I prefer giving a short *résumé* of the experience of Kœberlé, Péan, and Verneuil.

M. Verneuil, in 1875, published several very interesting papers on Forcippresure in the *Bulletins et Mémoires de la Société de Chirurgie de Paris*. He explained how he had been led, in several cases where ordinary methods were inapplicable, simply to leave in the wound the forceps which he had used to seize the wounded vessel. His first case, about 1865, was an uterine polypus with a long pedicle. He cut the pedicle, and was surprised by free bleeding from a considerable artery. Cold injections proving useless, he seized the end of the pedicle by his polypus-forceps, tied the handles together, and left them in for two days without inconvenience to the patient. In 1869, he treated an artery deep in the palm of the hand in a similar manner, leaving the forceps for five days. In 1870, a wound of the internal mammary artery was also successfully treated, the forceps being removed after forty-eight hours. In 1873, in removing the coccyx, the lateral sacral artery was wounded and secured by forceps, which were left in for four days. In 1874, a very vascular naso-pharyngeal polypus was removed by a wire *écraseur*; and, very free bleeding not being stopped by plugging, the bleeding surface was seized by forceps, which were left in till the next morning and then removed without any recurrence of bleeding. Equally successful cases of wounds of the radial artery, of bleeding from the tonsils after removal, and from the interosseal artery after trephining, are also related. A large nævus was surrounded by ten forceps (which were left on till they fell off on the fifth and seventh days), and the growth was thus removed without the loss of one drop of blood. The remarks of M. Verneuil on these cases, on the varieties of forceps successively constructed, on the use of compressors of arteries by Assalini and others for the cure of aneurism, on the movable forceps of Nunneley and the "cannula artery-forceps" of Wolfe of Aberdeen (described in the BRITISH MEDICAL JOURNAL in 1867), the "self-acting wire compress" of Taylor (described in the same JOURNAL in 1868), and Richardson's tubular compress (in the *Medical Times* in 1869)—are all worthy of attentive perusal. He then analyses the results of forcippresure in 27 cases of forcippresure of large vessels—I axillary, 1 subclavian, 17 femoral, 2 tibial, 2 brachial, 3 of the forearm, and 1 radial in the hand. In 22 of these cases, the success was complete. The forceps were left on for various periods from twenty-four hours to the fifth or sixth day, and four times until they came away spontaneously. In only one of the 27 cases was there secondary hæmorrhage. The inconvenience to the patient and the interference with the healing of the wound has been greatly exaggerated.

As a means of preventing or anticipating hæmorrhage, M. Verneuil also shows how forcippresure becomes useful before paring the edges of hare-lip, or removing epithelial growths of the lip or cheek, or portions of the tongue, in compressing the spermatic cord before castration, and in removing growths from the neck of the uterus.

The concluding portion of M. Verneuil's papers, on multiple and prolonged forcippresure as a mode of permanently stopping bleeding, is perhaps the most important of all. He shows that M. Péan has carried out this practice far beyond other surgeons. In comparing the relative advantages and disadvantages of leaving several forceps or several ligatures in a wound, it is thought that both are equally efficacious if the forceps be left on long enough. In rapidity of application, the advantage is altogether on the side of forcippresure. The sponging and irritation of the wound necessary for the ligature are spared, and the pain after recovering from anæsthesia is said to be less, if forceps are properly supported, than from ligatures. In quiet patients, forceps may be left in the mouth, vagina, or rectum; but with timid or restless persons the ligature should be preferred. But the main advantage of forcippresure is that the forceps need not be left on more than a day or two, perhaps not many hours; whereas ligatures separate slowly, and if not cut short retard the healing of wounds.

In the account of M. Péan's practice, given by Messrs. Deny and Exchaquet, a number of general observations on the different modes of suppressing hæmorrhage are followed by examples of the use of forcippresure, *before* operating, as a means of *preventing* hæmorrhage; and particular forms of forceps are described for the tongue, lips, and neck of the uterus. Then a number of cases are related, where forcippresure was not only of temporary utility, but as permanently stopping bleeding, "*moyen d'hémostase définitive*":—amputation of the breast and limbs; resection of joints; operations on the scalp, mouth, tongue, neck, trachea, and rectum; castration, and gastrotomy; also on vessels not divided, as in aneurism and varices; the general conclusion being that the forceps may be removed in from two to thirty-six hours after the operation.

