZ, Chicago: The paper of Dr. Quick's is certainly very comprehensive and one of the best presentations of the subject I have ever heard. It teaches us two important things. In the first place there is an absolute necessity of studying our cancer cases in order to make out our plan of treatment and in order to be absolutely sure of the prognosis of the case. In the second place, it teaches us that we must not only treat the local lesion but the entire locality that might be involved. It is not necessary that it is involved, but it may be involved. We are often confronted by the question of why we get results in one cancer case and not in another. If we group our cases we can answer this question very soon and Dr. Quick has done this very beautifully. We divide our cases into, first, the simple excision cases; in the second group we place those in which we are not sure that by simple removal of the growth we would remove all the cancer tissue; in the third group, we place those cases in which we are absolutely sure that it would be impossible by surgery to remove all the cancer. Those are the ones that have a very extensive local infiltration and a palpable invasion of the lymphatic glands. In the fourth group we place the cases which are absolutely obscure, in which we cannot palpate or recognize the cancer. In the last group are the recurrent cases. Surgery will invariably cure cases in the first class. I think that in the second class surgery will cure 90 per cent of the cases. In the third class, of course, none at all are cured. These are the three classes that can be successfully treated with x-ray and radium. We can never successfully treat cases in the fourth class. In the first three groups we can absolutely hope for results, as Dr. Quick has told us. We may have an apparent cure.

The second point that Dr. Quick brought out, which was very important, was to the effect that we should never overlook treating the regional lymph nodes. Personally, it is my belief that if the regional lymph nodes are palpable the case is lost. The effect of radiation or excision is not going to free the patient from cancer. It is my opinion that when the glands are found to contain cancer cells they should be removed. I would remove the glands in every case of cancer either by radiation or the knife. If we do this and treat the disease, we will cure the patient.

DR. A. F. TYLER, Omaha: There are four points that I think I would like to emphasize in connection with Dr. Quick's paper. The first was we should not manipulate cancer of the lip or cancer of any part of the body. I have been so impressed with this that I have tried in teaching students to emphasize that above every other point. The second thing of great importance in treating cancer of the lip or any cancer is to treat the draining lymphatics, as Doctor mentioned, using the same principle as the surgeon has followed for many years. The third point is one that should never be forgotten, that is giving a sufficient dosage. I have followed this rule with considerable satisfaction, namely, that I should treat the local lesion until it appeared to be well and then give it just as much more treatment afterwards. The fourth point is to follow up your cases. Do not be deceived by not hearing from the patients, thinking they are well, because many of those you do not hear about in private practice are those who have gone to other doctors. Dr. Quick has the advantage of some of us in his follow-up system, but any of us can do it by means of a routine system followed up by the stenographer.

DR. DOUGLAS QUICK, New York City (closing): There is another thing about inserting the radium needles or tubes from the outside into the lymph nodes, a thing that has come up with us very frequently. You cannot always tell just where to put them. Without surgical exposure the extent of disease cannot be determined accurately. New growth in the nodes is apt to displace the great vessels so that insertion from without is a dangerous procedure. We have even seen an extremely calcified carotid bulb simulate a diseased node.

Diseases of the Oesophagus

P. F. Butler, M. D.
Boston, Mass.

Anatomy

FOR the proper study of diseases of the oesophagus a knowledge of the anatomy of this organ is essential. The oesophagus is a musculo-membranous tube which extends from the pharynx to the stomach. It begins about five inches below the incisor teeth and is about ten inches long in the adult. The cervical portion is 5 cm. long and the abdominal portion about 2 cm. long. Below the diaphragm it has a funnel-like expansion as it enters the stomach. There are three normal narrowings of importance, one at its beginning, one where the left bronchus crosses it and another where it passes through the diaphragm. The capacity is about 100 cc. It is closely related to several important structures; in the neck the trachea lies just in front of it and the lobes of the thyroid gland, especially the left, are adjacent to it; in the chest the left bronchus crosses it just below the bifurcation of the trachea, and the descending aorta is in close relation for some distance. There are two muscular layers, an inner one running horizontally around it and an outer one running longitudinally. The circular fibres aid mostly in peristalsis. The sphincter action at the cardiac end is supposed to have the strength to support a column of water two thirds the height of the oesophagus. A bolus of food normally passes along at the rate of about one inch per second and fluids move through faster than solids. It is poorly supplied with lymphatics and has no digestive glands.

Technique

Technique is quite important. The oesophagus is best studied by watching the passage through it of an opaque meal. The best meal is barium sulphate and mucilage of acacia, three parts of the former to one of the latter, stirred thoroughly for fifteen minutes. Films and fluoroscope are both used. For the upper part the antero-posterior position is best, and for lower portion the three-quarter position, with right side near the screen, is best. The entire tube is visualized and the normal narrowings and peristaltic waves noted. A distinct pause is seen in the passage of the opaque meal at the entrance through the diaphragm.

Choice of Methods

There are two generally accepted methods of examination, the oesophagoscope and the roentgen ray. The former calls for special skill and training and is dangerous in the presence of aneurism, acute inflammation or extensive new growth. The roentgen ray offers a more convenient, safer and more accurate method of examination.

Diseases

The best classification is that of Jackson; stenotic and non-stenotic. The stenotic are the acute inflammatory, neoplastic, spastic and compression stenoses. The non-stenotic are diverticula, diffuse dilation, paralysis, inflammation and ulceration. In all these conditions the roentgen examination is the best method for study, with the possible exception of ulceration and inflammation, and in both these diseases the roentgen ray is a valuable aid. It is my purpose in this short article to describe the more common of these diseases.

1. Congenital Malformations—In these the oesophagus is usually seen ending in a blind pouch. They are sometimes connected by a fistula with the trachea. Both conditions cause death early, one by starvation and the other by inhalation pneumonia.

2. Inflammatory Conditions—Caused by chemical agents or infection. Chemical lesions are usually in the upper portion. Infection may be primary in the wall (which is very rare) or extend from a focus outside. The amount of obstruction depends upon the severity of the mechanical injury, or the extent of the inflammation. There is generally dilatation above the stricture. A stricture may come on early or late. The outlet is always at the dependent point. Tuberculosis ulcers may occur as a direct extension from a process outside the tube. Syphlitic ulcers are rare but may occur and result in contractions and obstruction. Aneurysm pressure and foreign bodies are other causes of ulcers. Ulcers are localized by the barium mixture adhering to them as it passes along the oesophagus. History is important in the differential diagnosis.

3. Neoplastic—These are usually carcinomatous and generally of the squamous celled type. Primary carcinoma of the oesophagus forms about 7 per cent of all carcinomata, and in frequency of occurrence among the different organs it occupies fourth or fifth place. It is responsible for about three-quarters of all the stenoses of the oesophagus. It is more common in males, the ratio being about 7 to 1. It is seen most often between the ages of 55 and 65. It is usually primary in the oesophagus, although it may be secondary. Metastases may occur but, because of the poor lymphatic supply of oesophagus or early death of patient, they are not often found. It is usually situated at one of the normal narrowings, and this suggests the possibility of continued irritation being a factor in its development. It is most often found at the cardiac end. Hemorrhage is not a common symptom, either by mouth or rectum. Pain is not a common symptom. History is important. Difficulty in swallowing solids is the first sign noted. Increased salivation also is an early symptom. This is followed by rapid loss of weight and strength. The roentgen picture is quite characteristic. The obstructed area is seen as a ragged, irregular lumen, rigid walled and with only a moderate amount of dilatation above. It always extends higher into the oesophagus than the plate shows, and this infiltration does not permit of much dilatation. Perforation is not uncommon and is usually into the trachea or a bronchus. It is inoperable and death ensues in a few months.

4. Spastic Stenosis — Cardiospasm. An improper name for this condition. The spasm does not occur at the cardia but at the diaphragmatic opening or in the retro-hepatic region of oesophagus. It is generally agreed that there is no sphincter at the cardiac end. It begins as a spasm of the lower end of oesophagus and is believed to be reflex. If the causative factor is not removed

and the spasm persists it results in hypertrophy of the oesophageal musculature at its lower end, dilatation, kinking, tortuosity and sometimes marked obstruction. It is most often seen in early adult life but may rarely be congenital. The vomitus shows undigested food, no blood or gastric elements and long retained food. It is more marked with cold liquids than with hot. The plates reveal it as a blunt or conical obstruction at the diaphragm with secondary dilatation above and long retention of barium. The walls are perfectly smooth and elastic. It may result in very marked dilatation and tortuosity of the entire oesophagus. One case in my series retained 1500 cc. of fluid for several hours. In the early stages it may be relieved by atropine.

5. Compression stenosis and displacements—These may be produced by aneurysm, mediastinal tumors, vertebral disease, cardiac enlargement or aortitis. Thorough examination with the roentgen ray will differentiate all these conditions.

6. Diverticula—These are of two kinds, dependent on the cause, pressure and traction deverticula. The pressure or pulsion type is due to increased pressure within the tube and results in a hernia of the wall. Traction deverticula are due to distortion of the wall from outside influence. The latter type are rare and usually cause no symptoms. The pressure type usually occurs just below the junction of the pharynx and oesophagus, and are generally on the posterior wall, where the musculature is deficient. When the sac is filled it causes pressure on the oesophageal wall and makes swallowing difficult. It is seen on the plates as a distinct pouch, more or less olive shaped, with its opening always at the top. Often a fluid level may be made out. In the act of swallowing, the pouch is seen to contract and eject some of its contents through the opening at the top. They vary from the size of a pea to a large pear.

Other Conditions

7. Fistulae of the oesophagus are usually due to carcinoma but may result from an adjacent tuberculous process breaking through or from a destructive syphilitic condition. We will show such a tubercular process connecting the upper left lobe with the oesophagus.

Foreign Bodies—If not opaque they can be localized by their interfering with the passage of the barium mixture. Very often enough barium adheres to them to outline their structure.

Syphilis—Is seen in two forms, (1) a gummatous condition of the sub-mucosa and degeneration with ulcer, scar and stenosis, (2) a diffuse process encircling entire lumen for several inches with points of partial stenosis. Is much similar on the plate to carcinoma but lacks the characteristics of the latter. In case of doubt the therapeutic test is the best means of diagnosis. We shall show one proven case.

DR. L. T. LE WALD, New York: I am very much interested in Dr. Butler's paper. There are three points in particular. The first is in regard to cardiospasm. It has been my belief that this is congenital. He mentioned that. We have seen three cases in young children along about eight or ten years of age. There was so much dilatation that it would give you the impression that it must have existed for some time previous, though the symptoms were not very evident until that age, eight or ten. I was very much interested to see his case of syphilis of the oesophagus. That is a thing I have been looking for but I have not had an opportunity to have a proven case. We have one case under observation at the present time which may be syphilis of the oesophagus. His case appears to answer all tests and the treatment seems to prove it an authentic case.

DR. G. E. RICHARDS, Toronto, Canada: I enjoyed this paper very much. There are two cases I would like to have much explanation on. I would like to ask Dr. Butler if he would explain to us a little more fully how he tells that he has proven that all the spasm is in the lower end of the oesophagus. The reason I ask this is because it has been my belief that the whole orifice is involved in these cases. We have also believed that more of these cases are reflex spasms or recurrent spasms than has sometimes been considered. In connection with that we have had three cases operated on for duodenal ulcer and one for appendicitis in which the cardiospasm later was entirely relieved. I would like to have more information on that.

The syphilis of the oesophagus is exceptionally interesting. We have one case which gave us an opportunity of observing one of the functions of the bronchus. It was a persistent bronchial fistula due to syphilitic ulceration in which we found the bismuth in both bronchi. I had that patient standing almost on his head for one-half hour to observe whether any drainage occurred out of the bronchus. At the end of one-half hour no drainage occurred and yet when we sent him back to bed he was able to empty the bronchus by the natural effort of coughing.

DR. W. H. STEWART, New York: I have had experience with quite a number of cases of tracheo-oesophageal fistulae, some of the patients retaining the barium or bismuth for a considerable length of time, without any undue discomfort or harmful developments.

We have recently had three cases of malignancy of the oesophagus, high up, involving the epiglottis, in which there was not a perfect closure of the epiglottis. In all three we noted a fistula in some of the branches of the bronchi, the opaque substance being expectorated in each case.

DR. HARRY A. BOWING, Rochester, Minn.: I would like to add another group of cases that are considered inflammatory. I do not know how many we have collected. These are the cases of stenosis following the pernicious vomiting of pregnancy. Just how it happens of course we do not know, but we feel it is due to some break in the mucous membrane of the oesophagus and lower lining by the gastric juice, and later infection, but we found the whole oesophagus much thickened and in some cases it was difficult to get a fine silk thread through. We are able after a while to split a very fine thread and get it through and later we are able to pass a fish line and a little later on it will be dilated.

DR. GEORGE C. CHENE, Detroit, Mich.; I would like to say one word. Dr. Stewart has had a great deal of experience in filling the bronchiectasis, which would lead one to think there is no danger in these cases. I want to report a case of an elderly woman, quite emaciated, who promptly died in the x-ray room when we attempted to give the bismuth.

DR. P. F. BUTLER, Boston, Mass.: (closing discussion): As to the differential diagnosis, I do not believe it can be made by the x-ray between carcinoma and syphilis. In the case in which we made the diagnosis we suspected it because it was not a typical picture of carcinoma. We suggested a Wasserman, and the presence of syphilis was proven by the positive Wasserman and the therapeutic test.

As to spasm occurring at the diaphragm or at the cardia, this was suggested originally to us by Dr. Mosher, who has done so much work on the oesophagus. Following that suggestion we have followed all our oesophageal cases with this point in view. In nearly all our cases the spasm occurred in the oesophagus where it passed through the diaphragm and behind the liver. At the Harvard Medical School Dr. Mosher has a wonderful collection of casts of the oesophagus which he will show to any one who is interested. He has a number of infants with this condition, proving it may be congenital. He has a large number of adult specimens. In all his specimens he has shown that the obstruction occurs at the oesophagus where it passes through the diaphragm. We are satisfied that is where the spasm occurs, both from his data and from the later observations we have made.

***—Read at mid-year meeting of The Radiological Society of North America, held at Boston, June 3 and 4, 1921.**

A Retrospective Note Concerning Treatment of Tonsilitis by X-Ray

H. W. Van Allen, M. D.
Springfield, Mass.

Recognition of the varying action of x-rays upon different tissues is the foundation of modern x-ray therapy. Rays of the same character striking a variety of cells produce in each cell effects peculiar to itself. As a rule, the more embryonic the cell the more readily is it destroyed by radiation. The lymphoid tissue of the tonsil is extremely easily effected and thus our ability to treat through the skin and muscle without effect while the more distant lymphoid tonsil undergoes retrogression.

W. D. Witherbee, reading a paper before a body of roentgenoligists in New York last December, showed the results upon sixty experimental cases of enlarged tonsils treated by x-ray. Extremely careful records were kept; drawings and photographs made. The results seemed excellent and in selected cases it would be a treatment of choice. His closing paragraph was:

> "It must be understood that this paper is only suggestive and that the permanency of the results only time alone will determine."

It occurred to me the effect of such treatment could be proven by work already done sometime in the past. During the past fifteen years many of us have treated large numbers of cases of cervical adenitis. The relation of tonsilar infection to cervical adenitis need not be dwelt upon in this paper, but simply recognized. A study of such cases with reference to the tonsilar condition would be of help and it is for this reason I come before you with this note.

Fifty cases were selected that had been treated more than three years ago; cases were taken that had a history of repeated tonsilitis with chronic enlargement previous to the cervical adenitis for which the treatment was applied. The results of this investigation were very emphatic in showing the beneficial effect upon the tonsils. About 80 per cent of those so investigated had never had another attack and the tonsil had ceased to be an annoyance. They all agreed that the tonsil had been greatly reduced in size. Those having tonsilitis after treatment were acute inflammations with no chronic irritation, as seen previously.

The method of treatment, by chance, corresponds quite closely to that recommended by Witherbee. It has always been fractional and extends away back to the time of the static machine. The dose, however, varied. It was probably much less in those early days when methods of exact measurements were not known. As instruments of precision came to our use I finally came to use 8-inch spark gap, 3mm. aluminum filter, 3½ M. A., 16-inch distance, 20 minutes time. Repeat once a week for about six weeks.

In the study of my cases, I believe a larger proportion of those in the early days showed a permanent cure than the later ones who had more active treatment.

It did not seem practical to inquire about the adenoids as no record was kept of the original condition and the patient's statement might not be reliable.

There seemed to be no permanent effect upon the salivary glands although, as you all know diminished secretion of these glands is noted temporarily by many patients under x-ray treatment of the region under discussion.

In my own cases I have never seen resulting telangiectasis or skin atrophy although I have noted this condition in patients who had received more vigorous radiation.

The foregoing is only a note in regard to tonsilar treatment by x-ray but I believe the deductions, which can probably be duplicated by many men of long experience in radiotherapy, are good and should have a bearing on our present attitude toward this method of treatment.

DR. O. H. McCANDLESS, Kansas City, Mo.: The problem brought out by Dr. Van Allen with regard to treatment of the tonsils is one that we have encountered in our work. So far we have sixty patients treated by this method. The unfortunate part is that we so seldom get tonsil tissue for radiation. There is not enough data in our laboratory to present this method. The retrogression of the tonsil is something we are familiar with. Those of you who have done nose and throat work can give us data that we as roentgenologists cannot give.

The technique used in regard to tonsil culture has been to place a culture from the right tonsil on one side and one from the left on the other, following a definite technique in each individual case. I think many of us are going to make the mistake of taking our tonsilar cultures too soon. I am not going to say whether our tonsilar cultures are going to be valuable. It is possible that some data will be obtained by sterilization of the throat. Second cultures we have not attempted to take until six or eight weeks after the last treatment. We give three treatments of 25 ma. minutes at a distance of 8 to 12 inches. We have had a good many children and a good many adults. I would like to wait a sufficient time after the treatment to get the final findings. I would ask that our results be not taken too soon after the treatment is given.

held at Boston, June 3 and 4, 1921.
***—Read at mid-year meeting of The Radiological Society of North America,**

The Value of Radium and X-Ray Therapy in Hodgkin's Disease

Harry H. Bowing, M. D.
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THE symptoms and course of Hodgkin's disease may be modified favorably by the application of radium and deep x-ray therapy. Many patients with Hodgkin's disease have been successfully treated at the Mayo Clinic with the technique described in this paper. The primary result is of foremost importance in this discussion, since there is not time to present details with regard to the after-result. Reduction in local and distant glandular masses and general systemic improvement are noted in practically all cases, and it is reasonable to conclude that the expectation of life has been increased.

Hodgkin's disease is an infectious granulomatous process involving the lymphadenoid tissue of the body with early enlargement of the cervical glands. The superficial and deep lymphatic enlargements are gradual, progressive, and painless, and produce anemia or are associated with it, hepatauxe, and splenomegaly with or without fever. Death may occur in a few months or the disease may extend over a period of several years.

Etiology

Although the specific etiology of the disease is not known, Trousseau, and Bunting and Yates have demonstrated that focal infection plays a definite part. The origin of the infection may be tonsilar, dental, or in the accessory sinuses. The patient usually volunteers the information that the glandular enlargement followed an attack of influenza, a "head cold", and so forth.

