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## CONTENTS.

	PAGE.		PAGE.
A Case of Dermatitis due to the $x$ Rays. By T. C. GILCHRIST, M. R. C. S., L. S. A., - - - - -	17	Proceedings of Societies :	
Lesions induced by the Action of Certain Poisons on the Nerve Cell. Study VI.—Diphtheria. By HENRY J. BRADLEY, M. D.,	23	Hospital Medical Society, - - - - -	29
Puerperal Sepsis due to Infection with the Bacillus Aerogenes Capsulatus. By GEORGE W. DOBBIN, M. D., - - - - -	24	The Surgical Significance of Gall Stones [Dr. F. LANGE].	
		Correspondence :	
		A Case of Pneumo-cardial Rupture. By GEO. S. BROWN, M. D.,	33

## A CASE OF DERMATITIS DUE TO THE $x$ RAYS.

BY T. C. GILCHRIST, M. R. C. S., L. S. A., *Associate in Dermatology, Johns Hopkins University and Hospital.*

Since the discovery of the  $x$  rays by Röntgen, thousands of observations and experiments have been made with them both in Europe and in this country, and hundreds of investigators have exposed various portions of the body, particularly the hands, frequently, and for long periods of time, yet, after searching the literature, records of only twenty-three cases (including the present one) have been given where injurious results have followed their use, and in these, lesions of the skin only have been described. Of these twenty-three cases, twelve occurred in this country, one in Canada, four in England and six in Germany.

The first report which I have been able to find was a communication in the *Deutsche Medicinische Wochenschrift*, No. 28, 1896 (July 9th), from O. Leppin, an engineer, who had used his left hand a great deal in experimenting with the  $x$  rays. He remarked that the rays had the power of producing cutaneous lesions like sunburn. The hand presented a peculiar redness, was swollen, and a vesicular eruption appeared later on the middle and ring fingers. Where the skin was hidden by a ring it was white and quite normal. Even five weeks after discontinuing the use of the rays the altered skin gave the hand an older look than the normal one.

Professor Daniel, of Vanderbilt University, reported a case of alopecia as the result of exposure to the  $x$  rays three months previous to Leppin's communication.

After examining the other reports (the references are given at the end of the article) it was found that the eruptions of the skin presented many points of similarity, and differed chiefly in

severity, according to either the length of time and frequency of exposure to the rays or to idiosyncrasy of the patient.

In Dr. Sehrwald's case, which was described fully, the lesion occurred after one exposure of forty-five minutes to the  $x$  rays, and Dr. Crocker's patient had also experienced only one exposure of one hour when an eruption appeared. In Dr. Kollé's case, the patient, a boy, was exposed once, for forty minutes, when a pronounced alopecia followed, and a similar result is recorded by Professor Daniel in a man after one sitting; but the most interesting case of all was Professor Thomson's, of Harvard, who, being skeptical as to the deleterious results of the rays, made the only experiment which has so far been recorded, by exposing his finger to the  $x$  rays for half an hour and at one and a quarter inches from the tube, with a definite purpose of producing lesions if possible. The cutaneous trouble followed in nine days after the exposure. In two cases the patients had two sittings; in Dr. Dunn's case the first exposure was one hour, and the second, seven days later, lasted one hour and a half; and in Dr. White's case the patient had two exposures of thirty and forty-five minutes each on successive days.

In Drs. Stern's and Richardson's cases the lesions appeared after three sittings, and Dr. Skinner experienced cutaneous lesions after three or four exposures of short duration. In eleven cases the results had only followed after prolonged and constant use, the duration varying.

I append a table of the cases which I have been able to find in the literature.