In M. Kœberlé's work, the same order is followed. Into the question of priority at issue with M. Péan I need not enter; nor into the difference between the instruments of Paris and Strassburg, as I think

those of London far superior to both. But I join heartily in the concluding remarks of Kœberlé, to the effect that forcippresure is easy and rapid, enabling the surgeon to do without assistants—thus remarkably simplifying the practice of operative surgery. When divided vessels are small, the pressure exerted during the operation is quite long enough. When vessels are large, the forceps may be left in for some hours, for a day or more. Thus ligatures may be entirely suppressed, except in some few cases where forceps cannot be left; even then, they facilitate the application of ligatures. After the removal of the forceps, which may be looked upon as a ligature or compressor removable at will, no foreign body remains in the wound.

My own experience fully bears out the conclusions of the French surgeons; and I feel certain that, if good forceps are used, forcippresure will soon become very general in the practice of British surgeons.

[To be continued.]

ON A NEW ACOUSTIC APPARATUS; AND ON INTENSIFIED SOUND AS A CURATIVE AGENT.

By WILLIAM A. MCKEOWN, M.D.,

Surgeon to the Ulster Eye, Ear, and Throat Hospital, Belfast.

I HAVE pleasure in bringing to the notice of the profession an acoustic apparatus, constructed with a view to aid the deaf in the most convenient and useful manner. Whilst this is the immediate object of the invention, I shall endeavour to show that its long continued use will exercise a curative influence over certain rebellious diseases of the ear, hitherto practically beyond the pale of medicine and surgery.

As the latter consideration is of even greater importance than the former, I will first deal with the grounds for my belief in the curative influence mentioned.

Toynbee's Pathological Researches show that *Vibratory Motion* ought to be a rational remedy for many cases of Deafness. To Toynbee the world is probably more indebted than to any other man, living or dead, for having put aural diseases on a scientific basis. From his tables, giving the results of his dissection of upwards of 1,000 diseased ears, it appears that a large proportion showed lesions in the conducting apparatus of the middle ear. I extract the following figures:

126 cases—membrani tympani thicker than natural.

59 cases—adhesions of membrana tympani to different parts.

202 cases—membranous bands between ossicles.

99 cases—ankylosis of stapes to fenestra ovalis.

66 cases—too rigid attachment of stapes to fenestra.

I am aware that doubts have been suggested by subsequent writers as to the pathological character of some of the bands described, and, also, that Hinton thinks that Toynbee's proportion of rigid and ankylosed joints is excessive, because the most of the subjects were old and more exposed than people in general to influences likely to disorganise the auditory apparatus. Still, that the condition of rigidity is one of most frequent occurrence in practice does not admit a doubt; indeed, it is highly probable that a large proportion of the cases described in books as "Chronic Inflammation of the Drum", and "Dry Catarrh of the Drum", are cases of simple rigidity of some of the parts induced by the advance of age or constitutional causes. These terms are often only a cloak for defective knowledge, and serve the same purpose as the term "Nervous Disease of the Ear" used to do. Besides, in cases in which there has been undoubtedly a chronic inflammation, this generally brings about a lasting deafness by the induction of rigidity. In any event it will be wiser, instead of trying to explain away Toynbee's results, to accept them as a fair index of the pathological condition in many cases of chronic deafness in old people, and as a guide to rational treatment. We have, I submit, clear grounds for dealing with stiff joints in the ear as we would with a stiff knee or ankle-joint, viz., by appropriate motion.

The Structure of the Ear points to *Vibratory Motion* as Curative.—The structure of the ear, constituted as it is of vibrating membranes, of ossicles with joints, of fluid, and of vibrating parts in connection with the nervous elements, points to it as a mechanical organ, and as one likely to require treatment on mechanical principles. For a stiff joint we prescribe exercise, for a rusty hinge we employ motion. If the muscles and joints of a pianist become impaired in their delicacy of movement, we prescribe much practice. By use, the hinge comes to work sweetly, and the muscles and joints often re-acquire their lost powers; so it is reasonable to infer that the stiff membranes, joints, and other structures of the ear, being brought into exercise by vibratory motions sufficient to set them in play, may advance more and more to a condition of health.

Recorded Experience supporting these views.—The paucity of observations on this subject is somewhat remarkable. We find only scattered fragmentary remarks in different authors of the advantage of exercise of the ear, and a few instances of the influence of strong vibrations, but no author seems to have been impressed with the important lesson taught. Willis (1680) reports the case of a woman who could hear the voice only when a tambour was beaten near to her, and Fielitz notes the case of a shoemaker's son who heard conversation only whilst leather was beaten on a stone by a hammer; Toynbee mentions a case of sudden restoration of hearing by a loud shout, but the improvement only lasted for a few days. In Hinton's book on the *Questions of Aural Surgery*, another case of sudden restoration is recorded. We find in several authors casual remarks of the curative influence exercised by the sounds of the human voice intensified by tubes.