Hodgkin's disease is widespread in the United States and in Europe. There is no special geographic distribution and no race immunity. In a group of 122 cases Bunting has shown that males are twice as susceptible as females. Although it is a disease of youth and early adult life, it may attack persons of any age. With a careful technique diphtheroids may be cultured from the glands. Negri and Mieremet, Bunting and Yates, and Rosenow have isolated these organisms. Inherited tendencies or direct contagion cannot be proved.

Pathology

There is a gradual enlargement of the superficial and deep glands and of many organs containing lymphoid foci. The primary lesion is usually in the cervical glands with extension to the axillary glands on the same side. The opposite cervical, axillary, and inguinal groups of glands are then attacked. Many of the lymphoid foci of the body may also enlarge. The primary lesion may appear in the gastro-intestinal lymphoid apparatus or in the spleen. The glands are encapsulated. They do not metastasize or show any vegetative characteristic, although they have the malignant characteristic of recurring after operation or radium and x-ray treatments.

The glands do not become so enlarged as those seen in cases of lymphocytic leukemia. They are spherical or oval in form and are never fused. The enlargements remain discrete, but may be intimately bound together by a chronic periadenitis, the end process resembling a huge mass. The consistency of the glands varies. The cellular hyperplasia, characteristic of the early stage, shows the glands to be soft but not so medullary as those of leukemia. In the late stage, due to fibrous changes, they become firm and hard.

The predominence of lymphocytic proliferation in the microscopic picture has led most observers to conclude that the process is inflammatory, the result of some irritant. The glandular enlargement, however, may be the result and not the cause of the disease.

The proliferation of the reticulo-endothelial cells and fibroblasts is the most characteristic change in the process. The gland's architecture is lost early. The stimulation is soon followed by a destructive reaction, reducing the number of the lymphocytes in the glands and, as Bunting and Yates have pointed out, in the blood stream. Diffuse sclerosis occurs as a fibroblastic change in the glands, but does not attack the capsule as in nonspecific chronic lymphadenitis.

The most important single feature in the microscopic pathology is the atypical proliferation of endothelial cells leading to giant cell formation. The cells are present in all cases but vary in number. If the lesions progress, sclerosis increases and the gland is gradually replaced by dense fibrous tissue.

Blackford's summary is similar to that of Dorothy Ried; proliferation of large endothelioid cells; production of numerous multinucleated giant cells; progressive fibrosis, and abundance of eosinophilic cells.

Symptoms

For therapeutic purposes the cases may be divided into two groups; the acute and the chronic. The acute condition is characterized by very rapid progression of all the features of the disease and is usually associated with intermittent fever. If fever is present, it is moderate, whether or not the glandular enlargement is marked, and lasts for from ten to fifteen days. Glandular swelling is usually the first sign, although recently the patient may not have felt as well as usual. Malaise and weakness are more or less constant. Periods of increase in glandular swelling alternate with periods of remission and the patient usually feels improved. The glandular swelling is painless, beginning in the cervical group with extension to the axillary, inguinal, and later to the mediastinal or abdominal lymphatics. One or more cervical glands on one side of the neck are usually affected first; later the growth extends in the same group and then into the opposite cervical group.

Many clinicians believe that superficial glandular enlargement is associated with a similar enlargement of all the lymphoid foci, including the lungs, spleen, and liver. Anemia is usually moderate and steadily progressive, although seldom extreme. The huge glandular enlargements may produce edema, and difficult motion of the head, arms, and legs. An intense generalized pruritus may be present. The acute condition seldom becomes chronic; it extends over a period of a few months, terminating in death.

Chronic Hodgkin's disease is similar to the acute condition except that it varies in intensity and duration. Pressure symptoms from involvement of the deeper group of lymphatics occurs usually in the late stage. The bronchial and mediastinal glandular enlargements cause an irritative productive cough, pains in the chest, intense dyspnea, dysphagia and cardiac embarrassment, with enlargement of the superficial veins of the anterior chest wall.

The abdominal enlargement may be primary and associated with jaundice and edema. The pain is usually a dull ache in the lumbar region, occasionally across the lower abdomen, and may be referred down the legs. The anemia increases steadily, although remissions are common. Malnutrition may be present. Fever, which is variable, is usually moderate and resembles that of pulmonary tuberculosis. The disease is usually a termination of intercurrent infection, acute tuberculosis, anemia, and so forth, or of a general decline resembling toxemia. There are many variations in these groups, the controlling features of which are unknown. The portal of entry and personal resistance probably play an important part. Many cutaneous lesions resembling inflammatory processes have been reported and described as definite nodules of Hodgkin's type and similar to the nodules of leukemia. The pruritus is usually generalized, intolerable, and resistent to ordinary treatment. The blood changes are not constant.

Differential Diagnosis

Hodgkin's disease, lymphosarcoma, tuberculous adenitis, and pseudoleukemia have certain symptoms and signs in common, although each has a distinct clinical course, and pathologic picture. The differential clinical diagnosis in early Hodgkin's disease, lymphosarcoma, and tuberculous adenitis is difficult and almost impossible. The blood picture of leukemia gives a clue to this condition. The process in Hodgin's disease is slower than in sarcoma and usually occurs before the age of 35. In early cases of lymphosarcoma a differential diagnosis is impossible, although the condition usually occurs after the age of 35. Extraglandular infiltration of the surrounding tissue with fixation of the mass is usually present. Tuberculous adenitis is considered a disease of youth. Diagnosis in the early cases is very difficult, although, if the condition progresses, there may be an associated extensive softening and caseation.

In pseudoleukemia the glandular enlargements are more widespread and are usually soft and medullary. The blood picture serves as a basis for the diagnosis. Radical surgical treatment of Hodgin's disease may be considered, although an isolated gland should be excised and submitted to pathologic examination.

Prognosis

In untreated cases of Hodgkin's disease, the acute condition is fatal within a few months, while the chronic phase may endure for from two to five years. The condition is uniformly progressive with latent periods and an associated feeling of good health. There are no reported cases of spontaneous recoveries.

Radium Technique

One thousand milligram hours of radium are delivered to areas of skin each 3 cm. by 4 cm. covering the involved glands. The number of areas is dependent on the amount of involvement. Fifty or 100 milligram doses of radium salt or emanation are contained either in a universal tube applicator, with silver walls 0.5 mm. thick, or in a brass capsule of equal density. The radium is maintained 2.5 cm. from the skin, being filtered through the wall of the applicator and 2 mm. of lead. The duration of radiation is twenty and ten hours, respectively, for the silver and brass applicators. To maintain distance, guaze or wood (Balza) has been used. This wood has been used satisfactorily at the Mayo Clinic for the past two years, as it is light, soft, and inexpensive. A disk of lead 3 cm. by 4 cm. and 2 mm. thick is placed on the top of the radium applicator to complete the package. Adhesive plaster is used to strap the parts of the block together and to fix it to the patient.

If the top surface of the applicator should come within 2 cm. or 3 cm. of the adjacent skin surface, it is thoroughly protected with a sheet of lead 1 mm. thick. Interposed between the lead and the surface of the skin is a sheet of rubber 1 mm. thick which absorbs the soft secondaries from the lead sheet; this extends 1 cm. beyond the edges of the sheet of lead (Fig. 1).

Treatment

From 5,000 to 6,000 mg. hours of radium are applied to each right and left cervical and to supraclavicular areas, from 2,000 to 3,000 to the infraclavicular and inguinal areas, and from 1,000 to 3,000 to the axillary areas. Any palpable abdominal glandular enlargement is blocked off in a manner similar to that described for the cervical area. Mild reactions such as malaise, anorexia, nausea, and occasional vomiting, are usually disregarded; severe reactions are avoided. Should a severe reaction occur, the radium treatment is usually abandoned for a period of from two to three days or until the patient returns to a satisfactory condition. The fluid intake and elimination are usually encouraged and soda bicarbonate is given in dram doses three times a day.

Two to four areas are usually radiated at one time with an interval of two or three days between treatments. A mild or intense erythema may occur after the last application or two or three weeks later. It yields readily to ordinary treatment and lasts for from three to ten days. The part should be kept dry and dusted freely with a good grade of bland impalpable dusting powder. No secondary skin changes are noted, although the natural skin pigments may be increased; this does not necessarily follow an erythema.

X-Ray Technique

Formerly many patients with Hodgkin's disease at the Mayo Clinic were treated by the formula as follows: A broad focus Coolidge tube, a 23.7 cm. parallel spark gap, skin target 22.8 cm. distance, time six and one-half minutes, 5 ma. of current, filtration 3 cm. of aluminum, and a piece of sole leather. Multiple portals of entry varying in size were used. Treatments were repeated at intervals of three weeks until a series of six or eight had been given. In our present formula the distance has been increased to 30.5 cm. from the skin, time twelve minutes, filtration 6 mm. of aluminum, and a piece of sole leather. The number of portals of entry is limited. One area of both the right and left cervical regions is exposed. The chest is equally spaced in four squares;

the size of the opening depends on the size of the chest wall. One area in both the right and left axilla and one area both in the right and left inguinal glands are exposed. The back is divided into eight areas. The upper and lower limits are marked, respectively, by transverse lines at the level of the seventh cervical vertebra and gluteal fold of the buttock. Treatments are repeated every three weeks until a series of six or eight have been given; an interval of three months is allowed to determine whether or not further therapy is indicated.

The x-ray treatments are usually given at the beginning or at the end of the radium exposures. Irradiation of the anterior abdominal wall is avoided, since it may result in very severe reactions, which resemble peritonitis, with marked distention of the abdomen and ileus, associated with abdominal pain. There are frequent foul smelling, greenish stools. Convalescence extends over a period of six to ten weeks. Mild reactions similar to those following radium applications may occur from x-ray exposures of the chest and back.

The two great body cavities and all possible superficial glandular enlargements should be treated with the x-ray at the onset of the disease in order to ward off the impending mediastinal and abdominal enlargements, if possible. The initial good results of radium and x-ray therapy may be due to the direct destructive effects on the glandular enlargements characteristically composed of an abundance of nuclear substance, lymphoid elements, endothelial cells, and so forth. The large glandular endothelial cells are very susceptible to radiation. Fibrosis, which is nature's method of recovery, is set up by radium and the x-ray.

Treatment should be instituted as soon as possible. The anemia should be treated with the ordinary therapeutic agents and all possible foci of infection removed. If the anemia is steadily progressive, radium and x-ray treatments should not be given too intensively because of the destructive effect of irradiation. Vaccine and serums are of doubtful value.

Conclusions

In early cases of glandular enlargement, an isolated gland should be removed for examination by a pathologist. The life expectancy of the patient should be increased by intensive radium treatment of the superficial glandular enlargements and deep x-ray therapy of the thoracic and abdominal cavities whether or not the roentgenograms are positive. Huge glandular enlargement and mediastinal involvement are markedly diminished. The generalized pruritus may diminish and in some cases may entirely disappear.

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Radiation in the Treatment of Leukemia

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THE average medical practitioner, whether engaged in general medical work or in the practice of any other specialty besides that of pure radiology, has neither the time nor the opportunity to keep informed concerning the various intricate steps and changes that have followed the development of radiotherapy. This accounts in no small measure for the opinion frequently expressed that radiation is unsuited for general therapy. A comparatively few broad-visioned medical men, who have laboriously followed the development of this science, and who by their carefully weighed experimental researches have begun to tabulate their findings, have become convinced that radiation is a force capable of ascertaining a profound influence on human tissues and that this influence can be brought to bear upon pathologic processes in a manner that so far has not been approached by any other remedial agent. To these men it is apparent that radiation has possibilities that are practically unlimited. This does not mean that our present day conception of radioactivity and radiotherapy will not undergo revolutionary changes, the future evolution of which we are as yet wholly unable to foretell.

After reviewing the different therapeutic measures introduced and used in the past decade to combat the various types of leukemia, the writer is convinced that radiation in the form of x-rays and radium has proved itself to be the most serviceable from a symtomatic standpoint. From a curative standpoint, it does not appear that we have, so far, any permanent foundation upon which to lay definite claims. Yet it must be remembered that we are still in the primary class in dealing with radiation. Although x-ray apparatus is now used in every civilized community, very little of the work can be considered as having passed the experimental stage.

The two distinct types of leukemia with which we are familiar are the splenomedullary or myologenous, and the lymphatic. Not infrequently a combination of these types may be seen. In the writer's own experience the myologenous type has outnumbered the lymphatic variety two to one. In the days before blood examinations became a routine measure, these patients were subjected to x-ray in an altogether unscientific and empirical manner. If the rays were of the proper quality to affect the blood forming organs, the symptomatology of the case under treatment would rapidly change. If the rays were not the proper kind, naturally no results were obtained. In more recent years, as the result of a wider knowledge of radioactivity, and a better realization of the value of frequent blood examinations, a more orderly technique was obtained, and radiation began to show more definite results. By the changes in the blood picture, we began to understand the rationale of exposing the bone marrow of the extremities in certain cases, and the spleen and lymphatic gland areas in other cases, until today we have a well regulated and fairly scientific basis for our work.

The technique varies necessarily with the symptomatology of every case. Our aim, of course, is to diminish as rapidly as possible the pathologic activity of an accentuated leukocyte total. It is of the utmost importance, however, in accomplishing this end to watch the behavior of the red blood corpuscles and the hemoglobin. Radiation can easily be carried to the point of a destruction of the red corpuscles and a lowering of the hemoglobin percentage, doing the patient more injury than the presence of a fairly large white cell body. Proper judgment must be exercised in dealing with such a condition.

It is astonishing to note certain instances in which a spleen large enough to fill the entire abdominal cavity has been reduced within two or three weeks time to a normal size. It is, in such cases especially, that the most careful watch must be kept over the condition to avoid a serious toxemia. Again, in some cases of the Hodgkin's type, glands of enormous size that are visible to the point of distorting the features of the individual, may disappear in a most remarkable manner. It is no uncommon occurrence to have mesentery glands of enormous size and cervical glands correspondingly large melt away with almost unbelievable rapidity.

In the face of such ocular evidence of the action of radiation, it would seem an easy matter to predict an early cure of these cases. Unfortunately, the test of time has shown us that these immediate results are neither permanent nor curative, that in spite of subsequent radiation, there is a gradual enlargement of the affected organs and glands, and that eventually there comes a time when radiation fails in every way to prevent a fatal termination. A recent case will serve as an illustration. This was one of the Hodgkin's type that showed a marked reduction of glands under a course of radiation, with an improved blood picture. The improvement was so satisfactory that we felt that we were justified in a hopeful outlook. The patient returned in three months with no enlargement of the glands but with a typical malignant appearance, which showed no improvement in spite of additional radiation and careful supplemental treatment, and the patient rapidly succumbed.

This does not mean, however, that we have reached the end in the development of our resources. In the past ten years, there have occurred in the writer's own practice a number of striking illustrations of beneficial results that would justify a most hopeful attitude. We have one male patient, of fifty-five, who comes from the East every winter and is under radiation in our office for two months every season. Five years ago his white blood count was sixty thousand leukocytes, red blood cells four million; his muscular tone was poor, but he was well nourished. During the first two years, his white count ran down to thirty thousand, his red count was about four million five hundred thousand, his general condition was static. In the past two years, his white count ran between twenty and twenty-five thousand, his red count a little over four million five hundred thousand. His muscular tone is somewhat better, his general condition more alert, and he maintains an even weight. His condition is on the whole considerably better than it was five years ago. We have another patient, a woman about forty-five, who had a leukocyte count of two hundred thousand. This patient was reeamined in the first part of the present year, and found with a leukocyte of eighty thousand and a chain of symptoms of alarming significance. This time the x-ray was employed, and in a few weeks the white count was down to ten thousand with a normal red count and the patient seems at present in good health. If we continue in the next ten years to make the same progress as in the past ten, there can be no question, at least in the mind of the writer, that we shall eventually find a solution of many present difficult problems.

One phase of the subject that is of importance is the possible correlation between lymphatic leukemia and adenosarcoma. In some of these conditions, the blood picture may be so atypical as to challenge the best diagnostic skill. It has seemed to the writer that a case that at the outset is diagnosed as a typical Hodgkin's disease may develop rapidly into a case bearing every clinical resemblance to a sarcoma of gross malignancy. Age seems to have considerable bearing on the effect of radiation. The earlier in life leukemia develops, the more rapidly fatal it appears to be. In patients of advanced years, it seems that radiation maintains a retarding influence on the progress of the disease, better than in younger individuals.

The effects of radiation from x-rays and radium are apparently alike. If radium is used, a sufficient amount must be employed to insure deep effects. The writer frequently employs radium over the spleen, and x-radiation over the osseous structures and glandular fields. The writer has one woman patient, with whom he has been in personal touch for eight years, in whose case the blood pathology has been held in check by periodic courses of radiation. It is difficult to lay down any stringent rules. Much depends upon the blood condition in determining whether to make a rapid attack over every available area and quickly get the condition under control, with a possible danger of lowering the patient's resistance, or to take the more conservative method of a gradual destruction of the pathological processes by a more graudated and a smaller radiation amount.

The technique for radium over the spleen that we ordinarily employ is as follows: The area is divided off into squares, eight centimeters in diameter. One hundred milligrams radium element, with one-half millimeter of silver, one millimeter brass, and two millimeters hard rubber filter, are placed in a wooden block, the whole wrapped in guaze, making a skin distance of three centimeters when applied. A total of fifteen hundred milligram hours is applied to each of the eight centimeter squares. At the end of this series, a blood count is made, and upon the findings thus obtained, additional treatment is regulated to suit the individual patient. We have not found it necessary to use radium over the bones.

The technique for the x-ray to the spleen, making use of the same eight centimeter squares, is as follows: Each area receives fifty milliampere minutes according to this formula: Voltage one hundred thousand with its equivalent ten-inch back up, aluminum filter four millimeters thick, cotton pad one-half inch thick, five milliamperes on tube circuit, ten minutes time, and eight-inch skin distance. When this series has been completed, the blood picture is analyzed, and the same procedure as with radium is followed.

Over the long bones, the eight centimeter spaces are again followed with a difference in the formula; only three millimeters of aluminum filter are used and seven minutes time given, making a dosage of thirty-five milliampere minutes. The radiation is administered to as many approachable bone areas as are necessary, all the work being controlled by a blood count. It is of the utmost importance to radiate thoroughly the inguinal and axillary regions, whether or not any palpable gland chains are present.

In leukemia as in other conditions, no machine made rules can apply. It is extremely important to view the patient from every clinical angle, and make use of radiation in a manner that will best serve the conditions under treatment. It is my rule to discuss the condition quite frankly with the patient, and to prepare him for periodic courses of treatment. It is, of course, not necessary to dilate unnecessarily upon the temporary benefits of the treatment, for there may ensue a better end result than we anticipate from past experience.

It does not seem unreasonable to assume that when we shall have become more familiar with the currents of high tension that will soon be supplied to the radiologist, a more exact method and dosage will be produced, which will enable us to be more specific in our therapeutic treatment of leukemia cases.

