SOCIETIES' PROCEEDINGS

ROYAL SOCIETY OF MEDICINE—SECTION OF OTOLOGY

May 5th, 1933

President—J. F. O'MALLEY, F.R.C.S.

The Treatment of Chronic Suppurative Otitis

The opening paper read by Mr. T. RITCHIE RODGER is published in this issue of the *Journal of Laryngology and Otology*, Vol. XLVIII, No. 8, pp. 525-34.

DISCUSSION.

DR. A. R. FRIEL: The factor which keeps up suppuration, and is common to all cases, is infection of the exudation or secretion by micro-organisms.

When a series of cases of chronic otorrhœa is classified by taking into account the position of sepsis and presence of any other factor, it will be found that sepsis confined to the tympanum, and without any other factor, such as granulations or polypi, forms the largest group. In this class the area of sepsis is usually accessible. Suppuration due to tympanic sepsis would appear to be a condition suitable for treatment by antiseptics applied directly to the surface. Tympanic sepsis affords an excellent test for antiseptic treatment.

In the treatment of tympanic sepsis by zinc ionisation the ear is first cleansed and a weak solution of a zinc salt is inserted into the meatus. An electrode connected to the positive terminal of a rheostat dips into the solution, while the negative electrode is applied at a distant part of the body.

Consider the part played by the current. It makes the positive ion (zinc) travel towards the negative electrode, so that the film of infected material adhering to the surface of the tympanum is penetrated and permeated by the zinc, as well as the superficial cells of the mucous membrane. The introduction of the zinc takes place sufficiently rapidly for the treatment to be carried out in a reasonable time. The action of the current is selective, as positive ions alone are introduced here. No action on the tissues results from the presence of negative ions in the solution, for they are not introduced.

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Consider the part played by the zinc : It is the antiseptic agent. It combines with albumin to form a dense insoluble precipitate between the subjacent tissues and the exterior. This antiseptic layer is not only a protective, but is a bad culture medium, and the micro-organisms present die. The zinc ion, when it has combined with albumin to form a precipitate, does not diffuse. Its action is confined to the depth to which it has been introduced and subjacent tissues are not irritated.

When the current is turned off and the solution has run out of the ear it is well, in those cases in which the tissues were previously much congested, to blow some boracic powder into the meatus. This prevents reinfection of any mucus or serum poured out while the congestion rapidly subsides.

The test of the treatment is the clinical result. The majority of cases in which the area of sepsis is accessible, and in which no other factor besides sepsis is present, cease to discharge after one treatment.

When other factors besides sepsis are present these should be removed before ionisation ; and when the area of sepsis is accessible only with difficulty, special means must be used to gain access to it ; when the area is totally inaccessible it must be made accessible by operation.

Mr. T. B. Layton said he thought that Mr. Ritchie Rodger was not quite fair when he said that chronic suppurative otitis was a reproach to the medical profession in general, and to the otologist in particular. They would do their best to improve matters, but seeing that this was, as the opener pointed out, a social problem, the hygiene of the factory, of the school and, above all, of the home, was the most important factor, and the reproach, if any, must rest with the nation as a whole.

Mr. Ritchie Rodger had not defined " chronic suppuration ". He (the speaker) considered that an otitis had become chronic when a second organism had gained entrance, and he believed that this had usually happened by the end of two months.

He disagreed with the view that Nature's method of relieving intra-tympanic pressure was by sloughing of a part of the membrane. That might occasionally happen, but usually the perforation caused by Nature was very small, and there was no sloughing. The change from this to the large perforation was due to ulceration round the edge. It was therefore a race against time to get the acute ear well. The most important part of the treatment was to clean the meatus before the drumhead had ruptured in the acute stage. The cleansing of the meatus—under an anæsthetic—from all débris, epithelium, etc., and anything which harboured secondary organisms, was one of the most important preliminaries of paracentesis.