Recorder.	Duration.	Distribution.	Character of the Lesions.	Subjective Symptoms.	Remarks.
O. Leppin (personal experience)...	Used very frequently for many days.	Left hand and fingers.	Peculiar redness, swollen, vesicles on middle and ring fingers.	No mention.	After five weeks hand still looks "older" than the other.
Dr. Marcuse.....	Young man, 17, exposed 5-10 minutes once or twice a day for four weeks.	Left half of face, back and chest.	Brownish redness on face, followed by desquamation; later, patch of alopecia above right ear; on back, large raw patch, exposing the corium with hemorrhagic points and exudation and a number of bullæ; on chest slighter changes.	No pain in face; on back much tenderness, but no pain was felt until just previous to the eruption.	Three months later, hair returning on the bald spot. Chest and back healed, but numerous fine cicatricial lines on the back and brown pigmentation.
Dr. Feilchenfeld	exhibited a somewhat similar case (no details given) to the Berlin Medical Society.				
Dr. Conrad.	A photographer had used the x rays very frequently and for some time.	1st and 2d fingers, left hand.	Swelling and stiffness of the joints; 1st and 2d fingers swollen and of a livid brown color on the dorsal surface from the tips to the carpo-metacarpal joints. Sense of touch greatly diminished. Mustache falling out and color was changed.	Fingers extremely sensitive and pain was of a burning and scalding character.	No mention.
Dr. Paul Fuchs (personal experience).	After prolonged use of the x rays.	Left hand and fingers.	Much swollen; skin was wrinkled, cracked and stained quite brown; condition of skin like a frozen hand; later, on further exposure, a vesicular eruption appeared.	None given.	
Dr. Schrwald.	In a boy 13 years old. Only one exposure of 45 minutes duration. Two weeks later eruption appeared.	Abdomen.	At first hyperæmia, then a vesicular eruption. Four weeks later central portion healed, but peripheral portion covered whole abdomen. Brown color. Exfoliation soon followed.	Itching when the vesicles appeared.	Cured in 9 or 10 weeks.
S. J. R. (personal experience).	Used the rays several hours daily and eruption appeared three weeks after.	Right hand and fingers. Later left hand.	Numerous dark little blisters appeared on right fingers; then marked redness and inflammation of the skin, which later became hard, very dry and yellow like parchment. Exfoliation followed. On further exposure tips of fingers became much swollen and nails affected. A colorless, bad smelling discharge came from beneath the nails, which were gradually thrown off. Left hand was substituted and similar symptoms followed.	After inflammation hand smarted very much. Skin became insensible to the touch. After second exposure serious discomfort and pain followed.	Results similar to those of sunburn but much more acute.
Dr. H. C. Dunn.	Man aged 35 years. Exposed first for one hour and afterwards for an hour and a half, the second with interval of seven days. Two days later eruption appeared.	Abdomen.	Three hours after first exposure some nausea. After second exposure, nausea, and on second day abdomen slightly red, like sunburn; redness increased in intensity until fourth day, vesicles appeared, which developed into bullæ. Eighteen days later the patch was $7\frac{1}{2} \times 8\frac{1}{4}$ inches between umbilicus and chest, and was smooth, glazed and weeping for some days, notwithstanding treatment.	No subjective symptoms; neither itching nor pain; the raw surface painless and almost insensitive.	Eruption healed after 28 days, but skin was like boiled fish skin. After cauterization of surface a slough separated and a tough yellow opaque membrane formed.
Dr. G. C. Skinner (personal experience).	Exposed the wrist 10-15 minutes for 3 or 4 days in succession. Ten days later eruption followed.	Wrist.	Reddening of the skin appeared first; this increased until it was almost purple; considerable swelling followed. Desquamation followed.	Great pain and excessive tenderness.	Process of repair was very slow.
J. Macintyre (personal experience).	Worked for months with the x rays before cutaneous lesions were produced.	Hand.	Appearance of a sunburn. Skin red and swollen, followed by exfoliation of the "epidermis" and loss of hair.		Author thinks condition due to heat and electricity; the latter the chief cause of injury to the tissues.
Dr. Freund.	10 days, child who had hypertrichosis.	Neck, back, upper arm and scalp.	x rays used as a depilatory for 10 days, when the hair began to fall out.	None given.	