DR. TRUMAN ABBE, Washington, D. C.: I would like to ask Dr. Soiland whether he has had any opportunity to compare the results he has obtained in these leukemia cases with the reports of one or two cases reported by Dr. De Grais, of Paris, in radium treatment after splenectomy. A patient with leukemia on whom splenectomy had been done was subsequently treated with radium over the splenic area just as though the spleen were still present. The results after the treatment in those one or two cases were the same blood changes as were found in patients similarly treated when the spleen had not been removed. We recognize that there were two factors in common that might have modified the blood pictures: One the irregular changes in the course of the disease and the other the radiation of the bone marrow of the ribs or possibly of some other tissue. I would like to ask whether Dr. Soiland could help us interpret the results in these cases of radiation after splenectomy.

Another question in connection with the size of the area treated as compared with the physiologic effect. Dr. Howard of the Radium Institute of London has repeatedly made the comment that the physiological effect is dependent not only on the strength of the applicator but also on its surface area. For example the reaction after the use of a half strength applicator for one hour over six square centimeters is practically equal to that from a quarter strength applicator for one hour over sixteen square centimeters whereas we should expect but half the effect in the larger area since the milligram hours are only one-half those in the smaller area. If this is corroborated there may be a marked modification of dosage calculation for all large areas. I wonder whether Dr. Soiland has had a chance to take up the question of comparative effect of the size of area and the physiologic effect?

DR. GEORGE E. PFAHLER, Philadelphia: This is a very interesting subject. I would like to ask a few questions. I would like to ask Dr. Bowing how long his longest patient has remained well; how soon he has found recurrence; what has he done for the recurrence? We have all gone through the experience of getting the most beautiful results in Hodgkin's disease and leukemia and sooner or later meeting with as equally disappointing results and failures from any effect of radiation. I think every one of us has seen great masses of Hodgkin's diseases disappear completely as far as we can tell from palpation or from x-ray examination and yet we get recurrences and the patient ultimately dies. Generally, it seems to me, they die in about three years. I have one patient who is alive and apparently well at the end of eight years. That is the longest I have seen. Dr. Holtz, of Grand Rapids, showed a case at the Chicago meeting six years ago that had been well eight years. That was the longest case that anybody within conversation distance had known of to be permanently well.

Now the question comes up, how can we get rid of these great masses of malignant tissue and how are we to prevent them from coming back; how are we going to get the patient completely well? What observations are you making or what shall you use to guide you in making the exposures? We cannot go on treating a patient forever just because he has had Hodgkin's disease. When shoud we stop and when should we begin again? How shall we answer that? Is there anybody who can answer that? I have these patients come back when they are well at least once in three months for careful observation. If there is the slightest sign of recurrence I treat them and treat them very actively. I think we should not confine our treatment to the areas we can palpate but should go beyond that. I have had a few cases in which I got rid of everything in the avilla and chest and at the time I was treating the patient I could not find anything in the abdomen and later the patient would turn up with a metastasis in the abdomen and would die. Just last week I saw a patient who was treated a year ago with large doses of x-ray and at the same time the internist used Coley's serum. It seemed foolish to add any devitalizing effect to the blood by using x-ray, so we stopped the x-ray. Later the patient was sent to the surgical department of another hospital for the removal of a large kidney. The surgeon recognized this as a part of the Hodgkin's disease and sent him to the x-ray department of that particular hospital. That patient came in the other day nearly well as a result of the x-ray treatment. You could not feel the abdominal glands. Most of these cases are very well nourished and abdominal masses are hard to palpate.

These same remarks can apply just as well to the leukemias. As to when we shall stop treatment, and when we shall begin treatment again. In treating the spleen I have not been able to see why there should be any reasonable advantage of radium over x-ray. Personally I divide the spleen into three areas, front, back and side, and in that way I am getting as much cross-fire effect as possible. I have treated quite a number of myelogenous leukemias in that way. Theoretically I think it is correct to treat the long bones, but I have not seen any better results than when the spleen alone is treated.

DR. L. A. SANTE, St. Louis, Mo.: I would like to ask Dr. Soiland whether he had any result in treating leukemias with intravenous injections of radium solid deposit? Three years ago at the Atlantic City meeting I heard Dr. Janeway give a discussion on three cases treated in that way. In the three cases the blood picture returned to normal and has remained so. One case had been well one year anad the other two years. At the time it seemed to me that this was the nearest approach to a cure that nad been attained in any other manner.

DR. BYRON C. DARLING, New York City: In regard to the treatment of leukemia, I had a case of myelogenous leukemia which I would like to report. This man came to Bellevue Hospital in 1910 with 73,600 white cells and 31 per cent myelocytes in the blood. That was in 1910 after Pancoast and Stengel published their work onthis subject. Following them I treated him over the long bones and got no result, but after I treated him over his spleen I got so much response that I stopped the treatment for a time. His improvement kept on with treatments, guided by blood counts from time to time.

In the next year he had his abscessed teeth extracted and an occasional treatment until his white cells at the end of the year went down to 12,000 and myelocytes to 1 per cent and nothing after several examinations over several months. Then when he began to complain of a staggering gait I sent him to a neurologist who found that he had a 4 plus Wasserman and treated him with salvarsan.

During the treatments his large spleen receded gradually from low in the abdomen to beneath the costal region. I instructed him to keep in touch with me and he did so for some years, taking an occasional treatment as his myelocytes showed a tendency to increase, each treatment being followed by improvement until in 1920 I heard that he had died with no cause given. He had lived over 10 years after the diagnosis was made and had had several years of previous history besides. I feel that since he was an intelligent man, if he had suspected a recurrence, he would have come to see me. He may have died from some other disease. At least he symptomatically recovered and lived ten years, showing at times a normal blood count, always directly the result of treatment. There was nothing to indicate remissions of the disease independent of the x-ray treatment.

DR. G. W. HOLMES, Boston, Mass.: I did not hear Dr. Bowing's paper, so I cannot discuss it. I am very much interested in the subject, however. We had an opportunity to observe quite a number of cases over a considerable period of time. We have also seen a few cases in which radium was employed. As Dr. Pfahler said, there are no permanent cures. About four years ago the reports from the Huntington Hosptal of cases in which radium was applied over the spleen was published. At present they are using x-ray as well as radium. They feel they are getting better relief and some of them stay well for a number of years under constant observation. When we began to treat these cases we rayed just the visible glands. The glands disapeared rapidly and then would come back in some other place. Later we rayed the chest in addition and prevented the accumulation of fluid. Our early cases died with fluid in the chest. When we began to ray the chest this did not occur, but they died with fluid in the abdomen, and, when we rayed the abdomen they died with no fluid. They died anyway. I believe as soon as we get a case we should ray all the glandular distribution in the body. Let them come back every three months for observation. When you see signs of recurrence, ray them again and do not be content with raying just the glands in the neck. We have found it of some value to have the blood examined. The character of the blood has helped us some in determining how far we can go with the treatment. I think any one who has done much deep therapy has noted changes in the white count. When the white count goes down to 3,000 it is time to stop and when the mononuclear lymphocytes are increasing it is a good idea to start again even though you do not see any glands. I have seen a case gradually losing ground without glandular enlargement in the chest or elsewhere. You notice as they come into the office that they have no "pep," they act sleepy. When you see these changes you know it is about over. One fellow who acted in this way was given a blood transfusion and he is alive today, but I think he is getting into the same stage again. I do not know whether or not blood transfusions do any good.

I never have any particular help from raying the long bones either in Hodgkin's disease or in leukemia. I think if you are going to ray the long bones you had better use radium. With the penetration we can use I have an idea that we do not knock out the bone marrow very much. I do not think it is necessary to get any burns. Our Hodgkin cases respond very rapidly.

DR. G. E. RICHARDS, Toronto, Canada: I would like to ask Dr. Bowing if he has felt that there is any real advantage in having circulating in the blood stream any of the metallic or other substances which are supposed to produce secondary rays at the time of radiation either by radium or x-ray. We ran a series of parallel cases some three years on the splenic medullary type and we thought we got better results when arsenic was circulating in the blood during the administration of the treatment, where the treatment was being done by x-ray. I would like to know if there is any other information and if it is right or if it is a fallacy?

This subject is one of great interest to me and I hope there will be one or two who might remember that I read a paper before this Society last fall on the subject. At that time we reported the results in twenty-three cases. The oldest living case, I think, is six years. I know we have a case of Hodgkin's disease which has been under my care for six years and we have several which have been under constant observation for periods over four years and a fair number running down from that to the more immediate present. While we believe that these people are cured, I think we can say, and I think we ought to say to the profession in general that there is no other known means of therapeutic handling of these cases that is so satisfactory or offers so much to the patient. It may be a symptomatic cure, but if I were up against Hodgkin's disease or splenic leukemia, I would look upon that extra five years as being something of very great value to me.

DR. HARRY H. BOWING, Rochester, Minn. (closing his part of the discussion): Dr. Holmes summarizes the situation and probably has answered many of Dr. Pfahler's questions. Several years ago when radium was applied for this condition at the Clinic, very small doses were given. For example, fifty milligrams of radium sulphate were applied and left in positon for from two to four hours, and with this small amount of treatment, favorable results were obtained, but remissions and chest and abdominal glandular enlargements occurred. X-ray treatment of the large body cavities was not considered at all. At this time we anticipate that with intensive radium and x-ray treatments from the very beginning in spite of negative x-ray plates, and negative physical examinations, except for the superficial glandular enlargements, we hope to accomplish more lasting results. In this way we are treating as Dr. Holmes pointed out, all the lymphoid tissues of the body, because there is a great chance that the superficial glandular enlargements are only a local manifestation of a general lymphoid hyperplasia. It has been my privilege to treat cases with intensive general toxic pruritus and as their general condition improved, the pruritus disappeared. We will add months and in some cases years, to their lives by this type of therapy, and markedly advanced cases will be made more comfortable.

Dr. Pfahler asks how long shall he carry on the treatment. Radium should be applied to the superficial glandular enlargements as long as they remain active, treatment being given at intervals of six to eight weeks, and x-ray treatments applied to the body cavities at intervals of three to four weeks until a series of six or eight of the latter have been given. Then a rest of two or three months to determine if further treatment is indicated.

As to the metallic substances circulating in the blood stream during irradiation treatment with the formation of secondary therapeutic rays, I believe it is physiologically impossible to get metallic particles to remain in the blood stream. They are almost instantly removed by the liver following their introduction into a blood vessel. Kendall has shown that many iodin compounds injected into the blood stream are immediately deposited in the liver. In cases of advanced carcinoma of the stomach, bismuth meals have been given with the hope of producing secondary therapeutic rays, but it has been abandoned.

I am greatly interested in the therapy in cases of leukemia as reported by Dr. Soiland. Our treatment of such cases is a little different. We do not treat any of the long bones with x-ray since we feel that there is little accomplishment as Dr. Holmes pointed out in his discussion. The usual application of fifty milligrams. We are of the opinion that the blood picture of patients treated with radium can be better controlled. Given a case of acute lymphatic or splenomyelognous leukemia; we usually apply larger doses of radium in an attempt to make the case a chronic type. The usual application in the chronic type is fifty milligrams of radium sulphate or the emanation contained in a universal silver tube applicator wall. 5 millimeters in thickness filtered through two millimeters of lead at 2.5 millimeters distance. In the lymphatic leukemia eight areas are mapped out, selecting the largest lymph glands. The duration of application is three hours to each area. In the splenomyelogenous type the radium is applied in a similar manner and four to six areas are mapped out in the area of the splenic enlargement. The duration of application is from four to six hours each. At the end of four or five days following the treatment, a blood count is made. Should the hemoglobin and red cells diminish in number, the treatment should be stopped for a period of six weeks. Should the white cells alone diminish in number, four applications at weekly intervals are outlined; then a rest of six to eight weeks to determine if further therapy should be considered. The usual medicinal remedies are given to combat the anemia. I do not know of another disease that comes under the observation of the radiologist which demands a closer coöperation of radiologist and clinician. The blood picture and general condition of the patient should be passed upon before each application of radium.

Regarding splenectomy in these cases, it has been my privilege to radiate the splenic tumor with marked reduction in size, affording its removal. Dr. W. J. Mayo and Dr. H. Z. Giffin have recently reported these cases.

DR. ALBERT SOILAND, Los Angeles, Cal. (closing his part of the discussion): Unfortunately I was unable to be present for Dr. Bowing's paper. There is today less room for argument between x-ray and radium radiation. It does not make any particular difference which one you use, provided you supply sufficient energy of radiation from either source. You can use them both together or each one alone. There is just this one difference, that radium is more strictly a local agent. If you want to get a local action over the glands or on the spleen, you can get it a little quicker with radium than with x-ray. I do not lay down a hard and fast technique except in a general way, because you have to treat every case individually. As a rule, we do not get leukemia cases until they have been through the hands of many medical men, and they have ordinarily had every form of treatment. All that remains then is radiation. In regard to the blood examination, this is always necessary. It is more important to maintain a good hemoglobin and red count than to lower the white count beyond a certain point. I have had no experience with post-operative cases of leukemia.

***—Read at mid-year meeting of The Radiological Society of North America, held at Boston, June 3 and 4, 1921.**

Determination of Dental Focal Infections by Means of the Radiogram

Maximilian John Hubeny, M. D.
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THE incentive for this discourse is to correct a very prevalent and almost universally accepted premise, that the radiogram is incontrovertible, prima facie evidence of the absence or presence of dental focal infection.

Epochal periods take place in medicine as well as in other fields of endeavor. It is the sincere conviction of the writer, that the appreciation of the potency or the actuality of dental infections as the causative or contributory factors of disease processes, marks a new era of such moment that it is second to no other discovery in the domain of medicine.

Generally speaking, three factors are the chief causes of disease; namely, disturbances of metabolism, trauma and infections. These may exist separately or in various combinations and sequences.

Traumatic conditions give a very evident etiology, but the cause or causes of metabolic or infectious diseases are not so easily recognized.

In 1683 Leeuwenhoek announced the discovery of spermatazoids, yeast cells and certain large bacteria. Plenciz of Vienna, was so favorably impressed with Leeuenhoek's work that in 1762 he announced the results of his researches, stating that each disease is caused by a special organism, that decomposition is caused by micro-organisms and that bacteria can grow in living tissue.

This, most naturally, was of tremendous importance. Subsequently Oliver Wendell Holmes in the year 1843 published his famous essay on the "Contagiousness of Puerperal Fever"; in 1847 Semmelweiss maintained the same theory.

The first definite knowledge of bacteria and their products came from a chemist and not a physician, and dates from the study of fermentation by the illustrious Frenchman, Pasteur.

Before his day, bacteria were known, theories of infections had been elaborated and vaccination practiced, but he definitely established the importance of bacteria in putrefaction, fermentation, and disease, and gave to vaccination a scientific basis.

The views of Pasteur, which were radical departures from accepted belief, inaugurated a bitter controversy, and in that controversy were born the microbic theory of disease, the doctrine of preventive inoculation, antiseptic surgery and serum therapy.

Since then, considerable knowledge has been added to bacteriology, serology and immunology. Asepsis and antisepsis, for which Lister deserves great commendation, were developed on the predication of infection.

It appears then, that prophylactic medicine was to be and now is, the most auspicious procedure for the preservation of human life and abolition of much illness and discomfort. This formula naturally requires donors and recipients, the latter representing the patients, the former the physicians and dentists.

Great difficulty is encountered in persuading the acceptance of ideas that appear radical and re-education, which is sometimes slow and tedious is not productive of the results consistent with the exigencies of the ever present end results of invalidism or death.

Medicine is so manifestly empirical, that in the attainment of a diagnosis, conservatism, a postulation, so often used to cover up ignorance and procrastination, is advised and practiced, often terminating seriously.

There are three factors that have a direct bearing on any infective process; firstly, high virulence of the infecting organism; secondly, degree of resistance of the individual, viz: immunity; thirdly, inoculation with an unusually large number of bacteria, which if introduced in large numbers overwhelm the protective elements of the body.

To anticipate eventualities or to practice conservatism the afore mentioned factors should be known; however, there is no method, now known, which can be applied to predetermine these factors before extracting the tooth or teeth that might be producing infection.

Unfortunately it often happens that little or no pain exists in the neighborhood of the pathologic teeth and because of this a sense of false security is entertained by the physician, dentist and patient; how fallacious this is, one can readily understand by calling to mind, such diseases as leukemia, pernicious anemia, sarcomata, tuberculosis, etc., where pain is practically absent and still the termination is fatal.

One often hears the argument advanced that the patient does not get well or improve after extraction; the solution of this can be found by considering the possibility of metastasis, or metabolic disturbances, because of toxin absorption or presence of other sources of infection than dental or a combination of these conditions.

The metastatic action of malignancies is always considered rather gravely, and something to be completely avoided, while metastatic involvements of infectious origin are too often disregarded, with the consequences that convalescence may be retarded, prolonged or wholly unsatisfactory. Furthermore resolution from a disease process depends to a great extent on the nature of the organism and the duration of the illness. It therefore appears reasonable that the earlier a focus of infection is removed the more rapid the convalescence.

The works of Rosenow, Duke, Head, Roose, Dively, Novitsky, Brown and Irons, have definitely established the presence of infection in teeth; their deductions were based on bacteriological, pathological, roentgenological and clinical observations.

Rosenow's work was done in conformity with Koch's law and was ultra scientific; however, it is unfortunate, that much of the practice of medicine is empirical and the end result is the deciding factor in judging values.

Consequently, the writer was impressed by clinical experiences, of the necessity of assisting in disproving of assisting in disproving some accepted notions based on the findings of the radiogram.

The radiogram records variations in densities, these apparent variations should describe bony and dental structures, some of the latter, viz: the peridental space, by indirect signs only.

Considering the behavior of bone in general, as observed roentgenologically, it appears to be a structure of very limited reaction to pathologic conditions. From this viewpoint, there seem to be only three reactions possible. First, atrophy or diminution of lime content; second, destruction of bone tissue, local or general; third, formative processes, characterized by formation of new bone or a condensation of existing bone around a focus of disease.

At the present time it is quite generally agreed that if a destructive area is observed around a tooth, that tooth should be extracted.

However, we have still under dispute, first, those teeth in which a peri-apical decalcification exists, regardless how minute; second, those areas containing formative bone.

The areas of decalcification have in the writer's experience, been more prolific sources of disseminating disease than those in infective processes attended by osteoplastic formation. The osteoplastic formation is the effort of the local bone structure towards localizing the disease, indicating a good immunizing tendency, and probably suggesting a low virulence of the infecting organism, and also an infection of long standing.

In peri-apical rarefactions the following impressions are perceived: First, relatively acute process; second, possibly a virulent organism, in large numbers; third, poor local resistance. In either case, extraction is advised.

A more contentious matter is, what shal be done with teeth that are well filled and have no roentgenological evidences of pathology? By all means, if the patient is sick and no other possible source of infection can be found, extract the tooth. This comes under the incongruous head of conservatism. Conservatism, because if we do otherwise, we are open to censure; but, the censure should be placed where it rightfully belongs, that is, on the patients.

Why should they approach the dental profession with foci of infection and expect the resurrection of dead structures?

As medical men we do not attempt to replace diseased organs by new ones, neither do we permit a pus appendix to remain. Why should the super-natural be expected from the dentist?

