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The Value of the "No Good"—The History of the X-Ray.

NINETEENTH PAPER

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"As Edison had his Franklin, so had Roentgen his Lenard."

In view of the fact that Roentgen did *not* discover the X-ray; yet everybody seems to know that he did discover it; perhaps the clearing up of the muddle is a valuable thing. Therefore it may be well to consult some of the literature that bears directly upon the matter and to quote therefrom sufficiently to correct the present American view. In European countries the writings of Roentgen himself and those of many other scientists are available and a correct idea prevails, or should prevail.

To abstract the literature would be a colossal task but fortunately Dr. J. Belot of Paris wrote a work upon Radio-therapy in Dermatology, that contains a Historical Review of Roentgen's Discovery. An English Translation was made by W. Deane Butcher, M.R.C.S., Surgeon to the London Skin Hospital and was published by Rebman in 1905 as an authorized translation from the second French Edition. Dr. Belot was considered "an electrician, a mechanician, a physician, a most enthusiastic investigator of the new science (X-ray), and one who had the necessary leisure to be able to devote himself exclusively to the work."

Unfortunately this work appealed to Dermatologists only and thus was its field and circulation limited. The following are extracts from the first chapter of the second (1904) edition of Belot's book. Though fuller details may be found in Bouchard's Treatis upon Medical Radiology, Paris, 1904. Between 1895 and 1900 many Roentgen Societies and X-ray Associations were formed. All the principal ones have published transactions so that these extracts may be easily corroborated in almost any country or in almost any language.

As long ago as the eighteenth century the Abbe Nollet, in studying the sparks discharged from an electrical machine, arranged an apparatus so that the spark should pass through a glass globe which could be gradually exhausted. He observed a curious phenomenon; little by little, as the pressure in the globe decreased, the spark, a mere narrow thread of light at ordinary pressures, broadened out.

From this he came to the conclusion that the electric fluid circulated more easily in a vacuum than in air, igniting the rarified gas more readily. The apparatus used by the Abbe is in principle the same as that employed at the present day for the production of X-rays.

In 1843, Abria of Bordeaux obtained a vacuum with a pressure of only 1 or 2 millimeters of mercury. The electric egg as his apparatus was called was driven by a Ruhmkorff coil.

About 1879, the English physicist, Sir William Crookes produced still higher vacua with a pressure of only a few millionths of an atmosphere. In the Crookes tube the electric egg of the older experimenters is reduced to a simple tube of

glass, the discharging knobs being replaced by platinum wires or aluminium discs.

According to Crookes, at the degree of rarification obtained in these tubes the gaseous particles are quite independent of one another. They can traverse a rectilinear path of finite length without mutual collision, and the extent of the dark zone in front of the cathode is a measure of the mean free path of the particles under the existing conditions of pressure. Masson has clearly demonstrated that in the highest obtainable vacuum no electric discharge takes place. Hence we are led to believe that the gaseous particles still remaining in the tube are the medium of the discharge.

Crookes devised various experiments to prove the truth of his hypothesis, among them the electric mill, which rotates under the impact of gaseous particles, and the mica cross which, when interposed in their path, throws a shadow on the fluorescing glass.

In 1893, Lenard, taking advantage of the transparency of aluminium to cathode rays, examined them outside the Crookes tube. In order to do this he inserted a window of thin aluminium foil in the glass opposite the cathode. The rays which have passed through this window cause many bodies to fluoresce, just as they do when placed within the tube. Further, these rays act on a photographic plate, they discharge electrified bodies, and after their exit from the tube they are able to traverse the most perfect vacuum which has as yet been obtained.

It was soon found that these radiations outside the tube were complex in character. Lenard showed that a part only were deviated by a magnet, the remainder being totally uninfluenced by the magnetic field. There were therefore issuing from the tube, radiations hitherto unrecognized. This second portion of the rays unaffected by the magnetic field, was in fact composed of X-rays. Lenard may therefore be regarded as the first observer of these new rays. He it was who first recognized their existence, though he was unable to isolate them.