Recorder.	Duration.	Distribution.	Character of Lesions.	Subjective Symptoms.	Remarks.
Dr. E. E. King.	Patient used the x rays for two and a half months from two to six hours daily before cutaneous lesion appeared.	Hand, left.	Hand felt stiff, then became swollen and large "blisters" formed; after five weeks rest he exposed the hand again 7-8 hours daily. In two weeks left hand became swollen, tender, discolored; vesicles followed, and the finger-nails began to fall off. The hairs disappeared. Left side of the face was also affected. The skin was swollen and erythematous, and the hair over the temple disappeared. Eyebrows were almost gone and left side of the mustache had almost disappeared.	Great pain followed the appearance of the blisters. Second eruption followed by aching. Face became tender and painful.	The case has been carefully and continuously watched.
Dr. M. J. Stern.	Patient was exposed at three sittings of 40-50 minutes duration. Eruption appeared two days afterward.	Extended from the side of the face down to the umbilicus.	Erythematous blush first appeared, which a few days later appeared like a severe burn, followed by a large slough.		Examination of the chest after a gun-shot wound.
Dr. F. Kollé.	A boy 12 years old. Whole body exposed 40 minutes. Sixteen days later alopecia appeared.	Right side of head.	Large area of alopecia over the region exposed to the rays. Hair fell out all at once the night previous. Skin slightly oedematous.	No symptoms.	Later, lanugo hairs began to appear.
Dr. J. C. White.	Young lady exposed to the rays 30 minutes on one day and 45 minutes on the next day. Eruption appeared the following day.	Sternal region.	Skin was first reddened, then blistered. Three months later the patch showed angry-looking granulations which had refused to heal.	Granulation surface very sensitive and the seat of severe neuralgic pain.	At the time of writing there were still two open spots.
Prof. E. Thomson.	Exposed half an hour at a distance of one and one-half inches from the tube. Eruption appeared nine days after.	Little finger of left hand.	Finger became hypersensitive, then dark red, swollen, stiff, and soon after vesiculation occurred. Pus formed and the epidermis became detached, but pustules remained over 3 weeks.	Pain.	
Dr. H. R. Crocker.	Boy aged 16. One exposure of one hour. Eruption appeared next day.	Epigastrium.	A Crookes tube placed five inches distant—flannelette shirt intervened. Next day, skin deep red in color. Nine days later vesicles appeared. Palm-sized patch, well-defined, purplish red. Vesicles increased in number; 9 days later the epidermis had separated. Healing very slow. Alopecia very slight.	Stiffness felt at first and soreness when the vesicles appeared.	
Prof. John Daniel.	Man; exposure 1 hour. Alopecia 21 days later.	One side of scalp.	Tube was 1½ inches distant from head. Bald spot was 2 inches in diameter; skin healthy.	None.	
Dr. M. H. Richardson.	Woman. Exposed three times to the rays, 20, 30 and 35 minutes. Eruption appeared two days later.	Abdominal region, particularly over liver area.	Bulb was 18 inches distant. First appearance was that of sun-burn, gradually became brown, and ulcer, 8 inches in diameter, formed; slough thrown off; very slow in healing.	Pain accompanied the first appearance of the lesion.	Four months later, even after curetting, granulating surface 4 inches in diameter still remained.
Dr. W. E. Parker.	Man. Exposed five times, from 20 minutes to 80 minutes.	Jaw and neck.	After two exposures face and neck became swollen and red. The later sittings were also followed by eruption.		16 days afterwards skin discolored and exfoliated.
University of Minnesota.	Man whose ear was examined for several hours.	Ear and surrounding scalp.	The parts presented later a frozen appearance. All the hair from this side of scalp was lost.	No pain or sensation at the time.	
Dr. Banister, U. S. Army.	Man. Numerous exposures.	Abdomen, chest and beard.	At first a patch, red, inflamed, hyperæsthetic, about half the size of a man's hand. The lesion increased in size until a denuded surface 8x15 inches was formed. Exudation profuse and uncontrollable. Beard turned white in places and growth stopped.	Raw surface, very painful and hyperæsthetic. Pain agonizing even six weeks after.	Patient confined to bed for one month, and will probably be in bed another month.
Dr. T. C. Gilchrist.	x ray operator. Eruption began after frequent and continued exposures.	Right hand, wrist, and lower portion of forearm dorsal surface.	Hyperæmia and swelling of back of hand; afterwards inflammation of fingers and hand. Skin became dark brown in color and gradually exfoliated.	No pain at first, but afterwards severe aching and shooting pains, which lasted about 2 weeks.*	

\* February 5, 1897, patient writes. "My hand is much about the same. I cannot use those (first) three fingers much better; and my nails are coming off, that is, the old nail is like a shingle on top of the new one."