Inference from and explanation of the symptom "Hearing better in a Noise".—I will pass now from these rare and extraordinary cases to the consideration of a symptom very frequently stated by patients, viz., hearing better in a noise. The woman mentioned by Willis, and the shoemaker's son, heard better in a noise, but very many have a similar experience; they may mention the fact over and over again to successive professional advisers, but their statement is either regarded with incredulity, or as true but beyond comprehension, or is explained on some utterly insufficient hypothesis. One thing is laid down clearly enough, viz., that the symptom is of bad omen. I trust I may not be thought to value too lightly the views of many distinguished aural surgeons, when I state that not only is "hearing better in a noise" an absolute truth, but it is perfectly capable of explanation, and is a most important guide to treatment in many cases. If the hearing be better in a noise, why not let the patient have more noise? The deaf can usually bear a good deal without inconvenience. What would stun a healthy ear only brings many deaf persons to the hearing point.

I have at present a young gentleman under my care, who is so deaf that, whilst he is in a quiet room, I must speak distinctly and close to the ear to cause him to hear, but, whilst walking in the street or riding in a railway train, he can converse with me with facility. I recently asked a lady whether she heard better in a noise; she replied that she heard quite well in a noise. Her daughter, who accompanied her, and whose hearing was acute, assured me that her mother heard much better in a noisy street or in a railway train than she did herself; in fact, it was only in quietness that her mother was deaf. Do the laws of physics not explain this apparent anomaly? Is the improvement not owing to the fact that parts whose rigidity has been overcome to some extent by strong vibrations, more readily respond to the minor impulses of the human voice? It is well known that vibrations of varied degrees of intensity and pitch may all at the same time traverse the same media, each system preserving its individuality. We know that it is difficult to set a laden wagon in motion, but once the inertia has been overcome, small forces may afterwards materially contribute to its advance. So with the rigid structures of a diseased ear.

Remarkable improvement in cases of profound Deafness by intense Vibrations.—Whilst this paper was in course of preparation, it occurred to me to imitate the plan adopted by the woman two hundred years ago. I selected cases of very long standing in which the hearing was so bad that words uttered close to the ear were only heard as sound, or in which it was necessary to speak in a clear voice close to the ear to make the patient hear. As the cases are at present under observation, I will reserve details for a future paper. I may state here, however, that the results have been surprising, and quite beyond my most sanguine expectation. I adopted the simple plan of causing the patient to sit in the acoustic chair, to be afterwards described, and whilst so seated, with the nozzles of the tubes in the ears, I caused a large roll of sheet-tin, which chanced to be at hand, to fall violently and repeatedly on the floor. I found that, in some cases in which words spoken loudly close to the ear were not distinguished, the hearing became so far restored after this treatment that the words could be distinctly heard. In other cases, the voice heard before treatment only close to the ear, became audible afterwards at the distance of two or three feet. Recently, a man, 71 years old, very deaf for many years, able, when he entered my consulting rooms, to hear with each ear a loud voice close to the ear, came to hear, after a sitting of a few minutes, every word I said at the distance of two feet from one ear, and four feet from the other, without the aid of tubes. To-day, similar treatment was repeated with the result of improving the hearing distance of one ear to six feet and of the other to eight feet.

I can draw only one inference from my own limited experience of the influence of intense vibrations, viz., that very many cases hitherto regarded as hopeless will be restored to useful hearing by the simple method described.

Inference from the Continuous Exercise of the function of the Healthy

Ear.—But whilst we may reason from the pathological conditions, the structure of the ear, recorded experience, and personal observation, we may take a lesson from the work daily performed by the healthy organ. Few have thought of the incessant exercise of the ear when in a state of health, or of the great evil of prolonged disuse in the case of the deaf. A normal ear during the whole of the waking hours is in a state of continual vibration; the human voice, the noise of the streets, the whistling of the winds, the rustling of the trees, and the innumerable noises pervading all nature, keep the ear in continual exercise. What a contrast for the persons who are deaf to a considerable degree! Excepting loud noises or the voice of a speaker close to them they hear nothing—the ordinary aerial vibrations are not strong enough to affect the delicate vibrating apparatus of the ear, prolonged rest is the result, and this rest makes the organ still less capable of responding in the future. A healthy ear has sixteen or eighteen hours of daily use, an impaired one has often not an hour. Should it not be our object to render it possible for deaf persons to use their organs for hours daily?