The lay people must be edu cated to visit the dentist early and often to prevent organic decay and it is then that the full value of prophylaxis will exist. Heretofore, the dental and medical professions have borne the responsibilities that the patients should have borne and by common accord the patients should be made to feel that the responsibility is wholly theirs.

In some cases the radiogram may reveal a change in the normal appearance of peri-dental space, this may be accompanied by a localized decalcifying or osteoplastic process and need not necessarily be apical. In such cases extraction is again advised. In the acute or fulminating types of infection, the x-ray is quite valueless, unless some antecedent process such as alveolar absorption in the immediate vicinity, is evident, from which reasonable deductions might be made.

With reference to alveolar absorption, a survey should be made as to the depth of absorption, number of tooth areas involved, acuteness and activity. If a single area is involved, the amount of absorption small and the progress slow, treatment might be tried; however, continued observation is necessary and if the process is progressive, extraction is advisable, to prevent if possible, an extension by continuity of structrue.

Of the two processes the closed infective process is generally to be considered more harmful than alveolar absorption.

Conclusions

1. Future of medicine and dentistry lies essentially in prophylaxis.

2. Burden of early treatment should rest on the patient.

3. Coöperation of dental and medical professions in re-educating the lay people.

4. (a) It is inadvisable to devitalize teeth and when that stage is reached, extraction should be advised, although it must be admitted that devitalized teeth are carried by patients, which teeth are not symptom producing. (b) However, these teeth are potentially bad and infection may occur at any time, without any local symptoms becoming manifest.

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Further Results Obtainable With the Movable Bucky Diaphragm

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GENTLEMEN, when talking with your president, Dr. Tyler, regarding this program I had it in mind that by this time I would have a considerable amount of material on kidney stones, gall stones, pyelography or sinus work to form the basis of a paper of some value. But for various reasons I do not feel that the material so far obtained in these fields is worthy of presentation. I am still using the first home-made apparatus for my work and for some of these special uses much could be wished for in its construction. For instance, in kidney work it is highly desirable that there be some method of immobilization and compression for the best results in detail of kidney outlines. This I have not. For sinus work, my diaphragm, mounted under the table, is too awkward to use. I have become satisfied that there is definite value in sinus and mastoid work, but before using this system in routine I shall have to build special apparatus for this purpose alone.

In walking about your exhibit rooms I see films made through the deep osseous structures that eclipse anything I have obtained, due to the finer grid construction now being furnished by manufacturers. And in talking with the members I have become convinced that most all are so familiar with the theory and practice of roentgenography with the Bucky arrangement that it would be needless procedure for me to dwell on it in a general way. There is one aspect of the work that I would like to emphasize, however, especially to those who are doing their first work with this diaphragm, and that is the question of dosage.

For the first month I used the diaphragm in conjunction with plain plates. The increased exposure required by this technique resulted in a high tube mortality. The Coolidge radiator type of tube built for thirty milliamperes and used at this maximum, backing up a five-inch parallel gap is not supposed to be used for more than fifteen or eighteen seconds without becoming overheated Since on an average individual at 25-inch tube-plate distance I was required to extend the exposure to thirty seconds or more the tubes suffered materially. With larger individuals the time under these conditions had to be prolonged still further. With the use of plain plates, therefore, I was obliged to make the exposures in relays of about fifteen seconds each, with ample rest between, often even changing the radiator during the pause. Suppose now that it was desired to make two or three plates in succession using this large discharge with a target-skin distance of about twelve inches. It is obvious that in doing so one approaches, if not surpasses the erythema dose, as has been given us by some investigators. It is in this connection that I would voice a warning which may prevent the enthusiastic repetition of exposures on the same patient.

When I realized that I was demolishing tubes beyond reason and in two heavy exposures running the risk of erythema. I naturally began a double screen-film technique, which has since been followed. By this method one does no harm to the standard radiographic tubes and is at liberty to make a number of plates without risk. Even with the double film-screen method I would advise a thin filter when radiographing sinuses for fear of epilation.

Looking back upon these facts it seems rather fortunate that I got along without an erythema or an epilation, but I am satisfied that the limit was so nearly approached on different occasions without once thinking of the consequences that the best thing I could say here today is to look out sharply for over-exposure of your patient during your first experiments with a Bucky apparatus.

Discussion

LEWIS G. COLE. Dr. Potter is certainly to be most heartily congratulated on his achievement in perfecting the Bucky diaphragm or grid.

It is, I believe, the greatest improvement in x-ray apparatus since the development of the Coolidge tube.

The serious detrimental effect of secondary rays in radiography has been generally recognized.

This Potter Bucky grid does not prevent secondary rays from being generated in the body, but does prevent part of them from reaching the plate or films.

The improvement in the contrast of the plate is so great that it might lead us to be satisfied in preventing only about one half of the secondary rays from reaching the plate.

If a double grid, working at right angles to each other, were possible the contrast would be still more increased. This, so far, has been impractical.

Another method of eliminating the secondary rays is to diminish the area of the body that is exposed. This fact was recognized by Albers-Schoenberg when he first used the diaphragm or compression blend of cases for abdominal radiograms.

Subsequently I attempted to use these cones or compression blends for various areas of an abdomen on a single large plate, but this was unsuccessful, and later I used a series of parallel slots, two in front and one behind the patient.

These three parallel slots were made to accomplish, by a totally different method, what has been accomplished by the Potter Bucky diaphragm.

This has been developed to the experimental stage, but has not been applied to practical radiography.

I believe that a combination of the Potter Bucky grid behind the patient moving in one direction and in parallel slots in front of the patient moving at right angles to the grid will still more increase the contrast of the plates.

It is strange how history repeats itself. Fourteen years ago, when I first attended a meeting of the American Roentgen Ray Society, I read an article on Direct, Indirect and Secondary Radiation, and that article at this date has a definitely direct bearing on the work of Potter and the work that we are now all interested in, viz: the elimination of secondary rays.

Dr. Steiner, my associate, told me that I could not talk these Direct, Indirect and Secondary rays to an audience and make them understand my conception of them, because he had lived with me for four years and could not yet understand by conception of them; and after reading the notes submitted by the stenographer I have decided he was right.

I am, however, going to attempt, at the next meeting, to describe and demonstrate my conception of Direct, Indirect and Secondary radiation.

***—Read at mid-year meeting of The Radiological Society of North America, held at Boston, June 3 and 4, 1921.**

EDITORIAL

The JOURNAL OF RADIOLOGY

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The Twilight and the Dawn

I.

A thoughtful search of the calendar of medical achievement for some powerful way to express the intense feeling which will inspire every man who attends the annual meeting of The Radiological Society of North America brings one very close to the high conception of human service which is the foundation of the science of medicine. It also holds a remarkable fascination, something akin to which public speakers must feel when they are able to tell a story of human conduct in such a vivid way as to make audiences laugh and weep alternately.

The science of medicine is not entirely devoid of funny incidents. That, however, is not the picture sought to be presented here. The time is one for serious thought. No man, no matter at what particular place or time he moved in the history of the world, ever lived in a moment of greater portent. No man ever struggled to master a more delicate and intricate question than that which embraces the national health. That is especially true when it is remembered that the answer to this great problem must very soon be written with a strong hand across the blackboard of eternity, and as written, will absolutely determine whether the medical profession is to become a dynamic force in national affairs, in social stability, in industrial progress, in economic righteousness, and in political decency; or whether, due almost entirely to its own inertia, the medical profession is eventually to become a miserable representation of those inviolable principles which have been its bill of rights wherever human suffering was found.

A conscientious effort to interpret the meaning, the cause, and the issues of the life we live, is bound to compel any man who attempts it to use figures of speech common to all men, and which per se hold that vital inner urge expressed in common appeal and universal understanding. There is plenty of justification for that method, though frankly, there would seem to be no need for justification beyond the tremendous importance which the question of national health holds for every man. As the professed guardian of the public health, the medical profession enjoys unprecedented opportunity for human service. And its responsibilities are just as surely commensurate with that opportunity.

II.

The purpose of this discussion is to crystallize a number of thoughts previously advanced, to clarify the supporting causes behind those ideals for which The Journal has striven, and to make an impartial and honest comparison between the opportunity and the obligation the medical profession enjoys as the inevitable consequence of its protestations of human service.

Preventive medicine occupies a prominent place in public and professional thought. It is but the logical and essential development of the science of medicine. Social medicine is being consistently advocated by a great many men. It is a sure sign the medical profession faces fundamental reconstitution. Much of what follows will essentially deal with the various aspects of those two phases of the question. And while some of the illustrations used to demonstrate certain points may seem to wander far afield, yet they have deliberate purpose and exact application to some particular angle of the subject if you will exercise the patience to follow through.

III.

Speaking in terms easily comprehensible, it would seem that the present condition of medical practice is fairly comparable to a daily natural phenomena, with its consequent reactions on the members of the human family. Reference is made to the transition from day to night, night to day, and the period of repose intervening. The twilight hour affords a period for reflection when the day's deeds may be recounted deliberately. Night kindly hides the jagged stones on which conquering feet must bleed. Dawn brings a compelling witchery and sorcery. While the combination of the three lays hold of men with a spirit of intrigue which stimulates nearly all men to action, and some men to great achievement.

While the psychology of the thing may not be entirely understood, there is something peculiarly fortifying about that sort of self-communion which some men enjoy at the twilight hour. It provides a cumulative power to accomplish substantial things. Life passes in review in a sort of panoramic pastel on which kindly thoughts and forms appear in the delicate hues of hope, of ambition, of love.

Contrariwise, there is something impelling about the dawn. It is the beginning of things anew. The scars of defeat are forgotten in the lure, the novelty, and the romance of certain success, and hope warms the blood.

IV.

The annual meeting is the summation of a year of earnest endeavor. It is a period of transition. It is a scientific metamorphosis. Men from all parts of the United States, Canada, Mexico, Cuba, England, France and Germany come to a common meeting place for a common purpose. They are actuated by common ideals. They know that in the free interchange of ideas, experiences, observations, aspirations, knowledge is formed—that knowledge which justifies and revivifies the earnestness, the hopefulness, the zealous pursuit which they give to the problem of adding a cubit to the stature of a diseased and distorted humankind, which they accord their promise of a fair measure of comfort and health for a sick world.

V.

Reviewing the potential possibilities of medical science, is there not need for that calm deliberation and invigorating atmosphere which so characteristically and so exactly merges the failures of today into the successes of the morrow? In the reconstitution of the medical profession which appears so imminent, must not our judgment be tempered, our aspirations renewed, by the fact that the science of health must extend to the widest shores of a human world, and jut out here and there and everywhere into a sea fed by the bitter tears of millions of men and women and children who come to the medical profession asking bread, and to whom that profession must reluctantly give a stone? May we not find in this meeting some significant fact that will effectually lay the ghosts of the science of medicine as they stalk about in the shadows of our own shortcomings, give us assurance that the morrow will be a day of greater usefulness, and thus cheat the dark hours of human service of their fearful congery?

VI.

Developing the idea a little further, is there not an abundance of evidence everywhere to support the view that the science of medicine is in the twilight hour of its progress, and that it is but the part of prudence to lay specific plans for the dawn of that new day so near at hand—a dawn which will unquestionably measure the value of medical science as a social factor by the sort of intelligent social service it accords the nation? Or, is there any question that the practice of medicine as it is conducted today, fails to respond constructively to the economic and social needs of a hundred millions of people whose ability to do a day's work is a prime condition of their existence? Can any one successfully refute the wisdom of a preventive, positive, cohesive, and organic national health program into which all the achievements of the medical profession can be incorporated?

Finally, should the medical profession, composed as it is of men of high ideals and large scientific training, be expected to drift along in an idyllic state of nonchalance while the greatest potential science for human betterment is robbed of its manhood, deprived of its spirit, and plundered of its soul?

VII.

These are the reasons why the medical man as an individual is struggling under a heavy load—a load which is utterly beyond his capacity. It is the reason, also, for going back behind the actual science of medicine and applying the rudiments of that scientific training to the laying down of a formula which will find the unknown factors in the great problem of social well-being. In this way, and in this way only, can there ever be any assurance that every member of the medical profession is building his particular part of the whole social structure in conformity with those ideals and purposes which are bound to grow out of the concerted effort of the entire profession to accomplish an inclusive and conclusive health program.

It certainly cannot be reasonably expected individualistic study and opinion concerning this important question will merge into a harmonious conception either of its possibilities or its probabilities unless, and until, the problems and thoughts of those individuals have been conjointly stimulated and refined, and hammered into sound judgment by the simple expedient of compelling every man to lay what he sees against what every other man sees.

That you are going to counter with some reference to the combined effort of the medical profession in the promulgation of "Cancer Week," there isn't the slightest doubt. But reviewing all the arguments advanced in its behalf both within and without the profession, summing the whole thing up in a composite picture for critical analysis, one is inexorably forced to accept the conclusion that the thing which holds the medical profession in leash, the thing which degenerates into an impasse an otherwise laudable effort to acquaint the public with exact knowledge concerning this horrible disease, is a collosal confusion of ideas which suggests that specialty is arrayed against specialty, is that sheer lack of continuity which provides the public with ample ground for believing that there is neither unanimity of purpose nor sustained effort in the ranks of the medical profession.

Quite naturally, it is not supposed that The American College of Surgeons conceived this campaign for the purpose of deifying the knife. However, more than one surgeon, speaking on the public platform under the auspices of the "Cancer Week Program" was heard to make the silly assertion that the knife was and is the only method of relief known to medical science in the treatment of this frightful scourge.

VIII.

This publication endeavors to correctly represent leading radiological opinion predicated on correct medical knowledge. For this reason, it does not hold the childish view that radiology is the only method of treating cancer or any other disease. It firmly believes it is much more sensible to admit the truth, which is, first, that many cases of cancer, as well as other diseases, are incurable so far as medical, surgical, and radiological science and skill now go; second, that in some cases surgery is a very proper method of relief; and third, that in many cases, exactly in the proportion more certain knowledge of the possibilities of the science of radiology increases, that science, in the hands of competent medical men, is capable of very beneficial results pre-operatively, post-operatively and inoperatively.

IX.

It is not the purpose of this thesis, however, to engage in a purely controversial discussion of method. There can be no opposition to the proposition that every case should be handled according to its peculiar history and conditions, and treatment rendered which accomplishes the best results for the patient. That is the premise on which this discussion proceeds. The incident is cited merely to prove that there is a fundamental weakness in the profession as at present constituted, a weakness which renders it incohesive, and gives birth to that spirit of public distrust and uncertainty every medical man experiences every day in his private practice.

That sort of a condition cannot endure, simply because the public will no longer tolerate it. Nor should the medical profession permit it to endure.

The problem is one of procedure and organization, which, stripped of all dissembling and mouthing, resolves itself into the question whether the medical profession will assume the responsibility for setting its own house in order that it may serve the national health effectually and intelligently, or whether it prefers to let other agencies prescribe its sphere of activity, and restrict its field of responsibility and opportunity simply because it has failed to fully appreciate its inherent obligations; and failing to appreciate them, has introduced into the record of human conduct the utter incapacity of medical science to function as a constructive social agency.

X.

There is nothing flambuoyant about this statement of the facts. If ever there was a time in the history of the medical profession when individual practitioners needed to suppress all petty jealousies, submerge personal aggrandizement, and devote every ounce of energy they possess to the conception and discharge of a constructive national health program, that time is now, when the future of the profession is in the balance. There must be unity of purpose, loyalty to ideals, and an intensity of devotion to the achievement of those vital things which beget the blessings of suffering humanity and which constitute sufficient justification for large public confidence in the vision which that profession holds of its own and the public welfare.

These are plain words. But an emergency exists, and there is neither the time nor the inclination to waste effort in useless pettifogging and interminable discussion of insignificant details.

XI.

The issues involved in the practice of medicine are very different today than they were in the nineteenth or even the early part of the twentieth century. The change has produced a lot of uncritical drifters, men who have become hopelessly confused trying to determine the course of blind social currents coming from everywhere and leading nowhere. Today the future is menacing and unfamiliar. Everybody is grabbing for a friendly lamp post in a giddy world.

Obviously, there is great need for enlightened leadership. The socio-economic welter is struggling for crystallization, direction, deliberate purpose. H. G. Wells succinctly states the situation when he says, "These big questions affect everybody, also they are too big for anybody."

The medical profession is not exempt. The flow of patients does not follow previously established lines. Men and women defer medical attention until the compulsion of fear operates. And there is a widespread physical and mental neurosis which is destroying the individual will to live correctly, the mandates of health and public welfare considered.

Perhaps this sounds like an extravagant statement. But when it is remembered that the statistics compiled by the United States Surgeon General in examinations conducted under the selective service drafts, show more than fifty per cent of the total population suffering from diseases, a great many of which are absolutely preventable, there is ample justification for vigorous language. And perhaps, too, that fact in and of itself, is sufficient reason in the average person's mind for pinning his faith to a nationalistic scheme of medicine; at least that would be the logical conclusion drawn by men vigorously schooled in nationalistic principle and spirit during the war.

Whatever the cause, the fact is that men have temporarily lost their sense of direction. They are wasting their energies in gabbing about the necessity of "getting back to normal." They fail to recognize that a new social level has been established, and that the normal of today is an altogether different condition than it was yesterday; they don't like the process incident to the readjustment of their lives to fit a different state of facts which requires different standards of social and economic activity; they would much prefer to pursue the old habits of geographic culture; they feel an uncomfortable squeeze about their ribs, gasp for air, and try to reduce their physical and mental proportions instead of buying a new suit of clothes and consciously accepting the benefits of the new world in which they live.

XII.

It is not expected that the medical profession will assume the responsibility for all the ills of the human family without a struggle. A good many of the members of that profession are going to insist very earnestly these things are not within the province of medical science.

But preventive medicine must mean this sort of thing in view of the broad contact of the medical profession with every phase of human conduct. It must mean infinitely more than the mere use of the police power of the state to safeguard the life and property of the community, or it is as false a god as was ever conceived. It must mean that there is some obligation on the part of the medical profession to acquire specific knowledge concerning the immigration question its its relation to the public health, with the resulting responsibility of applying that knowledge in the erection of preventive agencies. It must mean that there is some relation between the present housing shortage and the public health, and that it is absolutely impossible for the medical profession to prescribe either preventively or curatively in an intelligent fashion without definite knowledge concerning what that relation actually is. It must mean that there is some causal connection between the question of unemployment and the physical and mental stamina of those persons without jobs, to say nothing of their dependent wives and babies; and if it be admitted such a relation exists, how in the name of common sense is the medical profession going to prevent or definitely cure the thing all the world accepts as the result unless it makes an earnest, conscientious and honest effort to understand and remove the cause?

XIII.

These are but a few of the intricate ramifications of the numerous phases of modern medical practice. But they are sufficient, it is believed, to demonstrate beyond the point of dispute the justice in the current criticism of the medical profession; and further, that the medical profession will have to pursue some deliberate program which will coördinate all the latent forces of medical science into a national health plan, or publicly admit that it is unwilling and incompetent to undertake the task which is inherent in the science it employs.

XIV.