As far as the cutaneous lesions were concerned, the skin of the trunk appeared to suffer the most severely, although when the hand was attacked the pain was the most prominent feature.

As to the character of the lesions produced, the majority of observers describe a peculiar redness or erythema at first, then swelling of the derma, followed by a deep discoloration of the skin until it became quite a dark brown color. Exfoliation of the pigmented skin followed later. In a number of cases vesiculation occurred after the hyperæmia, and quite a serious eruption resulted in two cases after only two exposures. The most severe effects followed after exposing the same region again to the rays when the lesion had only partially or wholly healed.

The cases of Dr. Dunn, Dr. Banister and S. J. R. showed perhaps the most severe results. Other lesions produced were alopecia, loss of the finger-nails, and obstinate ulceration. In connection with the subjective symptoms, severe pain and aching were present in the majority of the cases, especially with the eruptions on the hands. The lesions on the abdomen and back were, rather curiously enough, unaccompanied by pain.

Many theories have been advanced to explain the injurious lesions produced by the  $x$  rays. Some have supposed them to be entirely due to frequent and long exposures; but that is not tenable, because in five cases (Dr. Sehwald's, Dr. Kolle's, Dr. Crocker's, Professor Daniel's and Professor Thomson's) marked results followed a single exposure, and in two cases two sittings only preceded the eruptive phenomena, and finally three other cases experienced deleterious results after only three exposures. Others again have compared all the phenomena to severe sunburn, but it can be demonstrated that more severe results have followed the use of the rays than have ever been known from exposure to the sun. Tesla believes that the hurtful action of the  $x$  rays is not due to the rays but to the ozone generated in contact with the skin. Ozone, he says, when abundantly produced, attacks the cutaneous surface, its action being no doubt heightened by the heat and moisture of the skin. In his discussion of the rays themselves he speaks of the disintegration of the electrodes, especially if they are of aluminum, but this is so slow that no appreciable diminution of the weight results, even after long use; it follows, he says, that the matter conveyed by the Röntgen stream is so minute as to escape detection. Some bulbs which he has used for a number of months showed that the bombarded spot of the glass was entirely permeated with particles of the aluminum electrode, but it would probably require years of constant use to accumulate any appreciable amount of matter outside. He further remarks "that no experimenter need be deterred from carrying on an investigation of the rays for fear of poisonous or generally deleterious action, for it seems reasonable to conclude that it would take centuries to accumulate enough of such matter to interfere seriously with the process of life of a person." His last remark is certainly incorrect. His ozone theory is also incorrect, as I shall show later.

Professor Thomson, with the definite idea of producing cutaneous lesions, exposed his finger to a bulb of low potential and used a small 24-plate static machine. "The rays came from

a bombarded spot, and were limited to the area which the Röntgen rays could reach. The tube was of blue glass, with a clear German glass window from  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inches in diameter opposite the bombarded spot." One striking feature was the fact that the fingers opposite the blue glass were not affected, as this was so dense as to absorb the rays. Only where the little finger was opposite the clear glass was it affected with a sharp line of demarcation. He says the blue glass would have been transparent to the ultra-violet rays. He also thinks that brush discharges have nothing to do with the cutaneous phenomena. His theory is that the deleterious effects are due to the  $x$  rays themselves or something that goes with them.

The case which I will now report presents a sufficient number of interesting points to make it worthy of record.

