Their names are truly well chosen; the circumvallate represent a circumvallation, but it is to be noted that the real papilla, which occupies the circumvallation, is a truncated cone which stands on, i. e., is implanted by its apex and not by its base.

We must bear in mind that taste goblets exist only in the hemispheric and the circumvallate papillæ, and not in the conical; that these are provided with long epithelial processes, the object of which seems to be to retard the course of the fluids on the surface of the tongue, thereby giving the taste goblets time to be thoroughly impressed by the special taste of the fluids. These long epithelial processes are characteristic and unique. No other organ presents them.

The papillæ of the tongue are the same as the small microscopic papillæ seen on the surface of almost all mucous membranes, being projections of all the elements of the mucous membrane, only on the tongue they are much larger. The villi of the intestines are similar to the papillæ of the tongue and have the same fundamental structure, but they are characterized by a cecal lacteal in their center, instead of presenting taste goblets or epithelial processes.

The appearance of the capillaries of the tongue is notable and characteristic, resembling a large oak-tree in the circumvallate, a smaller oak in the hemispheric, and a poplar tree in the conical.

That the whole tongue is formed of a solid mass of muscles is noteworthy, being covered only by a mucous membrane. We must also take notice that the tongue has intrinsic fibers. The stomach and the heart also present intrinsic fibers.

We must recall here the importance of that portion of the lingual artery which runs above the great horn of the hyoid bone and below the hypoglossal nerve, because that is where the artery is ligated whenever any operation on the tongue extends beyond the anterior half. It is also to be noted that when the two linguals are ligated simultaneously, as must be done when the operation extends beyond its posterior half on both sides, the organ does not slough although there is no anastomosis of any consequence with any other large artery, owing to the isolated condition of the tongue in the mouth. We can not here consider the anastomosis of the dorsal of the tongue with its fellow of the opposite side, because those arteries usually originate beyond the hyoid portion of the lingual. It is because the lingual arteries in their posterior half are large and, being deeply seated, are not easily secured in all operations of the posterior half, that the linguals must be ligated in their hyoid portions previous to operating on the posterior half of the tongue. We must notice also the rather serpentine course of the artery in the tongue, which enables it to accommodate itself to the numerous and various changes in the length of the organ. The cavernous arteries of the penis are also serpentine for the same reasons.

The superficial ranine vein is the only submucous vein visible to the naked eye and giving the membrane a bluish tinge. The lingual veins are interesting because they cross over the external carotid artery to reach the jugular, sometimes necessitating their section between two ligatures to make it possible to reach the artery underneath conveniently.

The tongue is the only organ presenting the three kinds of nerves, i. e., nerve of special sense, the gustatory, or lingual; nerve of ordinary sensation, the glossopharyngeal; and nerve of motion, the hypoglossal. We here recall that the gustatory is the only nerve of special sense originating in common with other nerves from the inferior maxillary, a compound nerve; also that it receives the peculiar cord of the tympanum from the facial, the only instance of a motor nerve anastomosing with a nerve of special sense. The termination of the filaments of the gustatory by hair cells into the taste goblets is seen only in the olfactory and the cochlear branch of the auditory. Finally, we must reremark that the gustatory is the only nerve of special sense that is a hard nerve, the others, the olfactory, the optic and the auditory, being remarkably soft nerves.

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SOME OF THE POSSIBILITIES AND LIMITATIONS OF THE *X*-RAYS AS A THERAPEUTIC AGENT *

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I wish to state, first of all, two self-evident propositions:

First: The administration of a therapeutic agent in a disease, the pathology of which is known, is attended with a greater or less degree of success, depending on the potency of this agent to remedy the pathological condition present.

Second: However potent an agent we may possess, for its use to be attended with the desired result, it must be applied in such dosage, with such frequency, and for so long a period as the pathology of the condition and the ends in view seem to require.

Mercury and iodin are the two remedies that are productive of more good in syphilis than all the other drugs of the Pharmacopeia. They were found to cause a disappearance of the manifestations of this disease long before its pathology or etiology was ascertained. Few patients, however, were permanently cured by these potent agents before there was some knowledge of the pathology of the disease and at least an idea of the causative factor in its production. With how much greater confidence do we administer these remedies now than formerly!

Having agents whose potency is established, we have but to apply them in proper dosage, with proper frequency, and for a sufficient period, and the cure is effected.

When the *x*-rays began to be experimented with in the treatment of disease, about 10 years ago, it was found out empirically that certain pathologic conditions were relieved by the application to the area involved, of this agent, for a greater or less length of time. Following this discovery, tissues were examined and the changes in them, produced by exposure to the light, were carefully studied. Gradually, from these investigations, the general principle was evolved, that in this new light, we had an agent that could be made to produce a variety of effects, depending on the method of application. Briefly, these effects on living matter may be said to be anesthetic, alterative, stimulant, and destructive. All the results so far obtained may be accounted for, I think, by one or more of these actions.

