of each class. Before they can be accepted they must be verified by other series of a similar character, but this, unfortunately, I have omitted to do, not having had sufficient time.

None of the photographs taken in any of our experiments have been retouched, even in the slightest degree.

While satisfactory photographs may, as a rule, be obtained at the first sitting, two sittings are sometimes required. In the first the focus is to be found. In the second, the focus being known, if all the other conditions are fulfilled, we can feel quite certain of obtaining as many good pictures as are desired.

Now let me explain to you the manner in which the focus of any subject is found. The distance from the position occupied by the mirror in the fauces to the vocal bands varies markedly in males and females, and to a less extent in individuals of the same sex. Without going into details as to the manner in which the method of focusing was arrived at, I will only state that, as a matter of fact, with this instrument, with the throat mirror eight inches from the front face of the camera, in men, with the tongue in or out, the lens must occupy a position of from $2\frac{3}{8}$ of an inch to $2\frac{1}{2}$ of an inch from the face of the camera. In women, from $2\frac{1}{8}$ of an inch to $2\frac{3}{8}$ of an inch from the face of the camera. The difference in the focus, whether the tongue is protruded or not, is about $\frac{1}{8}$ of an inch.

These figures being known, in order to find the exact focus, three exposures should be made, varying the position of the lens $\frac{1}{8}$ of an inch within the limits indicated above. By following these directions, one or more pictures of the larynx or trachea, in good focus, can almost invariably be obtained in three exposures.

If in taking several photographs of the larynx, care be exercised to vary the position of the mirror slightly, pictures may be obtained which, when viewed with the stereoscope, will present an appearance of greater depth of the cavity of the larynx than can be obtained in any other way.

I am confident that the method of photographing the larynx described in this paper is one of practical utility, and must prove of great service in facilitating the study of the functions and diseases of the larynx.—*N. Y. Med. Jour.*

THE HYPNOSCOPE.

A NEW APPLICATION OF THE MAGNET.

YESTERDAY an illusion, to-day a reality, hypnotism has definitely entered the domain of science. There is no longer any question either as to the possibility of these strange phenomena or of their high importance; it rather concerns us to increase the number of observations and determine the means of study. It is with this idea in view that I have devised a little apparatus which I call a *hypnoscope*, and concerning which I think it will prove of interest to say a few words. In truth, this little apparatus serves for discovering and, after a manner, of measuring "hypnotic sensitiveness." What is this special sensitiveness? Before it is possible to give a definition of it, it will be necessary to recognize its existence.

Up to the present we have had no suitable means that permitted of ascertaining whether a person was "hypnotizable" or not; and we have not even been agreed as to the possibility of reproducing hypnotic phenomena in every one, or in but a limited number of sickly subjects. On the one hand, the exaggerations of magnetizers, and, on the other, the incredulity of physicians, have for a long time contributed to prevent a solution of this problem. As a general thing, magnetizers have proclaimed the possibility of "making every one feel" their mystic influence, in asserting that "the producing of [magnetic] sleep, in whomsoever it be, is only a question of time," while physicians have been nearly unanimous in recognizing that it is only with those having diseased nerves, and especially with hysterical women, that these sorts of experiments have any chance of success. The researches to which I have devoted myself contradict both these assertions.

Hypnotic sensitiveness, that is to say, the faculty of being influenced by the practice of hypnotization, is neither inherent to everybody nor connected with any disease whatever—hysteria, epilepsy, neurasthenia, or anemia. It is a complex aptitude, but one *sui generis*, which depends upon peculiar reflex relations between the cerebro-spinal and ganglionic systems, and especially between the brain and the vaso-motor nerves. This special aptitude, being for the most part innate, one is hypnotizable or not just as he possesses such or such a temperament. The best of intentions, on the one hand or on the other, cannot suffice to put a person asleep who is devoid of such special aptitude.

What is the number of hypnotizable subjects? This question has been recently propounded by Dr. Bremond. "I know," says he, "97 young persons in whom all these nervous states can be produced at will. Here, at Paris, out of nine young people who belonged to liberal professions, and who consented to undergo experiment, it was found possible, in a few minutes, to put two into these nervous states of fascination, catalepsy, lethargy, and somnambulism. In what proportion are such impressionable subjects found? Who can answer the question?" This is a service that the hypnoscope is destined to render us.