The patient is a healthy-looking man, 32 years of age, who came to me November 18, 1896, with the following history: During the first week in September he exposed his right hand, wrist and lower portion of the forearm to the  $x$  rays while exhibiting an apparatus, each exposure lasting two or three minutes. No bad results followed, but on October 1st he came to Baltimore and resumed the use of the  $x$  rays for the same purposes. After he had exposed his hand for three weeks for four hours daily he noticed that the skin of the back of the hand, wrist and forearm began to turn very red and became "puffed up," although he suffered no pain. The swelling first occurred on the back of the hand from the knuckles to the wrist, then "inflammation set in" and he was compelled to stop his demonstrations. From about October 21st the hand, wrist and lower fourth of the forearm gradually became more inflamed and swollen, and the lesions spread to the fingers. The affected area ached and throbbed so much that he frequently could not sleep at night; there were also shooting pains which gradually increased in intensity and extended up the forearm along the ulnar side. These symptoms continued for a week when the patient consulted Professor Chambers, of Baltimore, who advised him to bathe the hand frequently in hot water and ordered bromides internally with benefit. The symptoms were much relieved and the swelling had gone down considerably in two weeks time. Three weeks after he had first sought medical advice he consulted me about the diseased condition of the skin.

*Condition at the time of the first examination.* The right hand on its dorsal surface presented a deeply pigmented condition. The skin over the dorsal surface of the fingers, hand and wrist was of a very dark brown color, and part of it was already exfoliating. The skin was dry, infiltrated and wrinkled. The patient says the skin was more of a greenish hue at the end of the first week after it became affected. In places near the lateral margins of the hand a slightly vesicular appearance was presented. They were not true vesicles, but were due to the loosening of the surface of the epidermis, and contained only air. The pigmented skin could very easily be peeled off from the hand without any pain, leaving a dull, dry, reddish surface beneath.

On comparing the two hands they were found to be practically of the same temperature. The fingers of both were of about the same calibre. A photograph, which is represented here (Fig. 1), was taken of the hand the first time I saw him,

and it shows very well the exfoliation of the epidermis. It also represents the position of the hand which was most restful and least painful to the patient. The palmar surface was dry and paler than that of the normal hand, but the palmar surface of the fingers appeared swollen.

I saw the patient ten days later, and the exfoliating epidermis had all been removed; the skin now presented a glossy appearance, and over the fingers it appeared to be tighter than on the corresponding fingers of the healthy hand. The palmar surface was still a little drier.

On careful examination the patient complained of rather severe pain when the first phalanx of his right index finger was grasped, and it was then noticed that this bone was distinctly thickened, especially as compared with the corresponding phalanx of the other hand. The first and second phalanges of all the fingers were found to be thickened, but the increase in size was most marked in the first phalanges of the index and second fingers. Further careful examination of the other bones of the hand revealed a very painful spot over the wrist joint. The metacarpals were also tender on pressure, and the head of the second metacarpal was enlarged. The hairs were found to be less numerous on the affected hand, but they may have been removed in tearing off the exfoliating epidermis.

*Movements of the hands.* All movements were found to be quite difficult of accomplishment and very painful. When the patient first consulted me, voluntary movements of both fingers and hand were abolished, except of the little finger, which could be slightly flexed. Wrist movements were also very limited in extent and caused much pain. The thumb and fingers could scarcely be apposed. The patient could not pick up a lead pencil or penholder, and could grasp with but slight force; if he could get his finger or thumb beneath an object he could pick it up. He complained of the joints being very stiff.

*Sensation* was very much impaired before exfoliation occurred, and even after that it was much diminished as compared with the normal hand. The sense of touch on the palmar surface was also markedly decreased.

When the distinct thickening of the phalanges was detected I requested him to obtain careful x ray photographs of both hands under similar conditions at the same distance from the bulb. The accompanying photographs show the bones of the two hands clearly, and I am particularly indebted to Professor W. C. A. Hammel, of Baltimore, for such excellent pictures.

The hands were placed exactly twelve and a half inches from the x ray tube, the distance being carefully measured from a plane passing through the long diameter of the tube to the fixed support on which the hand rested. The time of exposure was exactly three minutes for each hand.

It will at once be noticed from the photographs how much thicker all the first phalanges of the right hand (Fig. 3) are than those of the left normal hand (Fig. 2). The increase in size is particularly marked in the first phalanges of the index and second finger; that of the little finger is less marked. The second row of phalanges is also thicker than normal, but less thick than those of the first row. The heads of the second and third metacarpal bones are enlarged, and their shafts are also slightly thickened. It cannot be said, from the

photographs alone, that any of the carpal bones of the affected hand were at all increased in size.