This was reserved for Professor Roentgen, experimenting with a Crookes tube in his laboratory at Wurzburg. The tube, which was enclosed in a cardboard box, had no metallic window. Whilst working with it, he noticed that some barium-platino-cyanide crystals which happened to be lying in its neighborhood became luminous.

Under their influence a screen of barium-platino-cyanide was found to be illuminated at a distance of more than 2 metres from the tube.

Roentgen next conceived the idea of replacing this screen by a photographic plate, and found that it was also affected by the rays. A thick piece of wood or a slab of ebonite failed to screen the plate from their action. Aluminium was found to be transparent, while lead was quite opaque to these rays. He discovered that these rays emanated from those portions of the glass tube which fluoresced under the action of the cathode rays.

He found that they passed through most bodies opaque to light with more or less facility, and that the transparency of any substance to the X-rays was closely related to its density.

Following up this discovery, Roentgen interposed his hand between the glowing tube and a sheet of cardboard covered with crystals of barium-platino-cyanide. A shadow of the hand appeared on the screen, and the darkness of the shadow was differentiated for the bones and the softer tissues. The denser bones stopped most of the rays, and showed as a black shadow. The softer parts were more easily traversed, and allowed most of the rays to pass through them, thus causing the screen to fluoresce feebly, so that the whole shadow was of a pale gray color. The unshadowed portion of the screen fluoresced brilliantly. This was the birth of radioscopy.

Roentgen next replaced the fluorescent screen by a photographic plate. After a suitable exposure he developed it, and ob-

tained a clear outline of the form of the hand, with a distinct silhouette of the bones. This was the origin of radiography.

The memoir communicated by Roentgen to the Physico-Medical Society of Wurzburg in December, 1895, aroused the greatest interest. Scientists all over the world welcomed the new discovery. In every country the experiments were repeated, and all other original work in the laboratories was suspended. "What excited the imagination," says M. Bertin-Sans, "was not so much the new theory of the electric discharge, as the discovery of a new procedure as precise as it was unhoped-for, which enabled us to obtain a photograph of the skeleton and to perform an autopsy of the living body."

The advance was now rapid. The power of the electric generators was increased, induction-coils were improved, and static machines were gradually brought into use. In 1896 Jackson constructed the first focus-tube by interposing a small platium disc in the path of the cathode rays. By this arrangement the power of the tubes was considerably increased, and the duration of the exposure necessary to obtain a radiograph was reduced from thirty minutes to as many seconds. Many other scientists besides Roentgen set themselves to discover some theory which would explain these phenomena in accordance with accepted physical ideas.

In many cases during the course of experiments with X-rays, it was found that these radiations set up a peculiar reaction in the skin of the operator's hands. In some instances even more serious accidents occurred.

Schiff and Freund conceived the idea of employing this reaction in the treatment of disease. This was the origin of radiotherapy.

With increased knowledge of this new form of energy, it became possible to measure it both qualitatively and quantitatively, and thus an empirical and arbitrary procedure became a true science; for all science is based on accurate measurement.

Thus Lenard is the discoverer, Roentgen the utilizer for photographic purposes and Schiff and Freund the employers for therapeutic purposes. Americans seem to be quite unaware of the enormous amount of experimentation and writing upon Roentgenology that Paris and its publications afford. Unfortunately the French scientists only write for those who read French and it is but rarely that a translation is made into English, whereas translations into German abound and many Germans read French, consequently many Americans refer to many scientific matters as being of German origin; when they have but reached us through German sources.

Care of Childrens' Teeth.*

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I have been asked to discuss the care of children's teeth. The subject, to me, is vitally important and I am more than pleased to know that the Mothers' Clubs of Reno have shown an interest in this subject, thereby making a step forward in preventive medicine and dentistry. It was my good fortune to be able to attend the Carr School of Preventive Dentistry and Medicine, which opened my eyes to the necessity of the early care of children's teeth and the close examination of all restorative measures.