According to the experiments that I have been able to perform, among persons of all conditions taken at random, the number of subjects who are hypnotizable amounts to about 37 per cent. These persons are hypnotizable in varying degree; 15 per cent. exhibit complete somnambulism, and four-fifths per cent. undergo the influence of suggestions, even in a waking state. Thirty per cent. marks a mean. The figure is lower in certain professions, and especially among physicians (about 5 per cent.). It is higher in ordinary people, in the sick, and in young persons between 15 and 25 years of age. Women are no more susceptible than men, and in spite of a certain relation with nervous diseases in general and hysteria in particular, this aptitude *sui generis* is not synonymous with nervousness. A goodly number of extremely nervous persons is not sensitive to hypnotization, while we find excellent subjects among healthy people who are in no wise nervous. Healthy women are generally less sensitive than men, while among the sick there is a marked preponderance on the side of females. Sometimes the proportion is 45 per cent. in men and 37 in women (service of Dr. Du-

montpallier, at the Hôpital de la Pitié). Hysteria seems to present a favorable field, yet there is a goodly number of hysterical women who are absolutely refractory.

And now, if this sort of a research has appeared to us worthy of attracting the attention of our readers, it is for the reason that, according to our observations, what is true for hypnotism is likewise so for the *physiological action of the magnet*. Everybody who is sensitive to the magnet is hypnotizable, and this too to a degree that entirely corresponds; all others are refractory.

Having remarked this principal fact, I have endeavored to give the magnet a form that is at once efficacious and practical. The hypnoscope is a tubular magnet, whose form (Fig. 1) recalls that of the Joule electro-magnet, only the lines of force therein are directed rather within than out of the magnetized tube. This latter is only $3\frac{1}{4}$ cm. in diameter by 5.5 in. length, and weighs but 169 grammes. Forged from Alvar steel, it exhibits under this form a remarkable power, since it lifts as much as 25 times its own weight.

The mode of application is very simple. After removing the armature (Fig. 2) the forefinger of the person who is to be submitted to the test is introduced into the hypnoscope in such a way that it shall touch both poles at once (Fig. 3), and at the end of *two minutes* it is removed, and an examination made of the modifications that it has undergone. In 70 persons out of 100, taken at random, no change will be observed. In about 30 per cent. two kinds of modifications will be observed, viz., *subjective* or *objective*.

Here is where we think that we have found an answer to the question raised by Sir William Thomson in his last lecture "On the Senses of Man." Have we a special sense for the impressions of magnetism? "It is possible," says the English scientist "that there is a magnetic sense, and that a magnet of *very great power* produces a sensation entirely different from that of heat, force, or any other sensation; . . . at all events, the fact merits profound research."

In answer to these reflections, I will limit myself to the remark that in experimenting since 1880 I have

Fig. 3
THE HYPNOSCOPE.

never observed sensations that were entirely new, and as, moreover, it would be difficult to find organs for such new sense that were adapted to it, there is no ground for admitting a sixth, *magnetic* sense. But this does not prevent more than a quarter of humanity from being influenced by a magnet of medium power, and experiencing contain very distinct sensations. The principal of these are the following:

Twenty times out of a hundred, disagreeable formation and itching; and, sometimes, one would say sparks or needles pricking the skin. Seventeen times out of a hundred, a sensation as of a cold blast, or one of heat and dryness. The two impressions may coexist—one in the right arm, and the other in the left. Thus, a magnet placed under the feet of paralytics has been observed to warm them, although a good fire was powerless to do so. The cold draught much resembles that which one experiences in front of an electro-static machine.

Eight times out of a hundred there are painful sensations—pains in the joints. "I should say that my bones were being broken," exclaim the subjects under experiment.

Five times out of a hundred there is a sensation of inflation of the skin—and one which may be real, since it is sometimes difficult to remove the subject's finger from between the poles of the hypnoscope.

Two times out of a hundred there is a sense of weight in the finger or the entire arm; also a sensation of being irresistibly carried along, followed by a *real attraction*, and almost always a contraction with complete insensibility. This is an exceedingly curious phenomenon. I exhibited this experiment before the Medical Society of Lemberg in 1881. The subject (who was in excellent health) was asleep, the eyes closed, the pupils directed upward, and the head completely covered with an opaque veil. At every approach of the magnet to within a distance of about 15 cm. his hand was quickly extended toward it, and followed all its motions until it became rigid and insensible. Then it became necessary to restore sensibility, or rather hyperaesthesia, in order to rebegin the experiments. I hasten to add that the same phenomenon was reproduced, although perhaps a little less markedly, by the approach of a metal, of glass, or of any other body whatever. The subject, when questioned in his sleep, said that he felt as if he were being carried along in a given direction without knowing why.