A number of other points were discovered from these photographs. The spaces between the bones at the joints, particularly at the metacarpo-phalangeal and the interphalangeal joints, were much less marked and narrower than in those of the normal hand. The outline of the affected bones was also more irregular and rougher than that of the left hand. On looking at the hand as a whole, it is also, I think, noticed that all the bones are denser in appearance in the affected hand.\*

Two portions of skin were excised for histological purposes on the first day. One portion was taken from dorsal surface of the phalangeal region of the third finger, and the other from the lateral margin of the hand over the base of the metacarpal of the little finger. Neither stained nor unstained sections demonstrated the presence of any foreign particles, and only showed chronic inflammatory changes. The horny layer was thickened and half of it was partially detached. A large number of brown pigment granules were found in the exfoliating portion. The mucous layer was not thickened, but it was more pigmented than normal. In the corium the vessels were dilated, and the pigment cells of the papillæ were almost as numerous as are usually found in a section of negro skin. It was suggested that particles of platinum might have passed from the tube through the glass bulb deep into the tissues.

Portions of the exfoliating skin were accordingly submitted to Professor Abel for chemical analysis, and he has very kindly furnished me with the following brief report: "I could find no platinum in the pieces of epidermis that you left with me for analysis. These pieces weighed, just as you sent them, 640 milligrams, or about ten grains."

*Summary.* In reviewing this case, there is here an example of a disease of the skin which was brought about by frequent and prolonged exposure to the x rays. The lesions, as I have already described, were first those of hyperæmia, then œdema, without the accompaniment of pain. Subjective symptoms were felt later, and continued to increase in severity (he was still using his hand for exhibition purposes) until, on account of the severe pain, he was compelled to stop his work. These subjective symptoms consisted of aching, throbbing and shooting pains. The color of the skin gradually changed to a deep brown, and the epidermis began to exfoliate. The bones of the hand were very tender on pressure, particularly the first phalanges of the index and second finger and the carpal bones. The movements of the hand became so limited that it was practically useless for some weeks. Sensation was also much impaired, but after exfoliation occurred it recovered again, but only gradually. Recovery of all the lesions has been very gradual indeed.

The photographs have revealed what has never been observed before, viz. a distinct osteoplastic periostitis, and probably an osteitis, particularly of the first and second rows of phalanges of the index and second fingers, also of the heads of meta-

\*As an interesting point the photographs show the outlines even of the finger-nails and the interosseal muscles.

carpal bones of the same fingers, and judging from the symptoms, even of some of the carpal bones.

This then accounts for the severe symptoms, the aching, throbbing and shooting pain which prevented sleep. The density of these bones has also been increased, showing that even bone tissue has been affected.

A complete demonstration is thus afforded of the powerful, piercing character of the  $x$  rays, and the severe, painful symptoms which have been described by other observers are probably due to the inflammation of the periosteum, and possibly the bone, besides the softer tissues.

This inflammation has also extended into the joints, which would explain the loss of movements, and pain, when they could be used later.

As the result of these observations, it proves that the  $x$  rays are even more powerful than have been generally thought, that the deleterious effects can in some cases be quite serious, and that the cutaneous manifestations are not the most severe of the lesions, but those of the deeper tissues, and particularly of periosteum and bones, being more severe.

The discovery of this deeper and more profound effect at once overthrows many of the explanations which have been advanced to account for the cutaneous lesions. Tesla's theory of the ozone generated in contact with the skin will not explain these deeper effects. Prof. Thomson has demonstrated that they are not due to the ultra-violet rays. They cannot be compared to sunburn, since no case, as far as is at present known, has been published where sunburn has produced periostitis and even osteitis. Nor can such serious results be produced by brush discharges, and Thomson has also proved that these cannot be the causes. His further explanation that the effects (he was not aware of the deeper injuries to the soft tissues and bone) are due to the  $x$  rays themselves or something which accompanies them, is rather indefinite. It was suggested to me, as I have already mentioned, that it might be due to the platinum particles piercing the bulb and then attacking the tissues, but this almost appears impossible, since serious cutaneous effects have even followed only one exposure of half an hour (*vide* Thomson's case).