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He did not agree that it did not matter what time-limit was set. A time-limit should be set from the first; he thought it should be one of a month, allowing a fortnight for determining the operation before invasion by secondary organisms. The significance of this was shown when comparing the good results of the modern simple mastoid operation performed early, and the disappointing results from the same operation when once secondary organisms had invaded the mastoid region.

He agreed with Mr. Ritchie Rodger as to the risks later in life from the chronically infected ear, though he did not think it was possible to estimate what these were. He thought that the question of the radical mastoid operation had been fairly dealt with, except that Mr. Ritchie Rodger had not sufficiently emphasised the risk to life from meningitis due to this operation, a risk not attached to the simple mastoid operation, which one could advocate for cases of acute otitis media in which the condition threatened not to clear up.

The opener seemed to imply that, though the discharging ear was detrimental to a man in the labour market, after a radical mastoid operation the detriment no longer existed. He (Mr. Layton) had found that, in many walks of life, having undergone a radical mastoid operation was a definite bar to employment, even when the result had been clinically perfect. Many persons who had undergone that operation could never return to a dangerous trade.

Sir James Dundas-Grant said he thought that not sufficient stress had been laid on the difference between the postero-superior (marginal) and the antero-inferior perforation. The former was almost synonymous with cholesteatoma. A recent work by Professor Portmann confirmed all that he (Sir James) had long said about cholesteatoma. The antero-inferior perforation was comparatively benign; it indicated a slighter trouble, in which the discharge came from the upper part of the Eustachian tube, and recovery would sometimes follow Eustachian medication even in obstinate cases. He had shown at a meeting of the Section a patient who had an extensive perforation, about to undergo a radical mastoid operation. He stopped the discharge by injecting chloride of zinc solution into the Eustachian tube as this could be done through a Eustachian catheter with or without a Weber-Leil tube. In one very marked case the mucus in the typanum was so inspissated that it was almost a foreign body, and after removal by syringing and suction it recurred again and again, until he used forcible irrigation with bicarbonate of soda through the Eustachian tube. This, however, could be carried out safely only when there was a very large perforation.

Polypi sometimes grew from the edges of the perforation, and might remain inside and become larger than the perforation itself.

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In one case he had been able to force out the polypus by means of vigorous politzerisation and snare it away, when under ordinary treatment the discharge ceased, with no recurrence.

Another serviceable method of treatment was with a fine galvano-cautery point, with which he had put an end to small polypi which were keeping up a discharge. In desquamating conditions particularly, he recommended the use of a modification of the late Sir William Milligan's inter-tympanic syringe. It had a U-tube attachment into which a little spirit could be sucked and then blown into the attic.

MR. DOUGLAS GUTHRIE said that he would deal with this subject in relation to (1) the Army ; (2) hospitals for children.

(1) In the Army, suppurative otitis media had been, and was still, one of the commonest causes of the rejection of recruits, and of the invaliding of those already serving. He saw all doubtful ear cases in recruits in Scotland, and he did not hesitate to reject any recruit who suffered from chronic suppurative otitis, and even cases of dry perforation. That, he thought, was sound practice. Consideration was naturally due to the soldier who had served for some years, provided the ear condition was not a constant source of trouble, but it was of no use to perform the radical mastoid operation in Army cases because it did not render the man really fit. He agreed with Mr. Layton that the man who had undergone the radical mastoid operation was at a discount in the labour market and he was equally so in the Army.

(2) With regard to the problem in Children's hospitals, in the *Journal of Laryngology* for 1926 there appeared the results of an investigation of 500 cases of aural suppuration, acute and chronic. The speaker had endeavoured to follow up 500 cases collected over a period of years, allowing a period of two years to elapse before doing so. 345 were traced. Among all the chronic cases there was only one with intracranial complication, a boy aged 9, with cerebral abscess. In the acute cases there were intracranial complications in from 3 per cent to 4 per cent. It was found that 60 per cent of chronic suppurative otitis media cases were cured, the ear being dry, and deafness slight. Five patients had died (three from pneumonia, two from meningitis, probably otitic).