By this time the average medical man will be ready to say, "Granted, all you say is true, what specific plan or suggestion have you as self-appointed critic to offer which gives any promise of the achievement of this larger purpose so graciously thrust on the medical profession?"

Such a question is both pertinent and timely. But the man who asks it is going to be keenly disappointed, both in the striking simplicity and patent tediousness of the only answer that can be made to such a question; first, that human relations are not static so that a man can state a few specific facts, memorize a few fundamental principles, and say to the balance of the world, "Achieve these or be damned." Second, that the setting up of such a health program is not the job of one man, but rather the job of all medical men, because each is an important daily factor in the machinery of public health and opinion. And third, that before even the first meagre beginnings of such a program can be definitely stated, it will be necessary to make a complete survey of the nation for the purpose of getting a composite expression of the opinion and requirements of people engaged in all lines of endeavor, and the immediate facilities the medical profession itself can muster.

Perhaps that sounds like begging the question at issue. In a sense, it is. But it is the only possible method of understanding the situation, of avoiding the present accusations of purposeless drift, of preserving to the medical profession the dignity and opportunity for human service which it has always guaranteed to every man who bears the medical insignia as evidence of an unfrightened, masterful, and humble approach to life's realities, and of coördinating and correlating all branches of medicine and the collateral sciences into a cohesive and comprehensive effort to achieve a better universal public health.

One must necessarily commit himself to such a tremendous undertaking with an abiding faith in the vision, the sincerity of purpose, and the high ideals of the medical profession. But its record of accomplishments justifies the hope that the medical profession will find the will to tackle the job, and the constancy of purpose to grapple with it until something really tangible and worth while has been evolved.

XV.

Coming now to the more specific part of this discussion as it involves the science of radiology. Radiologists are trying to speed the dawn, a dawn, if you please, of diminished human suffering and enlarged scientific service, through the application of light waves advanced to the point of invisibility. To be sure, that is an immense ambition. It is exceedingly scientific. But it must be extremely human at all times, for on every hand appear men and women demanding succor, relief, prevention, cure, beyond the ability of the medical radiologist to give or promise.

Small wonder, then, that in this effort to reach some common conclusion concerning the future of all medical science, The Radiological Society of North America should be in the forefront. Surely the members of that society may not be criticized for seeking the inspiration and concomitant wisdom of full communion among all medical men on the perplexing questions which inevitably confront them. Surely they cannot be blamed for taking deliberate counsel with respect to that basis on which the medical profession can be organized in order to render an intelligent and constructive national health service. Surely, their motives cannot be impugned if perchance they want to know whether the medical profession of the future is to be more highly specialized, and then grouped for preventive and curative practice according to geographical units, political subdivisions, or social and industrial classifications. Surely, they may not be said to be altogether presumptuous for asking how any comprehensive organization of the medical profession is to be governed, whether by representation or direct vote; and for wanting to know what measures will be instituted to avoid the damning effects of inter-organizational politics and petty jealousies in the one case, and the stifling inertia and obsolescence of disinterested and irresponsible administration in the other. Surely they may not be accused of unprofessional conduct for suggesting that these are pertinent and grave questions which are absolutely certain to appear in any constructive organization of medicine, and that upon the capacity of the medical profession to develop and constitute a progressive and efficient government in its own affairs, depends the measure of confidence and responsibility the public will impose upon it, and permit it to assume in the matter of the national health.

XVI.

Remembering that it is a mighty poor rule which doesn't work both ways, and striving to be constantly thoughtful of the profound responsibilities which rest so harshly on the radiological profession, The Radiological Society of North America perceives it to be its imperative duty to lend every assistance of which it is capable to the formulation of an intelligent national health service. To this end it earnestly solicits the coöperation of medical men particularly, and will welcome conjunctive action on the part of all other agencies sincerely seeking a part in the unselfish elevation of the physical, mental and moral fibre of the human family.

XVII.

Such a serious study must have a place of beginning. With full confidence in its efficacy, the suggestion is made that the first step is the creation of a research bureau whose activities shall cover both the social and scientific phases of this important question.

On the social side, there is such a paucity of information concerning the large questions hinted at, as well as scores of others, and on the scientific side, there is such complete lack of coördination and purpose in the prevention and cure of disease, that no thinking man will offer any resistance to the creation of such an agency, and certainly no medical man will be heard to oppose it for the very good and sufficient reason that it will unquestionably open the door to greater human service and a renewed assurance of the future existence of the medical profession.

Think of the magnificent opportunities which await the magic touch of the combined intellect of the whole medical profession, the learned physicists, and expert engineers working in collaboration, synchronization, and preconceived unison toward the one great object of national health! Is there need for detailed statement concerning the value and the potential possibilities, pathologically and physiologically, of coördinating and correlating all these wonderful sciences on such specific problems as the prevention and cure of cancer, tuberculosis, leprosy, and dozens of others which now mock the individual effort of every medical man?

Simply to illustrate this point radiologically, what would it mean to the medical radiologist to have such a bureau study and determine the action of radiation on the tissues, biologically, bio-chemically, and bio-physically? Would not that information definitely establish which side of the spectrum should be used in the treatment of malignant diseases, and whether, and to what extent, there is ground for hope in the further development of high potential apparatus? Would not that information enable the radiological profession to so standardize its technique as to render its applicability more nearly universally productive of those results which some of the members of that profession are able to obtain in random cases?

The activities suggested are neither inclusive nor conclusive. They are intended only to be stimulative. It is impossible in this sort of a discussion to set up anything like a complete plan. There are so many other ways in which such a bureau can function as the basic element in medical science that the only limitations it will encounter will be the natural limitations of capacity of vision and enterprise on the part of those who conceive and constitute it.

XVIII.

This kind of a program will have to start in a small way. But a great deal of invaluable work can be done by a comparatively small staff for an inconsequential expenditure, the numerical personnel of those directly interested in it considered. The funds for development will be forthcoming once the movement is under way, and its enormous practicability demonstrated.

As has been previously stated in The Journal, a research bureau is of such vital concern that it should not be brushed aside as an opportunist's dream. It is a carefully thought out plan for accomplishing realities, and needs but the hearty support of the medical profession to make it a remarkably prodigious achievement in medical and social science.

XIX.

The Twilight and The Dawn! Is it going too far to express the hope that the annual meeting of The Radiological Society of North America this year, will definitely mark the consummation of the transition which begins in mature deliberation grounded in a life of human service and sacrifice, and carries over into the dawn of an era of large constructive social service like which there is no precedent in medical science? Is it too much to bespeak for every man who attends the meeting an inspiration flowing from certain knowledge that the medical profession has struck out boldly, courageously, and understandingly toward the attainment of those fundamental things which inevitably mean greater health and happiness for the men and women and children of this nation?

An Inexpensive Record System

THIS article owes its inception to an article recently published by Dr. R. D. Carman of The Mayo Clinic in the July issue of the American Journal of Roentgenology, in which the system in use in The Mayo Clinic for keeping the record of all cases radiographed therein and for filing the films of such cases is explained in detail. All credit must be given to this system as it covers the ground thoroughly, is complete and at the same time is compact. The great objection that can be made to it is that it requires the work of several clerks and at least one stenographer to complete it and keep it up to date; that it requires expensive filing cabinets and much stationery and that in using plates, it requires filing room far larger than can be given it elsewhere than in clinics such as this one. While this system is applicable to a hospital of the standard of The Mayo Clinic and a hospital which can afford to furnish the amount of space required, pay the salaries of the clerical force necessary to keep it always in order and up to date, and afford the stationary and filing facilities it demands; most of us are of necessity barred from membership in such an institution and the hospitals with which we are connected and in which we do our "bits" cannot afford to allow us the expenses and the space necessary in our work, much less pay for stationary and clerical help in addition.

I have therefore prepared a short outline of the system I am using and which is serving to keep for me, by my own efforts, a record of my radiographic work and a filing record of all films; feeling that it may serve as a basis upon which improvements may be suggested until through the contributions of many men from the smaller towns, the ideal and perfect system may be evolved, that may be in use by all men and that will be sufficiently inexpensive to suit all of us, sufficiently concise that it will not be a drain upon limited time, and yet of paramount importance, that will be sufficiently clear to enable us to keep a perfect, graphic record of all cases. There is nothing startling, original or scientific in this system, but it is workable and it can be kept up to date by a few moments work each day.

When the patient comes up to the x-ray room, the record card is filled out by the roentgenologist before making the examination. This card in the system I am using, was made for me by the McCaskey Register Co., of Alliance, O., to fit their system of case-records, and is filed at the end of the examination and after the diagnosis is made in the filing system they provide. The form and composition used thereon is my own, however, and should one not have such a system, can be readily made to fit any size card for filing, by any printing firm. It will be noted that the first page contains the information necessary for making the radiograph. First is the name of the patient, or of the corporation, if the patient is an employe of any corporation, next the address of the patient, and the occupation. The date and the price for examination are also placed in a prominent position. Next follows a description of the patient including sex, age, height, weight, race, marital status, whether the examination was for himself or some member of his family and if so the name and status in the family of the patient. Whether the examination was made at office, at home or at hospital. Below this are the date of injury, the symptoms, the method of injury, the clinical diagnosis and the first page closes with the radiographic case number.

The second page is devoted to covering two subjects. The upper half is devoted to technique and contains the essential details on this subject. The lower half contains the space for plate analysis, followed by radiographic diagnosis. This is followed by a space showing the time when report on the case was rendered and the method in which same was rendered. The third and fourth pages are devoted to a resume of fluoroscopic examination of lungs, heart and gastro-intestinal work and do not relate to this subject.

After page one is filled out, a record of the case is made in a standard columnar book. The one I am using is No. 21, and contains room on one line, writing across both sides of the page, for the following information: (1) the date, (2) the patient's name, (3) the patient's address, (4) the case number, (5) the name of the referring physician, (6) the part to be radiographed, (7) the charge for examination, (8) the date of payment.. By filling out this record we obtain the case number which is placed on the last line of the record card and is used on all films made of the case, regardless of anatomical locality.

To mark the films, the Victor stencil plate marker set is used. The top line contains the name of the institution, the bottom line contains the case number. The bottom line is subdivided in such a manner that the case number is contained on the left hand side of the marker, while on the right hand side are inserted the numerals corresponding to the month, day and year. By this means the case number comes first on the film, and following it we have recorded the date in addition. To illustrate:

St. Luke's Hospital
2063—9121

would mean that the case number was 2063, and that the films for the examination were made on September 1st, 1921. Films are further marked "right" and "left" and if desired the position in which same were made is added, by the use of small lead letters, stuck into adhesive strips, and additional adhesive used to cover the letters and stick them in proper position upon the cassette.

After the films are developed and dried they are then examined and studied for recognition of pathology. If none is found that is so recorded on the record sheet and the physician referring the case is so notified. If any pathology is discovered, a letter discribing same is written to the physician referring the case explaining the pathology found and the x-ray diagnosis made. A carbon copy of this letter is fastened by a Hotchkiss staple to the case record as described above. The films are now ready to be filed away.

After many trials, I personally have found nothing for filing purposes to equal the cartons furnished by the Eastman Kodak Co., in which the duplitized films are shipped. Each carton will hold comfortably and easily from sixty to seventy-five films. Before placing the films in the appropriate carton, a small sticker is placed in one corner of the film, so that it shall be on the top left hand corner of film. These stickers are made by cutting into one-inch strips, a piece of the brown paper now in use by many merchants to replace string or cord in fastening packages, and which comes in rolls of eight hundred feet, a roll costing the roentgenologist, from any of his friends who buy same in large quantities, not to exceed 50 cents. This paper contains glue on one side and once the glue side is wet and stuck, it stays stuck. It is used by The Eastman Co., to fasten the top to the carton in order to keep the films perfect and free from light contamination. An ink pad and a small rotating numbering stamp, such as is used by many of the parcel post offices to stamp the number upon the packages sent insured, and which costs from 50 to 75 cents, is now used and the film marked with the number and if desired the date contained in the film. The film is then slipped in the appropriate sized carton then in use for filing purposes in such a manner that the number on the sticker is on the top left hand side of film and on the top left hand side of carton, so that in the event the films are desired, the numbers on same in this carton can readily be ascertained.

Across the top of these cartons is stuck a strip of the same glued paper mentioned above, to cover the writing used by The Eastman Film Co., as well as to permit writing thereon the essentials for properly filing same. Starting in at the left hand end of the top are written (1) the year, (2) the volume number for that year, (3) the size of films therein contained, (4) the numbers of the first and last films in the carton, (5) the title for the class of films kept therein, and (6) in the right hand corner the key number for cross-filing and cross-indexing purposes. To illustrate:

1921 Vol. III, 8x10's. Bone Films. No. 1084 to 1162 A 36.

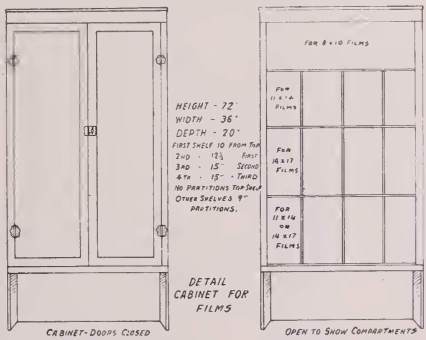
This key number is easily remembered and distinguished. Inasmuch as no separate cartons are kept for 5x7 or 10x12 films, they are placed in the carton in which they fit properly. Thus the 5x7 films go into the 8x10 cartons, and the 10x12 films, into the 11x14 carton. The key letter for 8x10 cartons is "A", after which letter is placer a number, which is in reality the number of that especial carton, and saves writing the year and volume number on the cross index card. I use numbers 1 to 300 to represent bone pathology films, 300 to 600 for gastro-intestinal films, 600 to 900 for genito-urinary films and 900 to 1000 for apex films in lung work. The next size, 11x14 films, contain the letter "B" as their key letter, with the same numerals to distinguish the classification of the films therein contained. The third size, 14x17 films use the letter "C" as their key letter. Here the numerals differ slightly, inasmuch as the greater portion of this size films are used for chest work. And 1 to 300 represent chest films for lung cases, 300 to 600 gastro-intestinal films, 600 to 900 genito-urinary films and 900 to 1000 cardiac films.

For cross-filing, either a card index system can easily be used with the above described system or I prefer a loose-leaf ledger, using cardboard sheets cut to allow marginal tabs for filing the main subjects, and subdivisions thereunder for the different forms of pathology.

These cartons are kept in a cabinet, which complete cost $10.00 and which as it stands is an ornament to any offce. This cabinet was built separate and can be moved to any part of the room or to any desired room, and contains facilities for filing films some a number of years for the roentgenologist who does not have an extensive practice. When it is filled another can be built and added to it, and thus the filing continued. The cabinet is seventy-two inches high, by thirty-six inches wide by twenty inches deep. It is solid throughout, and can be constructed by any carpenter who is a neat and careful workman. The front is composed of two doors which meet in the center, fasten with catch, and swing wide open. Each door is panelled with beaver board. The interior of the cabinet is divided cross-wise into four compartments. The first is ten and one-half inches in heighth, and provides room for the 8x10 films. The second is twelve and one-half inches in heighth, and is used for the 11x14 films. The third and the bottom compartments are fifteen inches each, and are for storing the 14x17 films. Excepting the top compartment which is left undivided, each of the remaining compartments are subdivided by partitions into four compartments, nine inches in width, for filing the different subdivisions into which this size of film is divided. I would roughly estimate that this cabinet contains filing facilities for one hundred and thirty cartons of films, which is ample for some time for the average roentgenologist in a smaller town or city.

An additional feature that may be added at but an extremely slight cost consists of wooden racks for holding film hangers used in tank development and for holding the washed films until they are dry. Since using the ones I am about to describe, I notice that one large x-ray manufacturing firm has placed a metal rack similar to this on the market. However, the ones in use here originated independent of their ideas and are certainly considerably cheaper to say the least. These can be made by any carpenter, and mine cost me exactly $1.50 each. Each frame consists of two right-angle triangles. The frame of each triangle is made of 13x16x1¾-inch dressed wood. The back is 24 inches in length, the top, 18, and the hypotenuse of the triangle which forms the front of the rack, and is the side used for holding the films, is 30 inches in length. These triangles are joined together by three cross pieces of the same size material previously described, one cross-piece being at the top of the back and one at the bottom of the back, and the third at the top in front. They are inset into the triangles to strengthen them and are of such width that the frame hangers will just clear the two triangles by one-eighth inch on either side. This measures exactly 16 inches. Two pieces of dressed material, one-half inch thick, by one and three-quarters inch wide are now cut and their ends suitably prepared so that they will fit accurately into the inner surface of the hypotenuse of the triangles above described. In the frame to hold the unused hangers, these pieces are bored entirely through (making the holes correspond on both pieces) with augur and a bit making a hole one inch in diameter, in six places, the holes being five inches apart from center to center. The pieces are then set on the inner surface of the thirty-inch side of the triangle and nailed into place. With a small hand saw, insets measuring one-quarter inch in width are then sawed into each hole from the front of the frame, at the upper margin of the hole. This in order that the hangers will not jump out. The hangers are slipped into the frame or rack through the inset into the hole, and each hole will accommodate five to six hangers. When finished the frame can be nailed or screwed by the two cross-pieces joining the frame in the back, which gives it ample support. In the rack used for drying the films the same triangles are used. The difference in this frame consists in the size and number of holes bored through the half inch strips. Here the holes are made two inches apart, center to center, and are bored out with one-half inch holes. This gives room for twelve films to dry, and if care is used when they are placed upon the rack, no film will impinge upon the one in front of or behind it, thus causing the films to stick together while drying. The rack for drying the films is nailed, as was the other over the sink, so that the drainage from the films will not soil nor dampen the floor. I have found it considerably more convenient to use two racks for drying films, instead of one larger rack, thus having room to dry a maximum of twenty-four films at one time, which is usually ample to cover ordinary work. A coat of lamp black applied to the racks makes them look better and increases the wearing qualities.

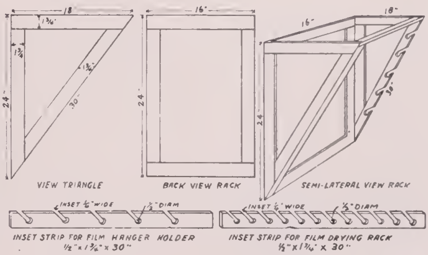
The above described outfit, including everything, save the McCaskey Filing Cabinet, but making allowance for converting a drawer or two in the regular office desk for filing records, and including record cards, film marking outfit, stamping outfit for films, three film-holding racks, cabinet for filing, and system for cross-index-



ing records and films, either by cards or loose-leaf ledger, can be installed by any one for less than $40.00 as follows:

500 Record Cards	$ 7.50
Cabinet	10.00
Film Marking Set, with extra letters and figures	4.00
Paint and brush for painting cabinet and racks	2.00
Changing desk drawers to filing cabinet and alphabetical index for same	2.50
Hotchkiss Automatic Paper Fastener and Staples	3.00
Racks for holding hangers and drying films	4.50
Cross-index cards and file, or loose-leaf ledger	2.50
Stickers and stamping outfit for films	1.50
Standard Columnar book, for record keeping	1.75
TOTAL	$39.25

This system gives a complete record as to name and clinical history, enables the roentgenologist to check up and develop a standard and uniform technique, gives him a record of plate analysis and of time and manner of reporting results, which can be used in the event he is called to testify in court and gives him a record of the finding in every case, and preserves in a logical manner and in logical sequence his films on all cases. It furnishes him with a means of cross-indexing his cases and enabling him to present statistics on any given subject within his scope. It is applicable to any and all roentgenologists regardless of the size of their practice and best of all, it can be kept



in order and up to date by a few minutes work each day by the roentgenologist or his office girl and does not require the use of a clerical staff.