The *objective* modifications are profounder, and more important for diagnosis. They belong to one of four categories, viz., (a) involuntary movements (quite rare); (b) insensibility (complete analgesia or anæsthesia); (c)

paralysis (impossibility of moving the finger); (d) contractura (rigidity of the muscles).

The phenomena that are called forth disappear in a few minutes under the influence of a very slight massage; but, without that, they may persist for several minutes, and even for several hours.

Persons in whom the hypnoscope causes insensibility, paralysis, or contractura may be hypnotized in a single seance. With others the experiment must be repeated.

Let us now touch upon the question of the causes.

So it is evident that the magnet exerts a certain influence upon the nervous system of *persons who are predisposed*. This *physiological* action has been very little studied; there exists, nevertheless, a certain number of experiments relative to the *therapeutic* action. Without speaking of Mesmer, it was established as long ago as 1779 by Drs. Andry and Thouriet, and confirmed by Becker (1829), Bulmering (1835), Lippie (1846), and especially by Maggiorani (1869-1880). To-day it is placed beyond controversy by Messrs. Charcot, Schiff, Vogt, Benedict, Vigouroux, Debore, Proust, Ballet, and others.

But, while it is incontrovertible, is it really *magnetic*? It seems to me that it may be so admitted, in part, since (1) the importance of the action is not in direct relation with the power of the magnet, but rather with the degree of hypnotic sensitiveness of the subject experimented upon; and (2) the north pole has no other influence than the south, although it should necessarily have in the case of an action that was purely and simply magnetic. Is it, then, a metalloscopic action, as Mr. Pellot has supposed? This question, which had been already asked at the date at which I made my first communication through Dr. Brown-Sequard, I will answer as follows: (1) The number of persons who are sensitive to metals is less than that of those sensitive to the magnet, and much less than the number of those who are specially sensitive to *steel*. (2) There are persons sensitive to metals (to copper, for example) and insensible to the magnet, and consequently likewise refractory to hypnotization.

Then is this mysterious action perhaps merely purely imaginary—*suggestive*, as one says to-day after the labors of Dr. Bernheim? No; because (1) it is sometimes (though rarely, it is true) exerted unbeknown to the subjects under experiment, upon persons asleep, upon animals, etc.; and (2) we may easily distinguish the sensations produced simply by emotion or expectant attention from those produced by the hypnoscope; for imaginary sensations change character or disappear on a new test, while genuine ones always return, preserve their characters, and even become more and more marked. Imaginary sensitiveness becomes effaced, while real sensitiveness is increased by habitude.

Nevertheless, we may grant that the imagination, without being a sufficient cause to explain the phenomena, enters into play in the great majority of cases, as an auxiliary, in preparing the accessibility of the patients. In short, the influence is double—physical and psychical.

Being capable of serving as a physical excitant, does the magnet act directly upon the tissues exposed to its influence, or rather indirectly by reflex way? It appears that both cases present themselves, but that the last is the more important. It is the vaso-motor nerves that seem to be reached by preference.

Are the direct action upon the tissues or the blood and the reflex action upon the nerves identical? It appears not. At all events, magnetism alone does not explain these effects. I rather incline toward the hypothesis that, in the majority of the phenomena, the magnet is merely the substratum of another action, which is so weak, from a psychological point of view, that it hides itself from our instruments, and exhibits itself only through the intermedium of exceptionally sensitive nervous systems.

Is this other physical action due to a new and unknown force? It is probable that it is not an entirely new force, but only a new and unknown manifestation—a peculiar modification of electric phenomena. This is all that the present state of our knowledge allows us to say. But the insufficiency of theory in no wise interferes with the practical use of the hypnoscope, and, if it is true that it gives us at the same time useful indications as to the state of the nerves in nervous complaints, the importance of the application may be readily seen.

My personal idea goes still further. I see in the revelations of this instrument the necessity of a future subdivision of therapeutics. It is useless and even imprudent to apply the same remedy to sensitive and non-sensitive persons. With a large number of hypnotizable patients, all remedies are equally good or equally bad, according to *peculiar nervous influences*. We may neutralize strong doses of the most typical medicaments, and reproduce their effect in a most positive manner, by *suggestion*. In sensitive persons we obtain an improvement that is often almost instantaneous under the influence of various trifling means that hypnotism and magnetism put at our disposal.