By following up the cases, he had collected those which had not been cured by conservative means, and had then instituted more thorough conservative treatment or had performed the radical mastoid operation. The results of this operation were very bad, and since that time he had performed very few radical mastoid operations in children, i.e. only one in the Royal Hospital for Sick Children in the last two years, although he had about sixty cases of Schwartze's operation in the hospital per annum.

He agreed with Mr. Ritchie Rodger in insisting upon great care

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in the conservative treatment. It was no use to ask the mother, or nurse, to carry it out ; the otologist must do it himself, or instruct a skilled assistant to do it, inspecting the ear at regular intervals.

He had recently taken up ionisation, and the results had been distinctly encouraging. It required meticulous attention to detail, and a fair degree of skill.

The method of washing out the Eustachian tube by catheter or the Weber-Leil tube described by Sir James Dundas-Grant, was well worth trial and might be done in some cases in which it was necessary to remove adenoids. The child being under an anæsthetic in any case, the Eustachian catheter could be passed and the middle ear washed out from the nasopharynx.

MR. L. GRAHAM BROWN said that he desired to associate himself with the plea of the opener for earlier mastoid operation in cases of chronic suppuration, i.e. after a certain time-limit had elapsed and cleansing and ionisation had failed. He also agreed that in most of the cases the ordinary Schwartze operation sufficed. In selected cases of long-continued suppurations, he performed the operation of transmastoid atticotympanotomy, introduced by Charles Heath thirty years ago, and subsequently modified. It was a rational method of inspecting the middle-ear contents in every case, and it was a conservative method, in that the membranous wall of the meatus was kept intact, and the other anatomical details were preserved as much as possible, as was the function of hearing.

MR. JAMES ADAM remarked that for many years he had used the galvanic cautery for occulsion of the Eustachian tube in the radical operation.

He suggested that one cause of the frequency of suppuration in the ear in bottle-fed sucklings was the practice of turning the children on their back. In a record kept at his request by Dr. Kerr, in Stobhill Hospital, out of 200 children (175 of which were bottle-fed) seven had discharging ears, while of the remaining twenty-five breast-fed ones none had discharging ears.

DR. SOPHIA JEVONS said that what was needed was propaganda for the medical-minded lay public, for if progress was to be made it was necessary to come into the open and explain the possibilities of cure. She felt sure a great improvement would follow. It might be well to form a Committee of the Section for this purpose. She (Dr. Jevons) always found great difficulty in making the working-class mother realise the danger to her child of chronic otitis media.

MR. RITCHIE RODGER (in reply) said that it had been interesting to hear Dr. Friel speak on his particular subject of ionisation ; he (the speaker) had tried it, but had failed to secure the same good results as Dr. Friel did. He preferred the well-known dry treatment which he had detailed in the paper. It was essential to get the ear quite clean and dry before commencing the treatment. The wall of

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protective powder should be left in until it began to break down of itself. Probably Dr. Friel and he obtained their good results in the same type of case, namely, that in which the suppuration was confined to the middle ear. If the suppuration involved the antrum and adjacent cells he did not think that any conservative treatment would succeed.

With regard to the points which Mr. Layton had raised as to a secondary organism being the cause of the chronicity, he did not agree with that idea; he considered that it depended on the point which the infection had reached, whether there was one organism or several. He always pointed out to the practitioner in charge of the case what were the principles on which he worked. The presence of mastoid tenderness at an early stage did not necessarily mean there was an infection of the mastoid process, but only a congested condition. Older physicians used to speak of this as a " determination of blood " to the part. All the forces of protection were directed to that particular spot; it was the " congestion of traffic " in the circulation which caused the initial mastoid tenderness. If myringotomy was performed, or if Nature produced a spontaneous rupture, the congested condition should disappear in about forty-eight hours. If it did not, one could assume that actual infection of the mastoid process had occurred.

Two Cases of Acusticus Tumour. With Clinical and Pathological Reports

The opening paper read by Mr. ALBERT A. GRAY is published in this issue of the *Journal of Laryngology and Otology*, Vol. XLVIII, No. 8, pp. 535-45.

DISCUSSION.