IRWIN P. LEVI, M. D.,
Anniston, Ala.

Perineal Treatment Stand

THE requirements for a simple, inexpensive apparatus for treating the perineum by means of the x-ray seems to be quite satisfactorily covered in the accompanying illustrations.

It is constructed of light but substantial wood and is lead covered under the top and behind the front. The aperture in the top is a circle six inches in diameter and may be covered with aluminum or other filters placed beneath in wooden slots provided for their use.

Fibre rods support the tube carrier and also project from the sides to hold the high tension wires at a safe distance from the patient. Three anode skin distances have been provided, viz., 8-10-12 inches, and the tube may be raised or lowered by inserting the fibre rods through holes behind and screw eyes in front, either up or down as desired.

The apparatus is being used with much satisfaction. No material improvements have been suggested by experience. It might be advisable to make it collapsable where space is a factor.

The lead lining is, of course, grounded while treating and the patient's feet should rest upon wooden blocks or a small wooden stool.

The measurements are as follows:

Top, 18 inches wide and 19 inches deep. Front and side pieces, height, 24 inches; breadth at bottom, 24 inches. Front to back at bottom, 26 inches. Diameter circle in top, 6 inches.

DRS. GROOVER, CHRISTIE AND MERRITT, Washington, D. C.

LEGENDS

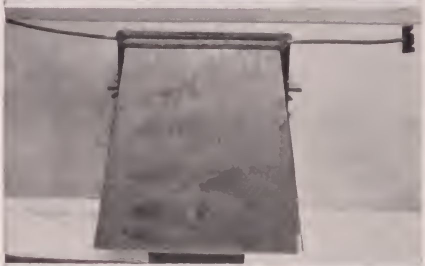
Fig. 1—Top view of perineal treatment stand, showing the six-inch opening and the fibre rods for keeping the high tension wires at a safe distance from the patient.

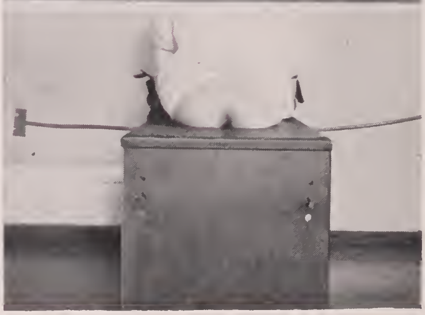
Fig. II.—Back view of perineal treatment stand, also showing the fibre rods.

Fig. III.—Side view, showing tube in place, supported by fibre rods on hooks.

Fig. IV.—Side view of perineal treatment stand with patient in position.

Fig. V.—Rear view of perineal treatment stand with patient in position.





Film Intensification

WHILE conducting some experiments to determine the influence on the film of secondary radiation derived from material on which the film rests, tables, boards, boxes, etc., I was struck by the decided "intensifying" action produced by ordinary lead foil when this was placed in contact with the back of the film. If this lead foil was doubled the action was more intense. Besides said "intensification" the lead foil prevents secondary rays from material back of the film, from affecting the emulsion from the rear. We can take advantage of this action to improve the quality of our finished radiographs.

If, in using a duplitized film, we lay it on a sheet of cardboard covered with a clean and bright lead foil and then "load" it in the black and orange envelope and take a radiograph as usual, we will find that the resulting image will possess a brilliancy and a richness of detail that many radiogists have denied to be possible to obtain with duplitized films.

JOSEPH S. GIANFRANCESCHI,
Buffalo, N. Y.

Annual Meeting Section

FOR ready reference, it is thought advisable to consolidate all announcements, information concerning railroad rates, and roster and plat of Commercial Exhibit into a special section.

The Commercial Exhibit will be found on the mezzanine floor, and visitors should feel perfectly free to nose about the exhibits and ask questions. Radiologists understand that to be a privilege which is really an opportunity. Competent technicians will be in charge ready to answer all questions.

Attention is also called by this means to the many interesting developments in apparatus evidenced by the displays of the manufacturers. Taken as a whole, as well as individually, the Commercial Exhibit is quite complete and will be found very interesting. Its purpose is to afford everybody full opportunity to study new machines and appliances first-hand and to acquire specific information of technique and correct operation from the mechanical side.

The Radiographic Exhibit of society members, in charge of Dr. Trostler, will also be found on the mezzanine floor. Every one is urged to visit it.

Exhibitors have taken an unusual interest in the annual meeting of The Radiological Society. A spirit of coöperation and courtesy will be manifest on every hand.

Official Business Meeting

AN official business meeting of all officers and counselors of The Radiological Society of North America will be held at 7 P. M. December 6th, 1921, at Hotel Sherman.

Reports of all officers and counselors will be taken up at that time. All officers and counselors must be present if at all possible. If compelled to be absent, written report of the year's work must be sent to the president at once so that it can be presented at this official meeting.

This is extremely important. Your coöperation will be appreciated.

Special Railroad Rates

Effective on all lines operating in territory covered by the Canadian, New England, Southern, Central, Southeastern, Southwestern, Western, and Trunk Line Passenger Associations, special rate of one and one-half fares will be granted all persons attending the annual meeting of The Radiological Society of North America, Chicago, Illinois, December 7th, 8th, 9th, and 10th, 1921.

The rate in question will be under the certificate plan, and conditioned only on a minimum of three hundred fifty tickets validated at Chicago.

To get the advantage of this rate, when you purchase your ticket, demand a certificate from the selling agent. Bring that certificate to Chicago and turn it in at time of registration at the Registration Desk. Validation will occur on December 9th and 10th. After securing your validated certificate, present it to the railroad agent, who will sell you a return ticket over the going route at one-half fare.

Dates of sale going, December 3rd to 9th, with final return limit December 14th.

These rates apply to all persons registering at the annual meeting and to the dependent members of their families of full fare age.

Be sure and get your certificate when buying going ticket and don't forget to turn it in at registration desk when registering.

Roster of Exhibitors

SPACE

INTERNATIONAL X-RAY CORPORATION......New York City—1 and 2
Featuring a deep therapy apparatus capable of delivering an equivalent of twenty-inch spark gap between points. Other new products will also be shown, all designed according to new principles for the purpose of accomplishing greater efficiency. The sphere gap and segmental toroid method of rectification will be displayed.

CAMERON'S SURGICAL SPECIALTY COMPANY.......Chicago, Ills.—3
Showing Right Angle Dentalamp for finding abscessed teeth and pathological conditions in the alveolar process; Diagnostolite for transillumination of the sinuses, and other electrically lighted instruments.

RADIUM CHEMICAL COMPANY.....................Pittsburgh, Pa.—4
Displaying new applicators, screens and other appliances for the therapeutic use of radium. Especial provision for consultation concerning the latest theory and practice in radium therapy.

EASTMAN KODAK COMPANY.................Rochester, N. Y.—5 and 6
A display of negatives on Eastman Dupli-Tized films and accessories developed for the purpose of standardizing the photographic phases of roentgenology. Several recent products will be shown for the first time, including a monel metal tank, unit illuminators and a new dental film. There will also be a display of clinical photography, including a a camera unit developed for this work.

SANBORN COMPANY...................................Boston, Mass.—7
Demonstration of closed circuit Metabolism Apparatus, Sanborn Benedict Metabolism Apparatus, and the Sanborn Handy Metabolism Apparatus, under supervision of technicians. Of particular interest to persons treating exopthalmic goiter and hyperthyroid conditions.

PATTERSON SCREEN COMPANY........ ....Towanda, Pa.—8
Emphasizing the New Patterson Cleanable Intensifying Screen. This screen is impervious to dust and dirt. Smearing materials like crayon and soot can readily be washed off. It is also water proof. Liquids can be wiped off without damage to the screen. Patterson Fluoroscopic Screens and the Patterson Operating Fluoroscope will be shown. Messrs. Patterson and Reuter will be in charge of this exhibit.

MIDDLEWEST LABORATORIES COMPANY...........Chicago, Ills.—9
Featuring the Metabolimeter and the few simple accessories necessary to Basal Metabolism Determinations. Demonstrations on normal and pathological subjects. Emphasis of the practical clinical application of the method in radio-therapy of goitre.

LIEBEL-FLARSHEIM COMPANY..............Cincinnati, O.—10 and 11
Including the complete line of Liebel-Flarsheim x-ray apparatus and accessories.

GEORGE W. BRADY AND COMPANY............Chicago, Ills.—12 and 13
Showing x-ray accessories, treatment timers, intensifying screens, etc.

CAMPBELL ELECTRIC COMPANY................Lynn, Mass.—14 and 15

This exhibit will consist of the "Clinix" X-ray Plant and Campbell Hospital Portable Unit, the latter of which is designed for use in the wards and corridors of hospitals. Both of these units contain some mighty interesting features.

THE RADIUM COMPANY OF COLORADO, INC........Denver, Colo.—16

Will exhibit a complete equipment of radium applicators, screens and accessories, of the most approved designs. Representatives in attendance will be glad to give complete information in regard to the technique of radium application and the installation of radium units.

SWEETBRIAR LABORATORIES............ .Pittsburgh, Pa.—12 and 13

This exhibit will consist of Sweetbriar Intensifying Screens, showing their hard, non-porous, washable surface and extreme flexibility, and demonstrating the use of the Combination Screen in Folder Form. Radiographs will also be exhibited to show the brilliant contrast, remarkable detail, and absolute freedom from grain resulting from the use of Sweetbriar Screens. George W. Brady and Co., of Chicago, western distributors, will be in charge.

ACME X-RAY COMPANY.........................Chicago, Ills.—18, 19, 20

Presenting a complete x-ray unit, consisting of a radiographic and fluoroscopic table combined with an x-ray transformer, which makes a complete x-ray unit in itself. The two predominating features of this unit are, first, the design which makes it a universal outfit, and second, compactness and lightness in weight. The table is about half the average weight. Many other x-ray accessories and sundries will be shown.

REBMAN COMPANY.................................New York City—21

Showing medical and surgical hygienic books and journals, especially those which are of interest to Radiologists.

BUCK X-OGRAPH COMPANY........................St. Louis, Mo.—22

Displaying X-Ograph Dental Film Packets and X-Ograph Developing and Fixing Chemicals, a new Cassette and Intensifying Screens especially designed for the use of duplitized films, and a complete line of Dental Film Mounts having a violet celluloid window for viewing dental radiographs.

JAMES PICKER................................New York City—23 and 24

Exhibiting a line of apparatus, appliances and accessories.

HORLICK'S MALTED MILK CO..................Racine, Wis.—25 and 26

Demonstration of the x-ray uses for "Horlick's" Malted Milk, including illuminated plates showing the product as a suspension media for Barium Sulphate in Roentgenologic diagnosis of gastro-intestinal tract.

VICTOR X-RAY CORPORATION...........Chicago, Ills.—27, 28, 29, 30

Chief among the items of interest will be the New Victor Deep Therapy Equipment, new Victor Stabilized Radiographic and Fluoroscopic X-Ray Unit, New Victor Potter Bucky Diaphragm Table with diaphragm, Victor-Kearsley Stabilizer, and the Sphere Gap for measuring x-ray voltages. There will also be shown a new combination Fluoroscope for use in either vertical or horizontal positions, and a combination radiographic table for use in horizontal or vertical position. A line of xray supplies and other apparatus will complete this exhibit.

STANDARD X-RAY COMPANY........................Chicago, Ills.—31

The question of safety in all x-ray work will be the keynote of this Exhibit, which will include the Standard X-Ray Transformer, Type C, the "Super-Standard," incorporating the patented safety device. Many other new and up-to-date features in laboratory apparatus will also be shown. Tables with added refinements, the efficient Junior Machine, which is marvellous for its compactness and remote control, and a Mobile X-Ray Plant for hospital use. Mr. Hettich will be in charge and assisted by a corps of trained men.

WILLIAM MEYER COMPANY.......................Chicago, Ills.—32

Featuring the new Meyer transformer, on which milliameter and kilovolt meter, the latter graduated as a back-up meter, are mounted on the low tension switchboard alongside the primary controls.

JOHN V. DOEHREN COMPANY .... Chicago, Ills.—33
This company will show a complete line of x-ray supplies of high quality, of both domestic and foreign manufacture, especially the well-known Gehler Folie Intensifying Screen, for which it is agent and general distributor for the entire North American Continent. It will also furnish information concerning the Dessauer Machine for Deep Therapy, which has a capacity of 200,000 volts.

BURDICK CABINET COMPANY .... Milton, Wis.—34
This exhibit will consist of a complete display of air-cooled and water-cooled mercury vapor quartz lamps, designed to produce Ultra-Violet Rays, which can be used effectively for protection against x-ray burns and for their cure. These instruments are used for immunizing normal tissue against x-ray burns in the treatment of malignancy, infection, osteomyelitis, and for superficial skin lesions. After immunizing with the Ultra-Violet Rays, the technician may administer the maximum x-ray dosage for deep seated infections.

FRENCH SCREEN COMPANY .... Detroit, Mich.—35
United States Agents for the French X-Ray Intensifying Screen, manufactured by Messrs. Caplain St. Andre Fils and Cie, Paris. A number of special advantages are claimed for this screen, that is, speed, freedom from grain, breadth of range, thinness and flexibility, and durability. Complete information will be gladly given by those in charge of the exhibit.

RITTER DENTAL MANUFACTURING CO., INC.... Rochester, N. Y.—36
An exhibit consisting of the Ritter Three-Inch Dental X-Ray Unit and the Standard Ritter Dental Chair.

UNITED STATES RADIUM CORPORATION .... New York City—37
Showing latest modes in applicators, radium therapy, etc.

ENGELN ELECTRIC COMPANY .... Cleveland, O.—A and B
Showing the new Keleket Tilting Fluoroscope, together with their new x-ray apparatus for radiographic work. Questions about this apparatus or general x-ray work solicited.

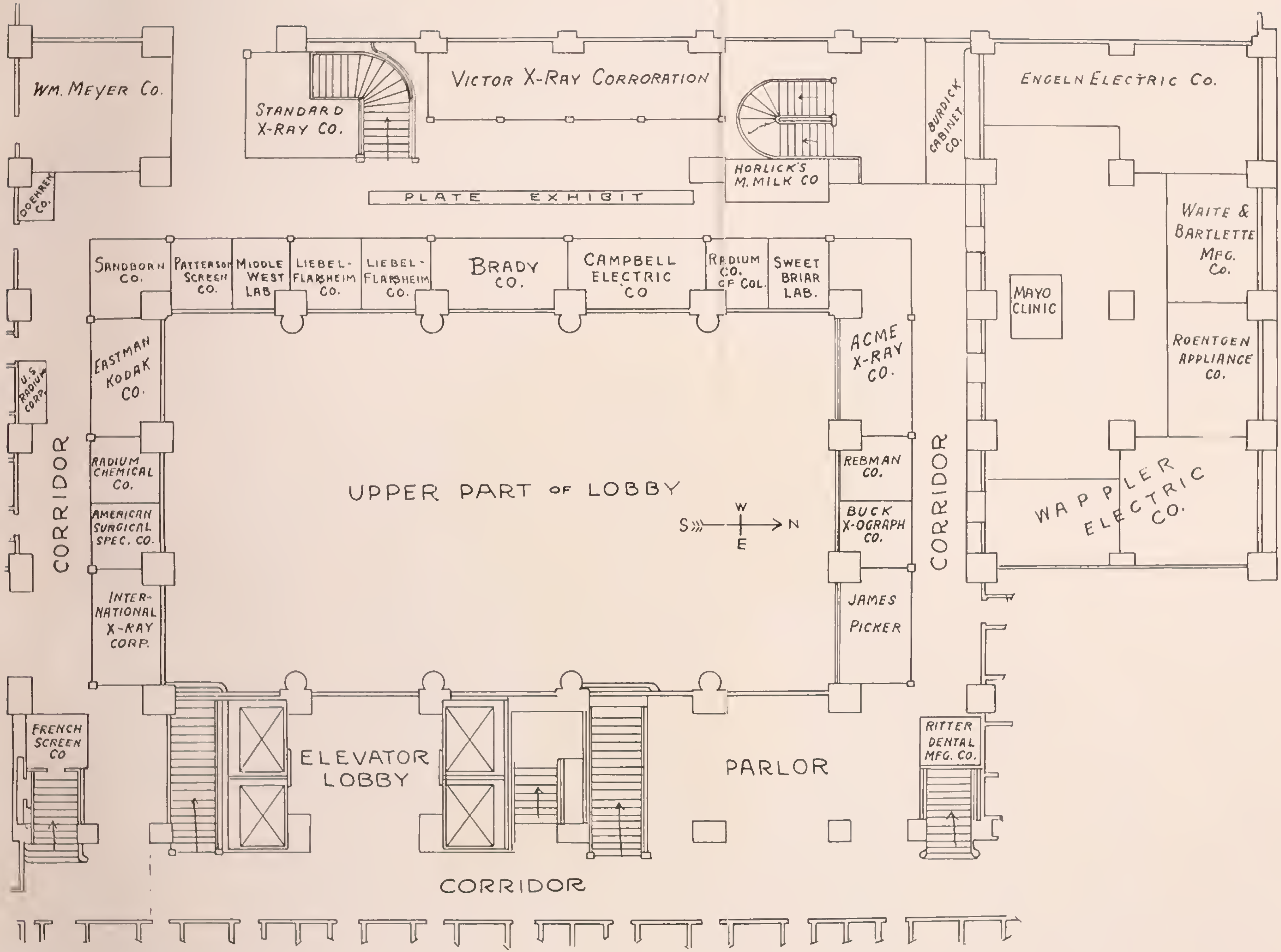
WAITE AND BARTLETT MANUFACTURING CO... Long Island City—C
Featuring an Oil Immersed X-Ray Unit, New Sphere Gap for accurate reading of high voltage, New Synchronous Motor Treatment Time Switch, New Vibrating Potter-Bucky Diaphragm, Twenty-Inch Interrupterless Machine.

ROENTGEN APPLIANCE COMPANY .... San Francisco—D
This company will show a full line of x-ray apparatus and appliances.

WAPPLER ELECTRIC COMPANY, INC...... Long Island City—E and F
A complete showing of all the new Wappler developments, including Wappler Deep Therapy X-Ray outfit and x-ray producing plant, new Deep Therapy Table, new Treatment Tube Stand, Wappler Sphere Gap, Wappler Unit Coronaless Aerial System, Wappler Portable X-Ray Unit, Wappler Vertical Plate Changer, Wappler No. 4 Table, Wappler No. 5 Bedside and Hospital Unit combining both Dental right angle tube three-inch ten millamperes and regular five-inch thirty milliamperes tube, and the new Wappler Junior Vertical Fluoroscope, latter of which uses a thirty milliampere Coolidge self-rectifying tube.