It seems to me that we have here a line of research worthy of attracting the attention of physicists and physicians.—*J. Ochorowicz, M.D., in La Lumière Electrique.*

OBSTRUCTION OF DRAIN PIPES BY ROOTS.

By F. A. CALKINS.

THERE are several varieties of trees that extend their fibrous roots a long distance in search of moisture, usually present in drains, and among them I have particularly noticed the following, viz.: Silver leaved maple, *Acer descarpum*; red maple, *Acer rubrum*; Elm, *Ulmus Americana*. The willow family causes more trouble than any other variety, and next in order is the elm family. In October last, when removing a tile drain in Central Park, I found the roots of a tree called *Paulonia imperialis*, which resembles the catalpa, growing in it for fifty-six feet. One-third of the length of this root was three inches in diameter, having broken a tile that was two and one-fourth inches in diameter in which it grew; the remaining two-thirds being nearly large enough to fill the tile. The small end of this root was not pointed, but circular in form, four inches in diameter and one and a half inches thick. I could discover no cause for the end to assume a circular form instead of a pointed one.

In 1871 a vitrified drain pipe eight inches in diameter,

for surface drainage only, was laid under my direction in Madison Square; located from seven to fourteen feet distant from white willow trees, *Salix alba*. The mortar used in making up the joints of the pipe when laid was composed of equal parts of Rosendale cement and sand. Three years after, in 1874, this drain pipe was found to be partially obstructed; and an effort made to force an opening with stiff wire met with only partial success. The following year the pipe was taken up, and found completely filled with fibrous roots growing from the willow trees; and so compact had the mass of roots become that a horse attached to one end removed a piece sixty feet long. The roots composing this mass varied in size from one-sixteenth to one-fourth of an inch in diameter; and the proportion I found to be as follows: fibers one-sixteenth of an inch in diameter composed thirty per cent.; fibers one-thirtieth of an inch in diameter, sixty per cent.; fibers one-fourth of an inch in diameter, four per cent. The mortar used in cementing the joints of this pipe was in perfect condition, and no cracks were discovered to allow the roots to enter the pipe, but a closer examination revealed the mystery. The fine fibers, one-sixtieth of an inch in diameter, had grown through the solid mortar, and increased within the pipe to the size and length described.

This drain was then relaid with similar mortar joints, but the roots still continued to obstruct the pipe, making it necessary to remove it in 1877, 1879, and 1881.

When this drain was relaid for the third time, in 1881, I recommended bituminous paving cement to be applied to the joints after having been prepared in the

perature of 200° Fahrenheit. Before applying this mixture the pipe was painted with crude coal tar without heating, to make the concrete adhere more readily to the pipe. The tar can be applied with a brush or rag tied on a stick. The concrete was then put on around the joints not less than three inches in thickness, extending four inches each way from the ends of the hubs, covering the surface at each joint eight inches longitudinal of the pipe, the ground having previously been dug away from under the joints and pipe for less than three inches. This concrete was packed thoroughly around the pipe by ramming with wooden rammers. Great care should be taken to pack the concrete thoroughly while warm. No filling of the trench should be done until after the concrete has become hard. This concrete was applied to the drain for seventy feet, with manholes at each end to enable it to be readily examined in the future.

The partial success obtained in the first imperfect trial has induced me to believe that the latter experiment will be successful; and also that the carbolic and cresylic acids, naphthalene, and the basic oils contained in the paving composition, when applied in the manner described, will effectually prevent the ingress of any roots into drains. Time will determine whether my conclusions are correct.—*Engineering News*.

A GROUP OF CACTUS IN JAMAICA.

In the temperate zones, although some species of the cactus are known, like that of the *nopal* in the Mediterranean region, which is the *Opuntia vulgaris*, there

ing Iceland in many directions. The country is civilized, and has a history in many respects like our own, yet nowhere was the slightest trace of any occupation to be seen. A brief note of the more salient points in its early history will render apparent how closely its civilization must have resembled our own in Saxon times; and if the styles of building were equally similar, we shall be at no loss to understand why no traces of them remain.