SIR JAMES DUNDAS-GRANT said that in the cases related there were two causes, either of which would suffice for a negative Rinne; it might be present even in unilateral deafness. It was a surprise to learn that otosclerosis was present, and what Dr. Gray had said helped to an understanding of the genesis of otosclerosis. He, Sir James, understood that the spot between the cochlea and the anterior limb of the stapes was, in some animals, the site of a depression, and was probably a weak spot. It was remarkable that in these cases of otosclerosis more frequent mention was not made of the galvanic reaction, as that was important.

Mr. F. C. ORMEROD said that in his own case he had been surprised to find a negative Rinne at the time of the examination, and he was greatly interested to hear Dr. Gray suggest that this was due to otosclerosis. Having in mind Dr. Gray's demonstration—fourteen months ago—of auditory nerves which he had removed from four

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otosclerotic patients, and the demonstration now given, he (the speaker) was impressed by the theory of the trophic cause of otosclerosis. He hoped that any members who encountered cases of acusticus tumour would send them to Dr. Gray.

MR. SYDNEY SCOTT said that when Sir James Dundas-Grant and himself had discussed the case referred to, they certainly thought it was perhaps a pseudo-negative Rinne. It might be a coincidence that otosclerosis was associated with the auditory nerve tumour.

Dr. Gray had shown a growth invading the cochlea. Twenty years ago he (the speaker) had shown sections of the labyrinth from a case of auditory nerve tumour, demonstrating the growth in the cochlea. It was quite possible that an otosclerotic condition had been overlooked in that case.

MR. W. STEWART said that in many of these cases there was no obvious facial paralysis, but one sign which was pathognomonic of auditory nerve tumour was a sluggish reaction of the lids on the affected side, and they did not close so perfectly as on the unaffected side. Often that was the only sign.

DR. T. B. JOBSON asked about operation in these cases. There seemed to be no limit to the extension of these tumours, and the possibility of eradication by a single operation appeared to be nil.

THE PRESIDENT said that in Mr. Ormerod's case the tests of the left ear had arrested his (the speaker's) attention, and he did not clearly follow the explanation which Dr. Gray gave. He himself thought there was a pseudo-Rinne, and it was of great interest to learn that an otosclerotic change was present.

DR. GRAY (in reply) said that with regard to the depression a little outside the joint of the oval window, referred to by Sir James Dundas-Grant as being present in some animals, it might be that there was a break across there of phylogenetic origin; but in ordinary otosclerosis one always found ankylosis beginning at the joint. It was not a case of interference with the vascular supply.

He thought the reaction might be a pseudo-negative Rinne, but the probability was rather that it was due to ankylosis of the right stapes. Mr. Ormerod said it was a case of nerve deafness so far as the other signs and symptoms indicated.

In reply to Mr. Scott, concerning serial sections, it was very important to have a series, because in Mr. Ormerod's case the focus was minute, and might have been missed otherwise.

With regard to Mr. Jobson's suggestion concerning operation, for five years he (the speaker) had given up operative work altogether. But the tumours were usually free from adhesions and might be easily removed in that respect. The real risk, however, was from hæmorrhage, and now that there was a special method of overcoming that by diathermy, removal could be attempted with a reasonable hope of success.

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Royal Society of Medicine

Demonstration of a New Apparatus for Examination, Diagnosis and Therapeutics of Chronic Deafness

By Dr. ISIDOR MÜLLER (Karlsbad)

My new apparatus, which I call the "Iatrophone", is an electric interference-tone-generator, equipped with a quartz crystal and constructed from the most modern points of view for diagnosis as well as for therapy. The quartz crystal makes it quite constant in frequency to a degree of 1 per mille. If the temperature does not change within certain limits, the constancy is still greater. Another important quality besides the constant frequency is the pure sinusoidal form of vibration, which can be shown on photographed tone-waves. The careful and elaborate technical construction of the apparatus allows the use of different voltages, 100 to 120, 200 to 240 volts a.c., 40 to 60 cycles. We have succeeded in constructing a small portable unit of about 16 lb. weight, for the scientific testing and treatment of the ear. The low price will also be an advantage.

