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RE-INTRODUCTION OF ETHER INTO
ENGLAND.

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My student life in Europe in 1858-59 taught me that English and Continental surgeons were generally unacquainted with ether and its administration as an anæsthetic, to such an extent as to readily explain their adoption and continued use of chloroform, notwithstanding its frequent fatal effects. Hence, I have from that time thought it would be doing good service to show our medical brethren, the other side of the water, our method of giving ether, and thus, perhaps, give them the confidence in it which we have here in Boston, where it was first used and has never been superseded. I had opportunity of doing this during my recent visit to England to attend the meeting of the International Ophthalmological Congress in London, Aug. 1-3, 1872. This Congress was composed of some 130 delegates, from South and North America, Russia, Germany, Italy, Spain, France, Holland and Great Britain, many of whom, especially the London men, were not only ophthalmic but also general surgeons. As they gathered at the several hospitals to witness operations on the eye by their London confrères, I naturally had the best opportunity of exhibiting to a large number of those unacquainted with it, the administration of ether, and thus establish their confidence in it, not only by what I said, but by what they could see for themselves. The Ophthalmic Congress was opened by my reading a paper on the "Value of Ether in Ophthalmic Surgery," which was published, with the remarks it elicited, in the *Lancet* of Aug. 17th, 1872. I showed the ether I carried with me from Boston, and offered to administer it for any gentlemen who desired it given for their operations. This resulted in my exhibiting ether in the

various hospitals seventeen times during my brief stay in London. I should have continued doing so, but I desired to leave some of the anæsthetic, as I did at Guy's and the Royal London Ophthalmic Hospital, in order that the surgical staff might use it for themselves as they saw me do. The editorial remarks in the same number of the *Lancet* explain when and where I gave ether and for what operations. They are as follows:—

"We print to-day a paper read by Dr. B. Joy Jeffries before the Ophthalmological Congress on the use of ether as an anæsthetic. The reaction that has set in in favor of ether during the last few years is very remarkable, and it will be seen that Dr. Jeffries claims for it an absolute immunity from danger to life. During his stay in London, Dr. Jeffries administered ether, on the 29th of July, at the London Hospital, while Mr. Hutchinson excised a knee-joint; on the 30th, at King's College Hospital, while Mr. Soelberg Wells performed iridectomy and operated for strabismus; on the 2d of August, at the Royal London Ophthalmic Hospital, during an iridectomy by Mr. Critchett, and a flap extraction by Mr. Bowman; on the same day, at St. George's, during a double iridectomy, a single iridectomy, and a double extraction of cataract, by Mr. Brudenell Carter; on the 5th of August, at the Royal London Ophthalmic, during a removal of prolapsed vitreous by Mr. Streatfield, and a strabismus operation by Mr. Hutchinson; on the same day, at Guy's, during a double iridectomy for glaucoma, and during the removal of a foreign body from the anterior chamber by Mr. Bader; on the 6th of August, at the Royal London Ophthalmic, during the extraction of cataract (two patients), an enucleation of the globe, and a strabismus operation by Mr. Critchett, and a flap extraction of cataract by Mr. Bowman.

"In all these cases, Dr. Jeffries administered the ether in the manner set forth in his paper, and saturated his towel with it

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with a freedom that at first sight seemed almost startling. In all the cases, the results were very good, and all the operators expressed themselves as being fully satisfied with the insensibility and muscular relaxation produced. If, indeed, it be true, as maintained by Dr. Jeffries, that the surgical use of ether cannot kill, it will have a strong claim to supersede chloroform alike in ophthalmic and in general surgery."