It has been ascertained that the radiant energy from the Crooke's tube is not homogeneous, but consists of

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several kinds of rays, which possess different properties. Just as sunlight is composed of rays possessing different characteristics, *e. g.* red, the greatest heating, and violet, the greatest chemical properties, so in the *x*-rays, there is one ray which produces marked physiologic activity, while another shows greater penetrating qualities. Those which produce the greatest physiologic effect are the most readily absorbed by the skin, and possess the greatest therapeutic properties. The skin seems to filter out the major part of these rays, while the most penetrating, having very slight physiologic activity, are allowed to pass quite readily. This is evidenced by the facts that *x*-ray "burns" are confined to the skin and most superficial structures. By means of certain materials, *e. g.* aluminum and wet leather, interposed in the path of the rays, those which produce the so-called burn may be filtered out, with very slight obstruction to the penetrating rays; other substances, such as silver, are said to absorb the penetrating rays, while those affecting the skin are largely transmitted.

It is easy, therefore, to see the cause of failure in the treatment of deep-seated disease, whereas the same pathologic condition readily responds, if the lesion be superficial.

The time has passed when a Roentgenologist was justified in applying the rays to conditions, concerning the pathology of which he knew nothing. He would be equally as culpable as if he were to administer mercury and iodin under the same circumstances.

Considering that the effects produced by the *x*-rays depend in their nature on the quantity applied, the dosage must be suited to the effect that it is desired to produce.

Would anyone expect to cure a case of syphilis with 1/100 grain of bichlorid of mercury, daily for a week, or 5 grains three times a day for a month? Neither is any more absurd than to expect to produce a definite effect with an indefinite dose of the *x*-rays, and yet it is being done daily by many possessors of *x*-ray machines throughout the country. Since mercury and iodin are specifics for syphilis, does it follow that they must also be beneficial in diphtheria when administered in the same way? There are physicians who would resent the insinuation that they would be guilty of such folly as this, who are treating with the *x*-rays, almost any disease that happens to fall into their hands. Is it a wonder that failure is oftener than otherwise the result and a "black eye" given to *x*-rays and *x*-ray operators everywhere?

While there is yet no satisfactory unit of quantity by which the *x*-rays may be accurately measured, the time is not far distant when one will be established so that the dosage may be applied as so many *x*-ray units. There are certain factors that by proper regulation enable us to vary with a fair degree of accuracy, the output of a certain equipment, but there is no fixed rule that applies to all. Each set of apparatus is a law unto itself and its characteristics must be ascertained before this outfit can be intelligently employed. A little care in the use of a new equipment will enable the operator to determine the reaction point with that equipment working under the same circumstances, within the limits of a few minutes. From this he can easily compile a table for that apparatus that will guide him in the application of the rays to pathologic conditions.

To determine whether or not a condition will probably be benefited by *x*-ray treatment, it is only necessary to make mental application of the known effect of the *x*-rays to the pathologic condition present.

The rays manifest their effects on cells to an extent proportional to the resistance of the cells; different kinds possess this resistance in a widely different degree. It is on this fact that we rely to destroy malignant cells without causing a similar destruction of the normal. Epithelial cells are much more readily affected by the rays than those of connective tissue or muscle; glandular epithelium is especially susceptible, while fibrous tissue is very resistant.

From the foregoing we may conclude that: Those pathologic conditions which involve the epithelial structures may be influenced by the *x*-rays when sufficiently superficial to be reached by those which are active. Fibrous growths and lesions in which fibrous tissue involvement is largely present, are very slightly affected except by pushing the treatment to the point of "burning" when the effect is very similar to other cauterizing agents.

In accordance with the facts and theories, as given, it may be deduced:

First: Malignant disease, while yet local, may be treated with the assurance of good results, provided the lesion is in the skin or very near the surface, and the age of the patient or condition of the general health is not such as to render the reparative powers too low. The treatment of deep-seated primary cancers should never be undertaken except in inoperable cases, or when the patient will not consent to surgical procedure. In these cases it is best to remove the diseased parts as radically as possible, and if practicable, leave the wound open to be treated by the Roentgen method, and if necessary, resort to a second plastic operation to close it.

Second: Such skin diseases as involve the epithelial and glandular structures are more or less amenable to treatment. Those involving the fibrous tissue of the corium respond with great difficulty, or not at all.

Third: Glandular enlargements, so long as they are due to gland-cell hyperplasia, will be greatly benefited by *x*-ray treatment; when the hyperplasia involves the connective tissue element, very little result will ensue.

I trust the principles that I have attempted to bring out may serve to lessen the tendency to approach fakery that is sometimes too evident in *x*-ray operators, and especially to establish the fact that definite *x*-ray effects are due to definite *x*-ray causes, and that in the Roentgen rays, we have an agent, limited in its usefulness, but of maximum efficiency when confined within its proper scope.

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The Cranial and Facial Characteristics of the Neanderthal Race.—W. J. Sollas (Phil. Tr. Roy. Soc. Lond., 1908; Series B, excix, 281), has made further study on the Neanderthal race and its probable significance in the evolutionary history of man. The skull of the Neanderthal race possesses many features in common with certain flattened skulls met with in certain Southern Australian tribes; it differs in breadth, in the glabellar region, and in thickness. But the Neanderthal large orbits, projecting broad nose, retreating cheek bones, absence of depression beneath orbits, long face and low degree of prognathism are peculiar. The Neanderthal race and the Australian probably represent diverging branches of the same original stock. In regard to cranial capacity the two races are almost indentical—"the Neanderthal and the Pithecanthopus skulls stand like the piers of a ruined bridge which once continuously connected the kingdom of man with the rest of the animal world."