The connection with the patient's ear, for translation of acoustical vibrations is effected by a device, which is in fact a loud-speaker of special construction, suitable not only for transmission of simple tones, but also of complicated tones and noises such as speech and music. Therefore we can transmit not only tones produced by the tone-generator, but also tones, noises, speech and music of electric gramophones, speech- and tone-records.

The diagnosis and therapeutics of chronic deafness are so closely involved that they really cannot be separated. The following points of view will always be taken into consideration by us.

The hearing is first tested by whispering, or in the case of very deaf persons by loud speaking. We thus avoid the use of figures, as after a short time the patients guess the numbers by the cadence and phonetics. After the speaking test, tuning-fork tests, etc. (Weber-Rinne-Schwabach and Gellé) are made. Further, the air connection is examined with tuning-forks of different keys, from bass C till C 4. As ordinary tuning-forks are not sufficiently reliable to ensure prevention of mistakes, for twenty-five years we have used our electro-magnetic tuning-forks, and for several years with an apparatus by which tone-frequent currents are used. The first advantage of these is that we can produce every audible tone, and tones beyond, which are almost free from overtones. The second advantage is, that in this manner we fulfill a postulate, which could not be fulfilled hitherto. The continuous tone-succession from Bezold-Edelmann has the great deficiency that the sounds used are of different origin, being produced partly by means of tuning-forks and partly by whistles. Moreover, some doctors had used the monochord, an invention of Pythagoras, as completion, to state the highest limit of hearing. (About 15,000 vibrations.)

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As already said, this important deficiency can be avoided by using tone-frequent currents, or frequencies of electric oscillations to produce a continuous succession of tone ; so that, while all tones are generated by electro-acoustical vibration of different frequencies, all are of the same origin.

With this apparatus it is possible to obtain from 0 vibrations to far above the limit of hearing—20,000 and more vibrations, sounds of various keys, which can be applied for a testing of hearing.

Another advance made possible by the use of this apparatus is that we are thereby enabled to test the air-conduction as well as the combined air-bone-conduction, or bone-conduction alone, if required, bringing the end of the device either quite close to the meatus, or inside the meatus, or applying it to the mastoid process. In the latter case experience has shown that it makes a great difference whether the end-piece is placed on the point which corresponds to the antrum, or on the descending portion of it, and in this way, and also by comparison of the two, it is often possible to procure information about the pneumatic condition of the mastoid.

A further advantage of this method, in comparison to the old test with tuning-forks is that we are able to vary the tone as required, the height of tone as well as the tone-intensity, from 0 to strong intensity, which we can produce in a more rational way than with tuning-forks. The height of sound, as we know, depends on the frequency and the intensity on the intensity of the electric current.

An important point to note is that we are able to measure the length of time until the central perception of sound is appreciated, and it is of great advantage that we can change the quality—as well as the intensity—of sound, *ad libitum*. Moreover, we are able to ascend and descend scales with any speed, or to use the same quality and intensity of tone for as long as we wish, and thus test the perception-faculties of the auditory nerve in every way.

One of the most important points about the whole method is, that we are thereby enabled to find the threshold of hearing for all these acoustic phenomena, from 0 to the audible point and vice-versa from a loud tone to 0. We do it both ways because we have found that they are not quite identical, but frequently show certain differences. As already mentioned, we use a specially adapted device, suitable for examination not only with simple tones, but also with complicated tones and noises, such as speech and music. In this way valuable information is supplied as to the condition of the auditory nerve and its capacity of perception. That is of great importance in various respects, because thereby we often obtain information as to the process of perception, especially in regard to central hearing, i.e. central perception of the auditory phenomena. The tone-frequent currents can also be used as simple stimulators

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without sound. The idea is, to send currents to the auditory nerve which have exactly the same amount of vibration as the corresponding tone. In this way one can excite the auditory nerve without tiring the brain with tones, using an intensity below the threshold of stimulation. A similar effect can also be produced through those tone-frequent currents, which attain tones above and below the range of auditory perception. Thus, in cases of advanced deafness it is not necessary to go beyond the general absolute range of perception of tone, but for these cases there are already otherwise audible tones, outside their individual range of hearing (extratonal), and it has often been found possible, by continuous use of such supratonal or infratonal frequencies and intensities, to increase or finally restore the patient's tonal perception.