Iceland was colonized in the middle of the tenth century, and so rapid that Harold, in order to check its too rapid growth, imposed a fine of four ounces of silver upon all immigrants. A Saxon bishop arrived in the year 981, and in 984 the first church was built. In A.D. 1000 the whole country was converted to Christianity; Benedictines and Augustinians settled, and a tribute was paid to the Roman See. It was not until 1261 that the inhabitants put themselves under the protection of Norway, and there is every reason to believe that prior to that date their civilization equaled any which obtained among their relatives settled in England. Their manners, customs, mode of life, were probably identical, and of these their sagas have left an almost uninterrupted record from the golden age of Harold, *aux beaux cheveux*, to late historic times. We have, in addition to direct evidence that these have never undergone much change, collateral evidence to show that the habits and customs of the population are still substantially the same as they were in the tenth and eleventh centuries. The ordinary Icander has no towns and no centers of reunion; he lives alone, whether priest or peasant, and when he meets his distant

A GROUP OF CACTUS IN JAMAICA.

usual manner with mortar, to prevent if possible further trouble from roots; but they obstructed the drain for the fourth time the present season, and when the pipe was removed, about twelve feet of it was found filled with roots, which entered at only a few joints, where the mortar had been imperfectly covered by the cement with a thin coat painted over the mortar joints. Wherever the cement was soft the roots grew through it, but were killed; wherever the coating of cement was only one-eighth of an inch thick but hard, it killed the roots but was not penetrated by them. I tested roots that grew through the soft cement, with a microscope, and also placed them in water of a mild temperature, where they remained for two weeks without any sign of vitality appearing.

This drain was relaid again in July last, and I then treated it in a thorough manner with a bituminous concrete, which will now be described. When relaying the pipe this season, the sockets only were filled with mortar, in order to present as little mortar surface as possible to be covered with the concrete, preferring to apply the concrete on the glazed surface of the pipe rather than on the mortar. The bituminous concrete was composed of N. Y. Coal Tar Chemical Co. paving cement, known to the trade as No. 5, mixed with fine gravel; No. 4 paving cement and fine sand would have been preferable—the proportions used being seven gallons of paving cement to forty cubic feet of fine gravel. This proportion should be varied according to the fineness of the gravel or sand. The paving cement and gravel were heated separately to about 220° Fahrenheit; then thoroughly mixed, and applied at a tem-

perature of 200° Fahrenheit. Before applying this mixture the pipe was painted with crude coal tar without heating, to make the concrete adhere more readily to the pipe. The tar can be applied with a brush or rag tied on a stick. The concrete was then put on around the joints not less than three inches in thickness, extending four inches each way from the ends of the hubs, covering the surface at each joint eight inches longitudinal of the pipe, the ground having previously been dug away from under the joints and pipe for less than three inches. This concrete was packed thoroughly around the pipe by ramming with wooden rammers. Great care should be taken to pack the concrete thoroughly while warm. No filling of the trench should be done until after the concrete has become hard. This concrete was applied to the drain for seventy feet, with manholes at each end to enable it to be readily examined in the future.

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ICELAND.

By J. STARKIE GARDNER, F.G.S.

THE utter disappearance, with the most trifling exceptions, of the dwellings and even public buildings of the Anglo-Saxon period, which must have been one of relatively high civilization, has been a subject of wonder to moderately well informed people like myself.

I had the opportunity a short time since of travers-

neighbors it is by accident. The people, though nominally under Denmark, have never been called on to supply either soldiers or sailors to the Danish services, and until quite lately no one ever thought of wandering outside his native land. There are even now no roads or bridges, and the country consists entirely of narrow valleys, separated by mountains or hills averaging 1,200 to 2,000 feet high, each valley being the bed of a torrent, often difficult and even dangerous to ford. The Norse language, which was carried to Iceland by the colony of noble families who first settled there, was spoken with conservative elegance, free from any mixture of foreign idiom. While, in course of ages, it became modified on the mainland, it was preserved in the interior of Iceland in all its native purity, so that even as early as in the twelfth century the language of the ancient sagas was spoken of as Icelandic. Under the primitive conditions and habits obtaining in this isolated country, it has remained undefiled and pure, indeed there is no priest or peasant at the present day in Iceland who cannot understand perfectly the language of even the most ancient of the sagas. The relationship between modern Icelandic and the Saxon element of the English language is still to be traced, for, though marked by wide divergences of spelling, a great number of common words, when slowly pronounced, can be mutually understood, and a glance at the names on a map will indicate the kind of community that exists. Another example of the small amount of change that has taken place in the habits of this people is seen in the collection of native work in the museum at Reykjavik. The wood-carving, and more especial-