The ear is quite analogous to other parts of the body. The most perfect development of bones, muscles, and joints, can only be brought about by much work. Weak and atrophied muscles and stiff joints are the invariable result of want of exercise. To have a perfect organ we must have exercise and plenty of it. If this be necessary to maintain the functions of a healthy organ, how much more is it so to restore an impaired one!

Objections to the Ear-Trumpets and Tubes hitherto in use.—Now let us inquire whether any of the instruments for intensifying sounds hitherto in use are adapted for prolonged application, or are generally of sufficient magnifying power to enable deaf persons to hear distant sounds, or are so arranged as to be applied to both ears at the same time when desired. An acoustic apparatus which fails in the first two particulars cannot admit of that prolonged use which is essential, not only for the pleasure of the individual, but for the necessary exercise of the function of the ear.

The acoustic cornets with a spring over the top of the head are mere toys, and are only useful in the slightest degrees of deafness. The stiff tubes of every variety of form to be held in the ear, are generally far too weak to enable persons deaf in a considerable degree to hear conversation, even at a short distance, and cause so much fatigue of the arm, that deaf persons would rather bear their infirmity than use them for a lengthened period; certainly I have never met a person who used such a tube to each ear. The large sound-collectors placed on stands, with long flexible tubes leading to the ear, are not well adapted for distant vibrations, and are also inconvenient. The long narrow tube impairs the sound very greatly. As to the long flexible tubes, having a nozzle at one end and a small receiving bell at the other, to which the speaker is to address himself, they are only of use for very short conversations and for very deaf persons.

The uselessness in general of all acoustic apparatus hitherto in use will be at once apparent to anyone who knows the history of deaf persons: they are practically debarred from social intercourse, their auditory organs lie fallow, and their mental powers become very much blunted from want of training in the great school of the world. They feel they are comparatively useless members of the community, and anything recommended as calculated to relieve them secures a patient trial. There is not an aurist or instrument-maker within reach who does not receive a share of their patronage. They are provided with a regular armamentarium of cornets, trumpets, and tubes, which they only use when absolutely obliged. If possessed of sufficient means, they go from watering-place to watering-place, and climates hot and cold are tried in succession. I have even heard of persons ascending the Alps, in the hope that the greater rarity of the atmosphere in these elevated regions would give relief. After trying everything, however, they usually come to regard their malady as incurable, and become the resigned victims of a gradually increasing deafness.

The Magnifying Power necessary.—It is little wonder that the tubes in common use have little effect in improving the hearing power for distance, when we bear in mind the law of acoustics, that the intensity of sound diminishes with the square of the distance. Suppose a person hear the voice at the distance of two feet from the ear, what is the magnifying power necessary to make the same voice heard at the distance of ten feet? According to the law stated, the tubes would require to magnify twenty-five times.

How I propose to obviate all the defects stated.—The idea occurred to me that I could accomplish this by making the furniture of home and office acoustic apparatus. Nine-tenths of a man's time is spent at home or business; and if during this period I could secure the easy exercise of the function of hearing, the advantage resulting to the deaf would be incalculable.

By this plan it is clear that very large tubes may be used ; but it was essential not only to use the large tubes, but have them so arranged that the terminal nozzles should remain in the ears, when introduced, without requiring to be held in place, that they should not press on the ears injuriously, and that the head might be moved without hurting the ears. I will not weary the reader by the details of my numerous experiments, but will state that I finally succeeded in fulfilling these requirements in the following way. I attached to each side of a chair, as illustrated in the accompanying drawing, a large tube consisting of a rigid and flexible part in combination. The drawing suffi-

ciently illustrates the mechanism by which the tubes may be raised and lowered, shifted backwards and forwards, and revolved so as to admit of the most perfect adjustment. The flexible termination is, perhaps, the most important part of the apparatus, and requires some explanation. When conducting my experiments, I had very great trouble in finding a suitable flexible part. The India-rubber tubes met with in commerce had always some serious fault; they were either so rigid as to hurt, so flexible as not to keep their position, so small as to diminish the volume of sound, or they had obstructions inside to the passage of sound, or were liable to closure of the canal on being bent. I required a tube of sufficient rigidity to maintain its shape and position, so that it would not require the aid of the hand to keep it in place, of sufficient flexibility to permit of its being moved freely in every direction on very slight pressure, without materially diminishing the bore of the tube, and of sufficient diameter to admit of a large volume of sound. It should have a smooth internal surface so as to have as little irregular reflection of sound as possible. It should admit of being shortened on slight pressure on the nozzle, so that if the head were moved against it the tube would shorten, and the ear be thus saved. I was much puzzled for some time as to how I should obtain a tube having all these properties, some of which almost seemed to be antagonistic to the others. At last I took a lesson from nature. It occurred to me that the trachea possessed all the properties specified, and I therefore made a tube, taking it for a model. On a shape of the desired form, a thin layer of India-rubber was moulded, and on this a spiral of the same material was coiled externally; rings would also suit. These tubes may be made of many varieties, curved, straight, cylindrical or conical. The woodcut illustrates the form I think best. On trial, I found that the tubes fulfilled all my requirements and rendered a binaural apparatus capable of easy use.