This apparatus and method of diagnosis and treatment of deafness, which produces a substantially continuous spectrum of frequencies from the infratonal to the supratonal bands, varying the intensity of each separate frequency over a wide range of values, further enables us to discover isles of hearing and the gaps between by noting the responses of the subject to the several frequencies and intensities. This enables us to treat the patient, with regard to the gaps of hearing, by transmitting the frequencies corresponding to these gaps into the ear.

It is in fact a method of education, covering the gaps and widening the corresponding range of hearing by continued and suitable application of adequate frequencies.

This kind of tone production is exceedingly adaptable for training the auditory nerve. Not only the simple musical tones, however, but also musical and talking records are of great importance. For this reason we have connected our apparatus to an electric gramophone of special construction. We have studied a number of cases of high-grade deafness in which music could no longer be perceived as such, but simply as a noise, an *ominum gatherum* of confused sounds. Some of these cases especially were exceedingly interesting, because the deficiency of perception had resulted from quite different causes. By some there was such a retarded perception of the single tones that, naturally, by the quicker change of tones, the melody could no longer be perceived, as the tones became totally confused. Up to a certain extent one could already correct this to some degree by suitable slowing down of the music.

In other cases, no slow perception of single tones could be found, but the perception of a variety of successive tones was impaired. When we applied higher or lower, weaker or stronger tones, of the same or different kind in slightly quicker succession, only a muddled noise could be heard. In both kinds of cases we were, by practice, able to abolish this deficiency, and after several weeks the music was heard as such. The patients assured us, spontaneously, that

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for the first time, after a long period, the music had been a pleasure to hear.

It is possible, therefore, in a number of cases to revive the perception faculties from that of simple tones to that of complicated melodies, our method being to proceed from the use of simple tones to that of whole scales, up and down, changing rapidity and intensity. Possibly we may assume that a similar procedure takes place in the ear to that in the eye, where the so-called " after-images " arise on the retina. In our cases it may deal with after-images in the labyrinth or in the different stations up to the cortex. One can restore the perception through the influence on the labyrinth and on the central auditory paths, and produce the right perception through the cerebral cortex and consequently the consciousness of the acoustic phenomenon.

Returning to the subject of the stimulation-threshold : We can determine not only the stimulation-threshold of different sounds, but also the range of hearing for different intensities and heights of tones. We can also state the exact time of perception more precisely than by any other method. This is a very important part of the treatment and the judgment thereof, the more so because, as already said, we can use simple tones as well as music and speech in the same manner for testing as for treatment, which leads to a deeper insight into the process. We also observed in a great number of cases, that the subjective auditory sensations (noises as well as disturbances of the equilibrium and irritations of the auditory nerve), could be influenced in a favourable manner.

With regard to the speech records : we know that in many cases of deafness an improvement of hearing can be obtained through long training. But our kind of training is much more practical, as a great variation of words and sentences can be used without tiring the doctor or his assistant. (Use of singing, etc.)

The cases of vertigo, which we have treated—and still treat—with our electro-magnetic tuning-forks, to aid the treatment with tone-frequent currents, show that the forks have the advantage of great mechanical influence, especially the deeper ones. The tuning-forks, as is known, make everything on which they are set vibrate in the same way as they do themselves. Thereby not only the auditory nerve and the labyrinth but the whole skull with its contents are brought into vibration. Thus, it seems that an intensified activity will be induced in the brain and the cerebral cortex and the circulation of the ear and the whole head will be greatly stimulated. One may observe in many patients—especially in nervous patients—a redness of the side of the head on which the tuning-fork is set. By disturbances of the equilibrium the deep tones, of the forks as well as of the apparatus, from 100 vibrations down are proved to be the most efficacious.