THE HIGH TENSION TRANSFORMER AND EQUIPMENT CO....
.... Hoboken, N. J.—17
Demonstrating a twenty-inch machine, a ten-inch machine, cautery, and high frequency apparatus taking a uni-directional current direct from secondary terminals of high tension transformer. This is something distinctly new in x-ray construction, making possible high potential machines much smaller in size and lighter in weight.

EXPLANATORY NOTE—Consolidation of Sweetbriar Laboratories Exhibit with Brady Company Exhibit, and substitution of High Tension Transformer and Equipment Company in space 17 occurred too late to show in plat of space. Members and visitors will please note substitution.



WM. MEYER CO.
STANDARD X-RAY CO.
VICTOR X-RAY CORRORATION
HORLICK'S M. MILK CO
BURDICK CABINET CO.
ENGELN ELECTRIC CO.
DOEHREN CO.
PLATE EXHIBIT
SANDBORN CO.
PATTERSON SCREEN CO.
MIDDLE WEST LAB
LIEBEL-FLARSHEIM CO.
LIEBEL-FLARSHEIM CO.
BRADY CO.
CAMPBELL ELECTRIC CO
RADIUM CO. OF COL.
SWEET BRIAR LAB.
WAITE & BARTLETTE MFG. CO.
MAYO CLINIC
ROENTGEN APPLIANCE CO.
U.S. RADIUM CORP.
EASTMAN KODAK CO.
ACME X-RAY CO.
RADIUM CHEMICAL CO.
REBMAN CO.
CORRIDOR
UPPER PART OF LOBBY
CORRIDOR
WAPPLER ELECTRIC CO.
AMERICAN SURGICAL SPEC. CO.
BUCK X-OGRAPH CO.
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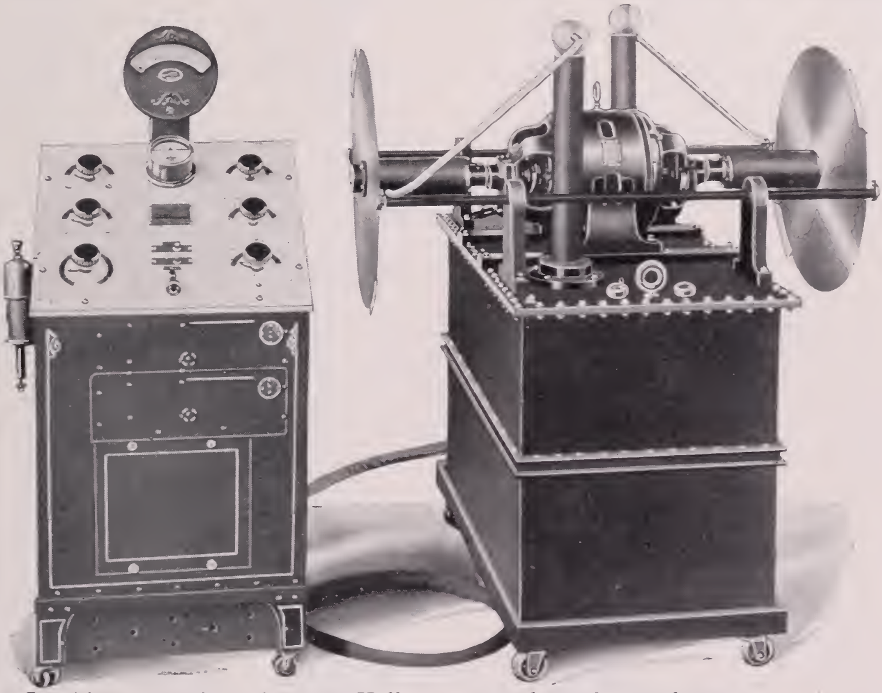
INTER-NATIONAL X-RAY CORP.
JAMES PICKER
FRENCH SCREEN CO
ELEVATOR LOBBY
PARLOR
RITTER DENTAL MFG. CO.
CORRIDOR

Kelley-Koett Deep Therapy Apparatus

DEVELOPMENTS are coming so rapidly the radiologist is pretty sorely pressed to judge, with any sense of security, which of the recent machines for deep therapy that have come on the market in the last few months, affords the greatest practical possibilities in high potential treatment.



In this connection, the new Kelly-Koett apparatus, of which to the time of writing, only meagre information is obtainable, has some distinctive features which commend it to the more scrutinizing members of the profession. These features may be stated in brief fashion:

1. COMPACTNESS. The transformer, or rectifying unit, measures 48x52x60 inches over all, so that floor space of 6x8 feet will allow ample room for convenient operation and accessibility.

2. REMOTE CONTROL. This part of the x-ray unit carries kilo-volt meter, polarity indicator, rheostat and auto-transformer switches, motor and main switches, and two filament controls and transformers.

3. CAPACITY. The transformer is said to be capable of producing and operating at 280,000 peak volts, as measured by the sphere gap, or an equivalent of a twenty-inch spark gap.

4. METHOD OF CONSTRUCTION. A synchronous motor is mounted on top of the transformer

and enclosed in the cabinet of the rectifying unit. As will be noticed in the illustration, the axis of the motor extends outward far enough to provide proper counter-balance for the motor and sufficient space for rectifying disc at each end. This is a novel method of construction, for that it makes possible a more compact unit, and the rectification of an unusual voltage, providing sufficient capacity to operate two tubes simultaneously at the same voltage though at different milliamperage.

5. MILLIAMPERE METERS. Two milliampere meters are set into the circuit leading to each tube, providing a double check, and making four milliampere meters to the unit.

6. METHOD OF RECTIFICATION. No definite information has thus far been received concerning the method of rectification employed. A more or less perfunctory study of the outstanding features of the machine as shown in the illustration, however, leads one to the conclusion that this machine rectifies both phases of the electrical wave. This would seem to be borne out by the use of two discs, one at either end of the axis of the synchronous motor, to one of which, judging from the appearance of the take-off circuits, one phase of the current is conducted, and to the other of which the other phase is conveyed. As nearly as can be determined by this purely theoretical calculation, the one phase or peak of the wave passes to the disc through the insulated tube leading from the sphere on top of the terminal post, is diffused over the surface of the disc, picked up and discharged at the point of contact by the connections or plates on the disc through the horizontal cross conductors, and then to the point of take-off for the x-ray tube. The other phase or peak of the wave follows a like circuit, but from the opposite side of the transformer. If this theory is sound, then this transformer converts both phases of the alternating current into a uni-directional current, and eliminates the shunt load or surge, to which most operators and owners of x-ray machines have been intimately introduced by transformer blow-outs.

The method and place of take-off to and return from the x-ray tube is not shown by this illustration. It is plainly evident, however, that both discs operate in the circuit, whether one or two tubes be in use.

7. SPHERE GAP. This machine is equipped with a sphere gap providing for the accurate measurement of voltage. These spheres are 12.6 C.M. in diameter.

One of these machines will be on exhibit at the Annual Meetng and will doubtless prove of unusual interest.

Acme Combination Table

THE first piece of apparatus placed on the market by the Acme X-Ray Company is a combination table for radiographic, stereoscopic and fluoroscopic work in any position or angle from the Trendelenberg to the vertical and counterbalanced in such a way as to make the hand raising gear mechanism extremely smooth in operation.

It is equipped with ball-bearings throughout and friction joints have been substituted extensively for hand lock screws, which makes for ease of operation and the saving of time.

For fluoroscopic work the screen and holder, which is adjustable to every possible angle, covers a very large fluoroscopic field, equal to two-thirds of the entire area of the table top.

Any part of the body may be radiographed without moving the patient as by means of an ingenuous arrangement cassettes can be inserted at three different points along one edge of the table top, so they will center below the head or shoulders, the torso, or the legs, which ever desired, and just as easily removed. This is a very necessary arrangement in stereoscopic work.

The combination head and shoulder rest and seat is instantly attached to any desired position.

Added protection against possible shocks is furnished by the specially constructed insulating tubes connecting the transformer with the high tension system.

The separate portable control stand is equipped with all necessary meters and switches together with a Coolidge transformer regulator and an auto transformer which will, without a separate means of adjustment, take care of any rise or drop in the line voltage between 100 and 120. The circuit breaker, which is also embodied in the control stand operates in such a manner as to open the main line circuit instantly in case of an overload caused by exceeding the limits of the tube or by the patient or operator coming in accidental contact with high tension wires. It also serves as a protection against burn-outs in the transformer.

The outfit will be supplied in various combinations from the plain tilt table to the complete unit and for use with either the radiator type or Universal Coolidge tubes.

Victor High Frequency Apparatus

IN the field of physiotherapy there is probably no modality that finds wider application than the high frequency current in its various forms.

The efficacy of the high frequency current was long ago established, and while at first its adoption in general medical practice was gradual, in recent years the medical profession has seen convincing results as obtained by the medical departments of the armies and navies of the allies, and today in the treatment of industrial injuries and diseases.

With the rapidly increasing use of this modality, there has been a demand for higher perfection of apparatus for its administration. To many physicians it did not prove its efficacy simply because of shortcomings in the apparatus itself, electrically and mechanically. This was indeed unfortunate, for the high frequency current is invaluable to practically every physician, a fact which is substantiated by those who have investigated, and used it over a considerable period of time.

Victor engineers have just accomplished further and important improvements in high frequency apparatus, as represented in the New Model "Wantz" and the Victor Portable High Frequency Apparatus. They mark definitely an advance in high frequency therapy, offering as they do the approved forms of current, unvarying in quality and under the finest regulation. These desirable and important features are realized with a control so simple that the physician can learn to operate the machine readily, and has to concern himself only with the therapeutics of the current.

THE NEW VICTOR MODEL "WANTZ"

This apparatus offers complete service, delivering every approved form of high frequency current, both Tesla and d'Arsonval. Heretofore the physician wishing to use both Tesla and d'Arsonval currents had to invest in two separate machines.

There are many important features in this apparatus, all of which are essential to the best results. Limited space prevents detailed description. Brief mention only of the range and nature of service this machine offers will be made.

The diathermy current is probably as widely used today as any other one of the high frequency modalities. Diathermy is synonymous with thermopenetration, or the treatment of deep-seated conditions with heat. In this instance the heat is conveyed electrically to the tissues in the affected part within the body. There is a mistaken idea that the d'Arsonval current delivered at an unusually high frequency is the ideal for diathermy, but it will be found that the resulting high heat confines itself largely to the surface of the part treated. Such machines, therefore, fall short in the treatment of the trunk or a heavy hip. From the Model "Wantz" is available a diathermy current (d'Arsonval) with the necessary high voltage which these other machines do not have, to carry the heat through to the part under treatment. Diathermy treatment of deep-seated conditions can not result in a full measure of success under the circumstances first mentioned.

A true Oudin current, absolutely free from faradic, is also available, with means of very fine adjustment. The cold spark is taken from the top of the Oudin resonator, and a d'Arsonval current, so that it is possible to do any form of electro-coagulation or bi-polar desiccation. The uni-polar spark is also available when that is desired.

Auto-condensation can be given with either Tesla or d'Arsonval current; both these currents, as above stated, being obtained from this apparatus, making it practically two machines in one.

In addition to the above mentioned modalities, this machine delivers currents for auto-conduction, effleuve, head breeze, fulguration (both superficial and orificial) and vacuum or non-vacuum electrode treatments.

The well known disc type spark gap, as used exclusively in the Model "Wantz" is one of the most important developments in high frequency apparatus in recent years. It permits of all-day service, without having to rest the machine between treatments, and with each setting the resulting current will be delivered without varying in quality throughout the treatment seance. This in contrast with the inconsistencies of spark gaps of previous design.

The elimination of all danger of grounding through patient, and completely enclosed switches and spark gap to prevent accidental contact by patient or operator are other desirable features of this apparatus.

NEW VICTOR PORTABLE HIGH FREQUENCY APPARATUS

This machine also offers a complete range of high frequency modalities, but differs from the larger apparatus in that it is restricted to intermittent service. Being of the portable type, this advantage is obtained at the sacrifice of the all-day service, as provided in the Model "Wantz."

The proportions of this portable machine are to allow it to be conveniently moved to the bedside of the patient in the hospital or home. In spite of its compactness, the machine has a capacity considerably greater than many machines on the market of the stationary type.

The various modalities delivered by this portable outfit are as true in form as those obtained from the larger apparatus; in short, it in intended for serious work. It is a highly practical and efficient outfit for intermittent service. Where the number of office treatments require a machine to be running constantly during the day, the logical machine is then the Model "Wantz."

From this portable outfit the following modalities are obtainable: Electro-coagulation, with a current range even beyond the requirements; auto-condensation with both Tesla and d'Arsonval currents; diathermy, including treatment of deep-seated lesions; fulguration, superficial and orificial, either uni-polar or bi-polar; vacuum or non-vacuum electrode treatments in all forms.

Eastman Dental Film Developing Cabinet

THE Eastman Company has just put on the market a Dental Film Developing Cabinet which should prove mighty helpful and economical for dentists and others who feel that they should do x-ray work but have no dark room space or hesitate to incur the cost of properly equipping a dark room.

The cabinet in question is a complete miniature dark room with tank development, safelight, and provision for circulating water.

The tank unit consists of an outer tank of monel metal and contains two smaller monel tanks with space between for washing. Four developing hangers are included, each holding ten dental films, so that the unit affords ample facilities for a large amount of work.

Any Eastman dealer will be glad to demonstrate this unit.

Wm. Meyer Company Transformer

STRIVING to accomplish the demands of the roentgenologist for accuracy, safety and convenience in a modern transformer the William Meyer Company of Chicago lately announced one in which the milliameter and kilovolt meter, both tied into the high tension circuit and the latter graduated as a back-up meter, are mounted on the low tension switchboard alongside the primary controls.

There is, of course, no question about the convenience of having these two instruments so accessible and so easily readable. But whether this company has evolved some method of overcoming the inaccuracy of distance between the measuring instruments and the terminus of the high tension circuit at the point of discharge into the x-ray tube cannot be determined without thorough examination. It may be said, in all fairness, however, that Mr. Meyer assures us such is the fact.

Frankly, the statement that the kilovolt meter is graduated as a back-up meter suggests that this company has not yet gained an absolute instrument of precision. The problem of back-up is so variable, considering the many inconstant factors, that it is doubtful whether this principle holds the correct method of approaching the solution.

But the Meyer Company may have solved this question, wherefore we reserve final decision. If it has solved it, then it will be our great pleasure to comment on this particular piece of apparatus in detail to the point of specificity. That it is impossible to do without complete data and an opportunity for examination, demonstration and study.

One of these transformers will be on exhibit at the annual meeting, where members and visitors will have ample opportunity to look it over and get first-hand information.

ABSTRACTS AND REVIEWS

Surgery Versus Roentgen Ray in the Treatment of Hyperthyroidism. G. W. Crile, M. D. Journal A. M. A., October 22, 1921.

THE treatment of Graves Disease is practically limited to two methods, viz., surgery and roentgen ray. In defense of surgery the writer elects to show that operative discomfort is probably less than transportation to and from the x-ray therapy room. The average period of disability after thyroidectomy is thirteen days and the mortality rate is one per cent. He believes that the end results are better. The review of 208 articles of the use of the roentgen ray shows that at present there is no standardized method of roentgen treatment, hence no definite statistics of end results are available. The ray nearly always reduces the pulse rate promptly. There is a divergence of opinion as to the effect of the ray on the gland itself. The advantages are: no fatalities, no scars, no interference with the patient's occupation, and no pain. If unsuccessful surgery is still possible. He admits the advantage of the ray in the adolescent thyroid. He quotes Christie to show that thryoidectomy exerts greater immediate curative effect than the treatment of roentgen rays.

V. M. MOORE.

NOTE—The author has evidently overlooked microscopic proof of the action of radiation on the thyroid gland.—Ed.

Observations on a New Method of Roentgen Ray Therapy in Psoriasis.

BROCK at Kiel is treating psoriasis through the action of the x-rays on the thymus and found that the psoriasis either improved or got worse under treatment. The action of the ray is either stimulative or destructive and the satisfactory treatment consists in stimulation. Hence cases which were made worse at first were apparently due to over treatment, but these began to improve after six months, the result being apparently a paralysis of the gland action with subsequent regeneration and hypersecretion. They advise against giving a second dose within two months on account of the danger of cumulative action. This method of treatment gives better results than treatment of bone marrow or of large skin areas. The authors adopted an eight and one-half inch spark gap, 3 mm. aluminum, 5 milliamperes 2 minutes time 10-inch distance and with this formula treated twenty-three patients. Thirteen were markedly improved, and in five the eruption vanished completely. Recurrence often followed, but with less severity than the original eruption.

V. M. MOORE.

Radiotherapy in Painful Sacralization. Japiot in Lyon Chirurgical, July-August, 1921.

THE author observed six cases of very painful lumbar neuralgia and sciatica in which radiography revealed sacralization of the fifth lumbar vertebra, and in which all other treatment, including epidural injection, failed. These were subjected to x-ray treatment. The writer obtained complete cures in five cases and considerable improvement in one case, which was complicated by a cervico-bronchial neuralgia in addition to the lumbar condition. In one of his cases the painful condition had been of nine years duration, and was so severe that the patient was completely incapacitated and did not work for several years. Two treatments in two weeks enabled the patient to resume work, and freed him completely from his pain. None of the cases required more than three or four treatments. The duration of the illness did not seem to have any bearing on the response to the treatment. Nor does the character of the pain determine the quality and quantity of the treatments, as the most lancinating pains were stopped after the first light treatment.

All the author's cases were thoroughly studied and sacralization was found to be the only possible cause of the trouble.

Three of the cases presented besides the severe pain also slight sensory and trophic disturbances, and while the radiotherapeutic action on the pain was very rapid it took from several weeks to some months before the sensory and the trophic conditions came back to normal.

The technique is essentially the same as for sciatica. The rays are applied over the sacro-lumbar region, that is, over the area where the roots of the sciatic nerve take their emergence. About 2 or 3 H is given through 1 mm. aluminum filter. This is repeated in fourteen days. No more than 4 H should be applied in one treatment.

The writer offers no satisfactory explanation regarding the therapeutic action of the rays. He advances the idea that the rays besides having a general sedative action on the irritated muscles and ligaments resulting from a mechanically incorrect lower back, also may exert a direct action on the nerve sheaths.

A. M. PFEFFER.

Stimulative Irradiation of the Spleen in Obstetric and Gynecologic Cases. E. Vogt, Woman's Clinic of the Tuebingen Uni. in Mediz. Klin. Aug. 14, 1921.

THE fact that irradiation of the spleen raises the coagulability of the blood leads the author to apply irradiation as a therapeutic measure in various hemorrhagic conditions as well as a prophylactic measure previous to some surgical procedures. Stimulative irradiation of the spleen is followed by the highest coagulability in 10 to 15 hours, while its action is entirely over in three days. Purasz and Tichy irradiated their surgical cases the night before operation. The technique is very simple. The patient lies on the right side, the splenic area is outlined, a field of 10 by 15 cm is exposed, and 0.5 mm. zink and 1 mm. aluminum used for filter, one-third erythema dose is used for therapeutic action, and one-fourth for prophylactic action.