It will be observed that the mouth of the tube figured in the drawing is oval. It may, however, be spherical, or its end may be truncated, or it may be bell-shaped. No doubt different forms will be selected by persons with different degrees and varieties of deafness.

Advantage of Binaural Hearing.—Few persons appreciate fully the value of two ears. Let a person who hears well close one ear whilst riding in a carriage or railway train, and he will observe a remarkable deadening of the sound; so when a person testing the tubes closes one ear, he will find that the increase of sound is not at all to be compared to the increase when both ears are used. I believe the intensity by binaural hearing is much more than doubled.

The Proper Power to be used.—The fundamental rule should be in all instances to use tubes of sufficient power to cause the patient to hear easily, if possible; and subsequently, if improvement take place, it may be desirable to diminish the power.

Prejudice against Tubes Irrational.—It is well known that many entertain an unreasonable prejudice against the use of tubes. What harm can there be, in case the conducting apparatus of the ear do not convey ordinary vibrations, to so increase the intensity of the sound as to enable the deaf to hear all the sounds to which the healthy ear is accustomed all day long? This prejudice is so totally at variance with reason and common sense, that I will not further refer to it.

Hearing-Tubes and Spectacles not entirely analogous.—This may seem a strange assertion, but is nevertheless true. Spectacles very rarely have any curative influence over defects of refraction. When spectacles are laid aside, the eyes are in the same condition as before they were put on. Tubes for the ear, on the contrary, by causing vibratory motion, render such motion on weaker impulses afterwards more easy, and are therefore curative. In the case of the eye, we have an irremediable defect of structure; in the case of the ear, a morbid condition, the stiffness of parts more or less remediable. It is an interesting question, which will probably ere long find an answer, whether the tendency to chronicity, so strongly marked in ear-affections, is not directly traceable in many instances to want of regular exercise of the function by intensified sounds.

Exercise of the Auditory Function will lead to the Cultivation of the Intellect.—Irrespective of the mere pleasure of hearing and the prospect of improvement by exercise, efficient acoustic apparatus must be strongly advocated on this most important ground. The majority of the deaf suffer very much from impairment of the mental faculties. In the case of a person whose mind was untutored previous to the deafness, his conversation is confined to the immediate necessities of life. He may hear questions as to his home, his family, his church, or his business; but when we pass beyond these topics, though we may speak with the same force, a laborious mental process seems to be brought into operation before he can understand. There seems an appreciable interval between hearing and understanding. In most instances, the attention must be so put on the stretch, that the deaf person prefers to avoid conversation unless compelled by necessity. The training of a deaf person must really be pursued stage by stage, like the education of a child. We must bear in mind, in dealing with the deaf, that a practised ear and a cultivated mind mutually assist each other.

Cases in which Acoustic Apparatus should and should not be used.—It should not be used

1. In nervous deafness generally (fortunately a rare disease):
2. In acute inflammatory attacks.

It should be used

1. In those numerous cases of deafness beginning without inflammation; no doubt owing, in most instances, to rigidity of parts resulting from advance in years or from constitutional peculiarities:
2. In those cases resulting from inflammation, but in which the inflammatory process has induced and left behind it changes in the conducting media which have resisted medical and surgical remedies.

Summary of Advantages of my Acoustic Apparatus.—1. By it large tubes may be used with the greatest ease and convenience, and for indefinite periods.

2. Both ears may be used at the same time.
3. Deaf persons, whilst the apparatus is in use, are put more nearly on a par with hearing persons as regards the exercise of the function.
4. Deaf persons are enabled to attend to business from which they would be otherwise precluded; for example, a judge on the bench, a lawyer in his chambers, a merchant in his office, may perform their respective duties by aid of an acoustic chair or acoustic writing-table.
5. The intellect is cultivated *pari passu* with the hearing power.
6. Improvement in the hearing is effected by the prolonged exercise of the vibrating and conveying structures of the ear by intensified sound; and there is reasonable ground for hope that persons hitherto regarded as afflicted with an incurable malady may be even so far restored as to dispense for the most part with the use of tubes.

I intend, in a future paper, to illustrate the powers of the apparatus by notes of cases.