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In conclusion: we do not wish to overthrow the old methods without reason or without providing a complete equivalent, but we hope that we have contributed a little towards progress in the examination of the ear and in the treatment of deafness, and have produced an apparatus that will be of use both for the aural clinic and the medical practitioner.

Demonstration of High-frequency apparatus

By Dr. ISIDOR MÜLLER (Karlsbad)

The electric high-frequency field has opened up a new range of application of extremely frequent vibrations.

The body of the patient has not to be brought in contact with any kind of electrode as is the case with the customary methods. The extremely high frequency can be finely and individually administered with this apparatus, adjusted according to the required effect. This fine, individually adapted regulation is absolutely necessary in order to influence the inner organs to any appreciable degree. Exact measurement has shown that diathermy can never have this effect, since it would require an electric energy of a degree which would lead to complete combustion of the surface. The diathermic current has quite a different influence upon the human tissue from that of extremely frequent currents. The usual diathermic current has, in fact, no penetrating power, not being able to overcome any larger resistance of conduction, while the ultra-high-frequency currents penetrate the whole body so that any of the inner organs, however deep, may be influenced by them. According to numerous observations, even the deepest parts may be heated, if there is any abnormal resistance as, for instance, suppurative focuses, abscesses, infiltrations, etc., it means that there are places where circulation and, consequently, caloric conduction are disturbed, i.e. diminished. The result is a much greater and quicker calefaction of these parts in comparison to their surroundings. This important observation leads to selective action and treatment. The best effects have been accomplished in cases of inflammatory congestion, infiltration and suppuration, suppurative focuses, etc. The apparatus is equipped with the finest regulator of energy and frequency, to adapt it for the treatment of ear, nose and throat troubles. It produces high frequency up to 65 megacycles. We have frequently been able to avoid by its use operations in cases of acute inflammation, and to treat with good results many cases of chronic catarrh.

It is expected that treatment with extremely high frequencies will bring about a considerable change in the practice of medicine.

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The effect of this kind of ray extends beyond our present range of vision.

Sir JAMES DUNDAS-GRANT said that he wondered whether the time taken by the auditory stimulus to reach the brain could be measured; this was slower in some than in others, and it might be a further aid in deciding in which cases there was nerve-deafness.

ABSTRACTS

EAR

The Diagnostic Significance of Hydrogen-ion Concentration in the Cerebro-Spinal Fluid. K. LÖWY. (*Arch. Ohr-, u.s.w., Heilk.*, 1933, cxxxiv., 180-7.)

It is now accepted that inflamed tissue has a higher hydrogen-ion concentration (greater acidity) than healthy tissue. The author undertook the present research in the hope of discovering an increased acidity in the cerebro-spinal fluid as an early sign of meningitis.

The pH value of normal cerebro-spinal fluid is the same as that of blood (7·35 – 7·40). The apparatus which is used for determining the pH of cerebro-spinal fluid is described, and the results in twenty-eight patients suffering from various intracranial complications of middle-ear suppuration, are tabulated. The tables also include the cell counts and the Pandy reactions, and the three tests can be compared.

In two patients the cerebro-spinal fluid was tested three days before the clinical onset of suppurative meningitis; these cases showed normal pH values, together with normal cell counts. Dr. Löwy's hopes, therefore, were not realised. Increased pH values occur only when the meningitis is advanced, as shown by a greatly increased cell count.

The cerebro-spinal fluid, like blood, has a great capacity for maintaining the normal pH value (" Pufferung ") by neutralising any acid substances which penetrate it or which arise as a result of inflammation.

J. A. KEEN.

Clinical and Experimental Research on the Function of the Salivary Glands after the Radical Mastoid Operation. F. ALTMANN and K. LÖWY. (*Arch. Ohr-, u.s.w., Heilk.*, 1933, cxxxiv., 188-200.)

The secretory fibres of the submaxillary and sublingual glands are found in the chorda tympani, and those of the parotid gland in the

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