I consulted with Professor Ames, Associate Professor of Physics in the Johns Hopkins University, who, after reviewing all the facts of the case, kindly wrote as follows concerning the present theory of the  $x$  rays:

"The radiation in an ' $x$  ray tube' may be divided provisionally into three classes: ether-waves, which may have wavelengths from 150 to 800  $\mu$ , approximately; kathode rays, which undoubtedly are streams of matter, electrically charged;  $x$  rays, about whose nature there is no conclusive evidence at the present time. If the walls of the tube are thin enough and of suitable material, all these radiations will emerge and pass into the surrounding air. It is a matter of doubt if the kathode rays observed outside the vacuum-tube are the same as those inside; but the inner ones undoubtedly cause the outer ones. There is no evidence that  $x$  rays carry with them particles of matter, or that they directly cause a stream of particles; in fact, all known facts seem to point to the belief that they are ether-waves of extreme shortness."

It will thus be seen that the opinion expressed here does

not make it possible for the  $x$  rays themselves to produce such deleterious effects as have already been described, but Dr. Ames mentions the fact that the kathode rays are undoubtedly streams of matter electrically charged. Here then we have some possible grounds for the theory that the lesions may be due to the entrance of particles (platinum in our case) into the injured tissues, and that the kathode rays which accompany the  $x$  rays may be the cause of the trouble, and not the  $x$  rays themselves.

On clinical grounds there is considerable support for this, at first sight, improbable theory. If the lesion extends at all deeply, it leads to the formation of ulcers, which are extremely intractable, and they may be due to irritating particles still present in the tissues.

I do not think that the possibility of injury ought to deter one from using these wonderful rays in surgical work, because only a few have been affected out of thousands who have been exposed to them. By keeping, as Thomson says, some distance away from the rays, injurious effects will hardly follow their use, and when the exposure is for a short time, unless, as may happen in all other diseases, idiosyncrasy plays a prominent part.

When I viewed my own hand two or three times near a new Edison bulb, through a tungstate of calcium screen, after four or five minutes I distinctly felt a tingling sensation throughout the dorsum of the hand; this symptom lasted for ten or fifteen minutes and passed away without any further results. It occurred to me that  $x$  ray operators and experimenters should expose to the rays the palmar surface of the hand, which is protected by a much thicker horny layer, rather than the back of the hand, which is much less protected.

In conclusion I would strongly advise all  $x$  ray operators and experimenters who develop any special idiosyncrasy, to abstain from their use if they find that the slightest deleterious results follow an exposure to them.

#### BIBLIOGRAPHY.

- John Daniel: Medical Record, April 25, 1896, vol. 49, No. 17.  
 O. Leppin: Deutsche medicin. Wochensch., No. 28 (July 9), 1896, p. 454.  
 Marcuse: Deutsche medicin. Wochensch., No. 30 (July 23), 1896, and No. 42 (October 15), 1896; also abstract in Brit. Med. Journal, Aug. 15, 1896.  
 Feilchenfeld: Deutsche medicin. Wochensch., No. 30 (July 23), 1896.  
 Conrad: Codex Medicus, August, 1896.  
 Paul Fuchs: Deutsche medicin. Wochensch., No. 35 (Aug. 27), 1896, p. 569.  
 Schrwald: Deutsche medicin. Wochensch., No. 41 (Oct. 8), 1896; abstract in Brit. Med. Journal, Nov. 7, 1896.  
 S. J. R.: Nature, No. 1409, vol. 54, Oct. 29, 1896.  
 H. C. Dunn: Brit. Med. Journal, Nov. 7, 1896.  
 G. C. Skinner: The Journal of the American Medical Association, No. 20, vol. XXVII, Nov. 14, 1896.  
 Macintyre: Nature, No. 1412, vol. 55, Nov. 19, 1896.  
 E. E. King: Canadian Practitioner, Nov. 1896.



FIG. 1.

Case of x ray dermatitis. Photograph showing exfoliation of the epidermis.



FIG. 2.

x ray photograph of left hand (normal).



FIG. 3.

x ray photograph of the right hand showing thickening of some of the bones.