For the purposes of this discussion it will be well to divide the time, in which the permenant denture is being constructed, into three periods: First, the care of the mouth and the prospective mother. Second, from birth to the fifth year. Third, from the fifth year to maturity.

It might be well to drive out a few sup-

*Read before the Mother' Club, Reno, Nevada, during Baby Week, 1917.

erstitions that you are most likely familiar with. First, the one that dental care of the prospective mother will produce birth marks upon the child, and the second, that it is natural for a woman, during pregnancy, to have trouble with her teeth and that she must expect to lose a tooth for each child.

To banish the first superstition, we have only to recall two facts. First, that fetal development is too far advanced before the mother is aware of her condition to effect the developing child. As for instance, cleft palate, or the failure of the two palate bones to meet, would occur in the second month. Then again, we are shown that major operations are successfully performed upon women during pregnancy, all of which are followed by the successful delivery of a normal child.

The superstition of a tooth for each child is harder to overcome, because women do suffer with their teeth and often lose one or more with each child. This is not a natural condition, but a pathological one due to neglect; the greater neglect, the more trouble.

The only danger a woman need fear from dental work is a shock so great that it will produce abortion or miscarriage. Such a danger is so remote that, for all practical purposes, we can say that it need not exist if the dentist knows the patient's condition, for then he will not undertake long or painful operations.

On the contrary, where the mouth is neglected, the shock from prolonged toothache, or the pus or poison absorbed from an abscessed tooth, may be severe enough to cause abortion. Even if this serious condition does not follow the suffering caused by a neglected mouth, the indigestion, the toothache, or the effects of absorbed pus, must surely lower the vitality of the developing fetus.

The pregnant woman can be saved much pain and destruction of her teeth if she begins to care for them just as soon as conception is known. A dentist should be consulted, all cavities cleaned and filled. those teeth that are too badly diseased to save should be removed, all teeth polished, tartar removed, inflammed gums treated, the condition of the saliva noted and a proper mouth wash prescribed.

If these conditions are neglected during the period of nausea the teeth and tongue become badly coated, the saliva ropy and acid, and the teeth decay in direct proportion to the proportion of acid, causing toothache, abscessed teeth, pyorrhea, loss of sleep, lowered vitality and absorption of pus. There are cases on record in which shock from such suffering has brought on premature delivery. Then again, the poison may be so excessive that the fetus cannot survive. *A clean mouth is necessary for good health of both mother and child.*

Popular beliefs to the contrary, notwithstanding, the newborn infant has teeth, calcified, but not yet erupted.

Between six months and two years, ten teeth erupt. These are called deciduous, or commonly known as baby teeth. The first operation the dentist is called upon to perform for the deciduous teeth is lancing the gums, as an aid to eruption of these organs. *This is not necessary in normal cases.* While the deciduous tooth is erupting the permanent tooth is forming just under it and when a deciduous tooth is bound down by dense gum tissue above, it retards its normal growth and causes pressure on the formative organ, causing intense pain, which manifests itself by functional inharmony. The gums are swollen and congested, the nervous system is disturbed. High fever, vomiting, diarrhea, convulsions, stupor, and in extreme cases, death.

So, should baby show the symptoms as mentioned, then I advise the attention of a dentist. Oftentimes it is well to rub the gums with ice as a temporary relief. It relieves the congestion, and being hard, aids the parting of the tissues.

The first teeth to erupt will be the central incisors, two upper and two lower, from the fifth to eighth month; these are followed by the lateral incisors, sixth to ninth month; then the first molars, fourteenth to sixteenth month. Then comes the cuspid, or baby eye teeth, seventeenth to eighteenth month. Lastly, the two

molars, eighteenth to twenty-fourth month. Cavities in any of the deciduous teeth should be the call for immediate attention of a dentist.

After two years the growth of the jaw carries the teeth apart, allowing, or making room, for the coming of the permanent teeth.

The absorption of the roots of the deciduous teeth starts at the fourth year. After this time abscesses are frequent and should be given immediate attention by a dentist. From the fourth to the sixth year is an important stage, in that the teeth are called upon for the masticating of harder foods, the retention of the deciduous teeth thereby aiding the growth of the jaws and preserving the fulness of the arch.