The writer found irradiation effective in 50 per cent of his sixty-eight cases, which consisted of various menstrual disturbances, such as menorrhea, metrorrhagia, oligomenorrhea, bleeding resulting from uterine displacements, from various pelvic inflammatory conditions, from pelvic tumors, and several cases of postpartum hemorrhage.

A number of gynecologic and obstetrical operations were almost bloodless following a prophylactic dose.

Tichy obtained similar results from stimulative irradiation of the liver.

A. M. PFEFFER.

Roentgen Diagnosis of the diseases of the Pancreas. Pueschel in Fortschr. a. d. Geb. d. Roentgenstr. Vol. XXVIII, No. 5.

ROENTGENOLOGICAL examinations for diseases of the pancreas are rarely used, nor are there any characteristic findings, but a number of signs may prove corroborative to the clinical picture. The following roentgen signs have been observed by the writer:

1—Formation of a high small stomach.
2—Bowing outward of the lesser curvature.
3—Formation of a filling defect simulating gastric carcinoma.
4—Reverse peristalsis.
5—Stenosis and displacement of the duodenum.
6—Widening of the papilla of Vater evident by its retention of barium after complete emptying of the stomach and duodenum.
7—Compression of the transverse colon.
8—Visualization of pancreatic calculi.

A. M. PFEFFER.

The Action of X-Rays and Radium on Bone and Cartilage During the Development Stage. G. C. Segale, Radiologia Med. 1921, No. 7.

THE following conclusions are based on animal experimentation by the author:

Even small doses appear to have a harmful action on growth of the limb if applied during the developmental age. If medium doses are applied the changes begin early, in less than four days, are not transient, and even increases. Growth ceases, the limb becomes shorter, bowing of bones may occur, the thickness of the diaphysis diminishes, and the muscles undergo atrophy. Later, in about 59 to 83 days, the structural changes are appreciable; there is almost complete absence of vascularization, changes in the bone lamellae, and checked ossification of the diaphyseal cartilage. During the developmental age the epiphyses are especially radiosensitive.

A. M. PFEFFER.

The Roentgen Treatment of Bone and Joint Tuberculosis. Prof. Stein in Mediz. Klinik, Nos. 33, 34 and 35, 1921.

AFTER emphasizing his claim that the great value of sunlight and artificial light in the treatment of bone and joint tuberculosis is in part due to the more penetrating ultra-violet rays, the author mentions the fact that various investigators, among whom are found Kirmisson, Iselin and M. Fraenkel, have used roentgen rays in these conditions since 1898. The writer is of the opinion that while the roentgen rays have a general beneficial effect equally with sunlight or any other artificial light, they seemed to exert a specfic effect on tuberculosis tissue in the cases under his observation. A light dose of x-rays which would be stimulative to carcinomatous tissue causes the decomposition of the lymphocytic elements of the tuberculous tissue, and further application of the rays produces shrinkage of the same with its replacement by connective tissue.

The writer describes his technique as rather simple. He advises the use of a hard tube of about 9 to 10 Wehnelt, and 3 to 4 mm. aluminum filter. The choice of the rays depends upon the stage and character as well as the position of the lesion. Softer rays are used when the destruction and the resorption of the lesion is aimed at, and harder ones are used when it is desired to bring the shrinkage of the irradiated tissue. The dose is about 20 to 40 per cent of the skin erythema unit for one treatment. Such treatments are repeated at intervals so that the skin should only get one erythema dose in three to four weeks.

The writer combines his roentgen treatment with sun baths, artificial light baths, and the administration of cod liver oil.

Contrary to the opinion of Iselin, the writer obtained excellent results in tuberculosis of the shoulder, hip, and the ileosacral joints. Similar results were obtained in tuberculous spondylitis. The best results were obtained in the early stages of the disease, and the author recommends irradiation in those cases as the method of choice. Notwithstanding the warnings of some investigators who found, in the experimental work on animals, that the application of x-rays caused cessation of bone and cartilage growth, the writer never noted any such interference with growth in any of his numerous cases. On the contrary, he observed a rather stimulative action on growth in some of his cases.

In the cases under his own observation the writer found 50 per cent cures, 45 per cent improvements, and 5 per cent failures. Moll of the Kraske clinic had 60 per cent cures, and Strhmeyer of the Lexer clinic had 80 per cent cures. The writer claims that if the work would be limited to beginning stages only the percentage of cures would be greatly increased.

While operative measures have been found less necessary since the irradiation treatment has become more frequent, the author advocates the application of all useful orthopedic measures, except that when a cast is applied an opening should be made for the application of the x-ray treatments.

A. M. PFEFFER.

Sixty-five Cases of Cervical Ribs. I. S. Trostler, M. D., F. A. C. P. Medical Record, September 17, 1921.

THIS is a careful tabulation of the radiographic findings, with symptoms, clinical findings, and a brief history of each case.

The diagnosis was made by the referring physician in only twenty-six per cent of the cases. Neuritis and progressive muscular atrophy were the diagnosis in twenty-eight and nine cases respectively. Nine of the cases were examined for other reasons.

The cases numbered twenty-one males and forty-four females.

The number who had cervical ribs on the right side only was three, on the left side only four, and on both sides fifty-eight. Seven presented no symptoms.

The youngest patient was four and one-half years old, the oldest sixty-five years. The average age of the sixty-five was thirty-nine years.

The average duration of symptoms in fifty-eight cases was forty-five months.

Thirteen were operated, and all were improved or cured.

E. W. ROWE.

X-Ray Burns. Dr. Arthur Dean Bevan. Surgical Clinics N. A. August, 1921, p. 935.

THIS is one of the important and unusual problems in surgery arising in the last twenty-five years.

Most of the burns in x-ray workers are found on those who handled it before the days of protection. Occasionally burns present themselves coming from experts. X-ray burns in patients are still common, for many of the workers are not expert.

One case presented is a young man of 25 who was treated for psoriasis. A massive dose was administered, which resulted in a burn six inches long and three inches wide over the anterior aspect of the leg. The original burn healed over, but the skin was low in vitality and sloughing occurred. The pain was so severe that he took morphine. There was a loss in weight and the nervous condition was affected. The burn was excised wide of the margin and down into healthy muscle and fascia. Thiersch grafts were used to cover the denuded areas.

The second patient was an old lady of 75 treated by x-ray for eczema. The burn was five inches long by two and one-half inches wide on the anterior surface of the leg. The patient had been bedridden for many months, chiefly on account of the pain.

The pain is a very important factor in x-ray burns, being like the pain of senile gangrene, due to obliteration of blood vessels and starving of the nerves of their normal blood supply. The pathology is practically the same. In x-ray burns about the anus the pain is agonizing and usually requires increasing doses of morphine to control. As soon as all the dead tissue is dissected out, the pain ceases.

This second patient was treated as the first case, and now, three weeks after operation, the wound has healed completely and the pain has ceased.

These burns should be treated early by excision and grafting. Out of twenty-five or thirty cases treated on his service, several developed malignancy. Severe burns such as these two patients had are not so likely to cause maliginancy as the long-standing irritation in x-ray workers.

The x-ray should be used only by trained hands. Burns may occur even in the hands of the greatest expert. Early removal of the damaged tissue and skin grafting is the second lesson to learn. This not only cures the patient, but lessens the dangers of malignancy.

E. W. ROWE.

Diaphragmatic Hernia. P. E. Truesdale, Fall River, Mass. Jour. A. M. A. Sept. 24, 1921.

"HERNIA of the diaphragm is one of the concealed deformities which roentgenology has exposed for study and cure, essentially during the past decade." These are the opening words of this article. The matter presented consists of a review of the literature, of the varieties of hernia, of the mechanism in diaphragmatic hernia, of the symptoms and diagnosis, and of the roentgen aspects.

Forty-three cases from battle wounds have been added from the recent war.

Prints from excellent roentgenograms illustrate some of the most interesting cases.

E. W. ROWE.

The Relative Value of Laboratory and Clinical Methods of Study in the Diagnosis of Tuberculosis. F. M. Pottenger. Am. Jr. Med. Sci. Sept. 1921, p. 352.

INTENSIVE study of the patient should come first, supplemented by laboratory study. The diagnosis should not depend on the laboratory findings, but these findings should be weighed along with those elicited by clinical methods and the diagnosis be based on the analysis and correlation of all the data obtained. The diagnosis should be the result of reasoning.

The most useful and most commonly employed methods of examination for pulmonary tuberculosis are:

1. Clinical history.
2. Physical examination.
3. Examination of sputum.
4. Roentgen rays.
5. Tuberculin test.
6. Complement fixation.

Sputum tests and the complement fixation test have many sources of error.

The roentgen ray may be used to a great advantage. To be of value in early tuberculosis it requires an expert and even in the hands of an expert the results are often doubtful. Except in the hands of genius it should never be relied upon wholly for a diagnosis. In conjunction with other data it is valuable. It should be used as a routine in the clinical diagnosis of all cases of pulmonary tuberculosis, and diagnosis made on the basis of all the data obtained.

E. W. ROWE.

Radium and X-Ray in Tumors of Hypophysis. Quick, D. Archives of Ophthalmology, v. 49, 1920, pp. 256-267.

DR. QUICK points out that, even with the advance made in pituitary surgery in the past few years, it does not represent by a wide margin the ideal treatment for tumors in this location; and consequently many other methods have been tried. During the past few years, x-ray and radium have been used more and more. While the results of this work to date are very incomplete and contradictory, reports from many who have been trying this method are encouraging. Reports from different observers show that the most marked improvement was the more or less complete disappearance of headaches, dizziness, nausea and vomiting. In several instances there has been decided improvement in vision.

Experiment in the use of radium, at the Memorial Hospital, New York, on three cases, showed favorable results and warrant them in looking forward to future work in this line with considerable optimism. Three factors stand out in favor of treatment by x-ray or radium: (1) There is no operative mortality. (2) Pressure symptoms respond much more promptly, without pain or inconvenience to the patient. (3) Radiation offers a hope to every case of pituitary tumor, whereas surgery is confined to a small group of hyperplasias and benign tumors. Kuttner reports the successful treatment of malignant tumor of the hypophysis with radium, and Gravezzenski one cured by x-ray.

E. W. ROWE.

Radium in Gynecological Service, St. Luke's Hospital. Harold O. Jones, Chicago. Surg. Gyn. & Obst. Sept., 1921, p. 409.

THE cases treated number 500.

1. Fibroids—120 cases.

In selected cases radium will control the hemorrage, and cause retraction of the tumor in 90 per cent of the cases. The size should not be greater than that of a three months pregnancy. Only patients approximating forty years should be treated. Earlier surgical removal is advisable

Dosage varies from 1,000 to 1,800 millicuries hours.

The menopause is more acute than normal, but yields to corpus lutem or ovarian residue. The uterus does not change much in size before the end of the twelfth week.

Repetition was necessary in seven cases.

Sixty-nine per cent were entirely relieved for over two years. Not enough time has elapsed to report on 22 per cent.

2. Hemorrages—129 cases.

Radium should not be resorted to until organotherapy has been given a trial. The effort should be made to produce only enough cessation for relief and not a permanent menopause. Radium is practically specific in the bleeding of menopause. Idiopathic bleeding is usually controlled.

From 750 to 1,000 millicuries hours should be sufficient. Begin with an initial dose and repeat in two or three months. The first menstrual period may be profuse, the second is less, and the third practically none.

Eighty-one per cent have remained relieved for over two years. Sixteen per cent have been relieved, but the time has been insufficient to justify a report.

3. Carcinoma—60 cases

Radium is a palliative agent of the greatest merit. As a curative agent it ranks at least equal to other methods.

Radium is inserted into the uterus. Needles are inserted directly into the tumor tissue. Emanations may be inserted into the malignant growth. The dosage is about 3,500 millicurie hours for the initial dose. The number of treatments varies after waiting eight to twelve weeks each time. Deep roentgen therapy is urged in conjunction with radium.

In thirty-five cases diagnosed as inoperable the benefit was great.

In forty-five cases radium was combined with surgery. Five cases are free after one and one-half to two years. The others have not been heard from or the time is too short to tell much about them.

4. Leucorrhoea—60 cases.

Leucorrhoea yields satisfactory results. Any gland or place harboring bacteria must be treated surgically.

5. Miscellaneous—100 cases.

These are mostly skin cases. Results are good.

Study of Liver Atrophy by X-Ray Examination. Dr. Geo. S. Strathy, Toronto General Hospital, Canadian Medical Association Journal, December, 1920.

THIS paper is based on the x-ray examination of the liver in forty cases of salvarsan poisoning presenting overseas work. The author takes up the method of measuring the liver, and discusses the difference between the x-ray shadows of normal and atrophic livers. The most characteristic sign of liver atrophy is the acute angle formed by the junction of the shadows of the upper surface of the liver and the vertebral column. This sign is corroborated by measurement of the liver diameters and comparison with the normal.

Decrease in the transverse diameter of the liver was more commonly found than decrease in the depth. This decrease is usually shown by the left border of the liver being shifted to the right rather than by the right border being displaced to the left. This shifting of the left border to the right gives rise to the acute hepatico-vertebral angle, and to a dome-shaped appearance of the upper surface of the liver.

This acute hepatico-vertebral angle was found in but one case out of a hundred normal individuals. It however may occur when the left lobe of the liver is displaced downward by fluid in the left pleura, as in pleurisy with effusion or haemothorax and also when a very large heart presses on the liver through the diaphragm.

The liver measurements are determined by fluoroscopy, rather than by radiography. At the end of expiration the upper and lower borders of the liver are marked on the skin in the right nipple line, and the depth measured at these two points. The depth of the normal liver, as determined by a large number of measurements, is five and one-half to six and one-half inches in the right parasternal line, and six and one-half ot seven and one-half inches in the right nipple line. Measurements from left to right were not made, but would be advisable, as confirming the acute hepatico-vertebral angle caused by narrowing of the transverse diameter.

Atrophy of the liver, determined by fluorscopic examination, has been found in cases of arsenical poisoning, catarrhal jaundice, and should be looked for in all cases of chronic dyspepsia, which often are slight cases of atrophic cirrhosis.

L. J. CARTER.

Ileo-caecal Regurgitation Symptom Complex. Dr. Wm. Goldie, Toronto, Ont. Can. Med. Monthly, April, 1920.

THE writer analyzes a number of gastro-intestinal examinations and attempts to show that there is a symptom complex definitely related to ileo-caecal regurgitation as apart from the symptom complex associated with organic ileo-caecal stasis.

In the series examined there was function fault at the ileo-caecal valve, as evidenced by ileal content in the morning after an evening barium meal, and by ileo-caecal valve incompetence for the barium enema.

With this function fault was associated the following symptom complex:

(1) Distress in lower abdomen most marked in right lower quadrant.

(2) Loss of appetite.

(3) Auto intoxication syndrome—tired, weak, pale, etc.

This symptom complex and this function fault might conceivably be associated with either stasis or regurgitation at the ileo-caecal valve. The factor, however, that points to regurgitation rather than stasis is the time of occurrence of the symptoms. It is on awakening and before breakfast that the distress and the gastric symptoms are not evident. During the forenoon they lessen or disappear. This time of symptom occurrence is different from ileal stasis. In the latter the distress is complained of after the mid-day meal, and if the mid-day meal is omitted there is no distress. So that the association must be with ileo-caecal regurgitation and not with ileo-caecal stasis.

Of course, it is not inferred that ileo-caecal regurgitation is the sole cause of the symptom complex. For ileo-caecal incompetency occurs so frequently without symptomatology, being found in one out of every six gastro-intestinal examinations. There possibly is a common cause of both the regurgitation and the symptom complex, such as defective innervation, general disease, or physical or chemical influences from the distal colon.

Operative reconstruction of the ileo-caecal valve has not proven a success. Medical treatment consists of small doses of saline, three or four times a day, an enema at night, means to relieve the nervous tension, and regular physical exercise.

L. J. CARTER.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC. REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of Journal of Radiology, published monthly, at Omaha, Nebraska, for October, 1921.

STATE OF NEBRASKA } ss.
COUNTY OF DOUGLAS }

Before me, a Notary Public, in and for the State and County aforesaid, personally appeared H. S. Tyler, who, having been duly sworn according to law, deposes and says that he is the Business Manager of The Journal of Radiology and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

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HERBERT S. TYLER,

Business Manager.

Sworn to and subscribed before me this 31st day of October, 1921.

CARL T. SELF,

Notary Public.

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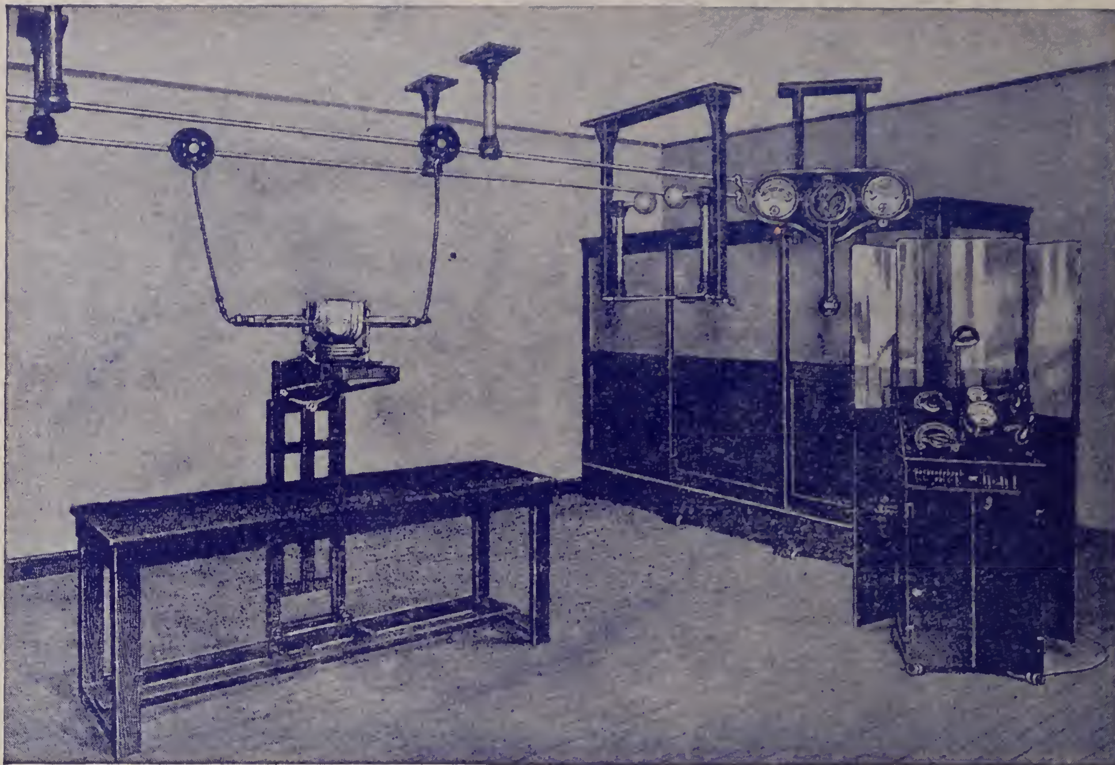

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