Should a deciduous first molar be lost it would allow the permanent or much larger first molar to move forward and occupy room that should be preserved for the second biscuspid. The same is true for the rest of the teeth. As a result you find crowded and unshapely teeth and arches.

It would be well, before considering the permanent teeth, to strongly advise that mothers nurse their babies during the first year of life. More than twice as many bottle-fed badies die during the first year, as do nurslings. Bottle-fed babies are more often ill nourished, not being able to digest artificial food. If this continues, the growth of the teeth in the tiny jaw is interfered with and the teeth will be badly shaped and have pitted surfaces. Bottle feeding is productive of ill-shaped mouths, adenoids, broken down deciduous teeth and malocclusion (orthodontists should be consulted).

The permanent teeth follow in their eruption at the fifth year. There are 32 permanent teeth, divided into four classes; incisors, cuspids, bicuspids, molars. Their time of eruption is:

First molar, fifth to sixth year.
Central incisor, sixth to eighth year.
Lateral incisor, seventh to ninth year.
First bicuspid, ninth to tenth year.
Second bicuspid, tenth to twelfth year.
Cuspid, eleventh to thirteenth year.
Second molar, twelfth to fourteenth year.
Third molar, seventeenth to twenty-first year.

From the time the permanent teeth begin to erupt, until all deciduous teeth are lost, is the most important time for consideration, some mouths being more susceptible to decay than others.

The proximal surface of the incisors and the morsel surface of the molars are to be watched closely.

The first permanent molar is the most important in the entire arch. It keeps the jaws at their normal distance apart and is the vital factor in the occlusion. If lost, it allows the jaws to drop closer together, which detracts from the strength of the character shown in the face, in that there is inharmony in the outline of the face. If lost before the eruption of the bicuspids or the second permanent molars, it producers mal-occlusion, in that it leaves a space toward which the bicuspids and second molars will tip.

The first visit of a child to the dentist is a momentous occasion. Some make it with most eager anticipation, others with fear, mostly dependent on the point of view given the child by the parents. The dentist, in treating teeth for children, should be a student of human nature. He should study the temperament of the child and should be a perfect master of him while in his office.

I advise mothers to be very careful when mentioning the dentist before children. Do not speak of him as a beast, thereby painting a picture in the little mind that will not wash out, and which will develop that dread which later will influence its life, even unto death. Be charitable, reason with the child, make little of pain. Picture the dentist as one who relieves pain and wishes to be a friend.

On the occasion of the first visit, I would advise that the mother ask for an examination of the child's teeth, allowing the little one and the dentist to get ac-

quainted. It is then up to the dentist to arrange appointments and gain the confidence of the child. When once the child's confidence is gained, you may rest assured that he will be well cared for. On the contrary, if the dentist seems rough and wishes to deceive the child as to what is to be done, by telling him that he will not be hurt, and then deliberately hurts him, that one act may so terrify the child that it will influence the life to follow and result in the early wearing of artificial dentures.

There are two ways of cleaning the teeth, natural and artificial. The natural way is by the elimination of our civilized foodstuffs and being uncivilized in that respect. Our foods are too soft. We should go back to hard bread and other uncivilized luxuries.

Artificial cleansing is our salvation. I believe in both bristle and rubber tooth brushes. Alkaline and acid mouth washes, as indicated; salt water for the normal mouth. The flat and dental flosses have their place. Children should have a suitable mouth wash and tooth brush, with proper instructions as to their use, and should visit the dentist every six months for examination, and treatment if necessary.

The physicians and societies in the larger cities are realizing more each day the absolute necessity of clean mouths in children. Of 12,000 cases of prevalent diseases reported, 63 per cent. had origin in the mouth.

In all the larger cities the public schools have their operator or examining dentist, who examines the teeth of the children, reporting to the teacher, who in turn reports to the parents, advising and specifying the course of treatment. This is one of the greatest preventive measures we have.

Ask the teachers of your public schools about the conditions of the mouths of the pupils and it will give you food for thought; 93 per cent of the public school children have defective teeth. It is my purpose and ambition to start just such a movement in our local schools, placing a young, competent man in charge. We will have less disease and our schools will not be closing, because of different epidemics, as they have in the past. I intend, in the near future, to start at that point and, with the aid of charitable organizations and clubs, give our school children a chance. It is a proven success. Even large business houses employ a dentist to care for their employees, thereby getting more efficient service.

Time does not permit the enumeration of all the possible accidents or incidents which the child's mouth presents during the transition period, when the permanent denture is being established. It is my wish to lay particular stress upon the necessity of more care than we ordinarily give the average child. This means much in the efficiency and subsequent health and usefulness of the individual. Unfortunately, even in the intelligent families today, the child's teeth are sadly neglected. Education of the parents to this end is essential, but there is no other way than through the children themselves at school.

Medical and dental inspection has proved to be a wonderful success. But no medical inspection has approached anything like completeness without a thorough examination of the mouth.

The care of the child is a sacred trust, from conception to maturity, and we must give them their birth-right of "preparedness" for adult life, even though they may have sprung from an environment of poverty or ignorance. It is up to us to remove all obstacles standing in the way of perfect development and growth.

In my opinion a great step in conservation would be made if our schools were provided with an adequate force of trained dentists, who would examine and report, or give the necessary treatment to children unable to secure service for themselves.

Masonic Temple.

A Medical Comparison of Castor and Mineral Oil.

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CHAPTER X

Mineral Oils

The mineral oils must be carefully considered in this regard. If they are really what they are claimed to be, the introduction of mineral oil in the pharmacotherapy would be a great advance. We regret to say that we have found to the contrary.

The claim of an ancient internal use for mineral oil is untrue. The fractionation of the natural oil was introduced between fifty and sixty years ago. The non-fractionated natural mineral oil was at that time considered too poisonous for any internal administration. The most prominent pharmacologists of fifty years ago counted the mineral oils among the other poisons.

Mineral oil has been used as a feces softener a very short time compared to the time that castor oil has been used. The first question that arises for the careful physician: Has Russian mineral oil been really proven a valuable and harmless drug after satisfactory pharmacological research? Having settled this question, the second question arises: Has American mineral oil really replaced the Russian oil in every pharmacological respect? The mineral oils of the old and new worlds are very different in chemical composition and physical properties. A third question may be: Are the different American mineral oils mutual equivalents?

The recommendations of these oils are based on empiricism and very unscientific deductions. We were entirely unable to trace any scientific testing by pharmacological or exact clinical methods. The isolated empiric statement of produced softened feces is all that the literature shows. The statement of therapeutical non-toxicological effect, without details, is no scientific statement. A scientific man, who wants to state his point, has to produce exact statements, that a series of biological processes did not become influenced in an obnoxious sense. A man who cannot show research work of this kind, cannot be a witness of the harmlessness of the different mineral oils. Especially, H. W. Wiley must be mentioned. He is the father of the famous pure food and drug law. He made very painstaking research regarding boric acid, benzoic acid and sulphurous acid. He is one of the advertised recommenders of mineral oils. In this case, we can expect that responsible man of his scientific record has made a small part, at least, of similar research in the direction of mineral oil in an earlier time, since he allows the use of his name for such advertisements. We were unable to find publications recording related research of H. W. Wiley. In a contrary direction, we cannot believe that he, or any other scientist, ever did similar investigation. Our experiments prove, undoubtedly, that mineral oil is more dangerous than boric acid, benzoic acid, and sulphurous acid. No scientific research has been done at all; one recommender followed his predecessor without using his own judgment; no recommender noticed the entire absence of any scientific basis for the recommendation of mineral oil. However, this absence is not a reason for us to repudiate the mineral oil. On the contrary, we believe that laymen's experience and tradition often contain many valuable remedies. We believe that it is the practitioner's duty to try these drugs; but our restriction is that this must be done only after a satisfactory