My experience in England, I mean what I saw and heard, proved conclusively to me that, whatever may have been the reasons in the past, at present, English and Continental surgeons do not use ether, principally because they are unacquainted with it, and rank it with chloroform, of which very many have a wholesome dread. Not being in any way an *etherist*, I mean as in England a *chloroformist*, I entered into no crusade against chloroform, but endeavored to show how simply and readily ether could be administered, and how perfectly harmless it was in any case where an anæsthetic was in place. It should be remembered that but very few of those who saw me give ether were not thoroughly convinced, from experience or otherwise, that ether was not a *practical anæsthetic*. I did not, and do not here, discuss the reasons for this. But I was as thoroughly determined to convince them through their own senses, to regard ether as I do. Truth will finally come out, and I foresaw the day when our English brethren, awakened to the danger of chloroform and the safety of ether, would naturally blame us Bostonians especially for not having enlightened them in spite of themselves. I found only incredulity to overcome in introducing ether into the London hospitals, and I will give the gentlemen there the credit of first, very properly, not believing till they had seen for themselves, and, secondly, frankly acknowledging they had not understood or appreciated ether as a *practical anæsthetic*. Before I left London its administration had been followed up as I taught them, and, of course, with the same success.

It is rather curious that the danger of chloroform had prevented ether having been properly administered. I mean that it was equally feared with chloroform, and hence not enough given at once in the commencement. Public opinion and public ignorance greatly hamper medical men in England as elsewhere in the world. When I asked the object of measuring the chloroform used, I was told, with a smile, "for the benefit of the coroner's jury." This explained to me the looks and expres-

sions of astonishment when I lavishly poured out ether on my towel cone, which I purposely did to prove there need be no fear of the anæsthetic, the important point being how much the patient got, not how much was in the sponge or other apparatus.

As may be well imagined, I had to answer many questions from the English and foreign gentlemen grouped about me. To the very frequent one as to relative expense, I replied by showing them that if ether was manufactured and sold only as cheaply as in the United States, and not wasted in administration, its cost was little if any above that of chloroform. Politeness, of course, prevented my adding what was naturally in my mind, namely, that probably any gentleman who had had one fatal case from chloroform would gladly deduct from his fee any difference in price of the anæsthetic to avoid another.

Till my audiences were convinced by their own observation, I was repeatedly questioned, with more or less of incredulity, as to the time required to etherize a patient ready for operation. This, I found, was universally thought to be so great as to practically exclude the anæsthetic in hospital practice, where in the amphitheatre perhaps a dozen operations must rapidly succeed each other, one surgeon waiting impatiently for the preceding one to finish. Now, in reality, when administering ether in London, the question of time never once entered my head, and I never hurried with the anæsthetic, yet several times I turned to the operator within fifty to one hundred seconds, and told them the patient was ready. In looking up at my audience, the comparison of watches amused me as much as it surprised them. I judge the question of time was pretty definitely answered.

As to the relative disagreeabilities of ether and chloroform I frankly told them I was not in position to judge, for I had never administered the latter and was not an *etherist*; in fact, we had, and needed none among us, since surgeons in America gave ether themselves when operating, or it was exhibited by a surgeon assisting, or by a medical student, experience having taught us that it was not a dangerous anæsthetic like chloroform. I saw there was evident surprise on finding, from inquiry, that I was simply an ophthalmic surgeon and not in any way an *etherist*, as they have *chloroformists*. It was a good argument in favor of ether.

My previous and recent experience both showed me there was a strong and firmly-rooted incredulity in England and on the

Continent as to the *practical* value of ether as an anæsthetic, and in England especially as to its safety as compared with chloroform. Now, with all due deference, I really feel that English surgeons are to blame for this. My only argument in proof will be to quote the words of Dr. Benjamin W. Richardson, at our last interview in London, which were, "Why, Doctor, I repeatedly told them, years ago, that ether was safer than chloroform."

In our talk at this interview over the relative value, &c. of the several anæsthetics, Dr. Richardson, in explanation, called my attention to what he had recently said and written, the subject being then quite fresh in his mind, as but the previous day he had spoken upon these very points before the "British Association" meeting at Brighton. I therefore take the liberty of quoting from his "Report on the Physiological Action of Organic Chemical Compounds" in 1871. He says:—

"I have taken occasion several times to observe the effect of narcotic vapors on the minute circulation of the blood. I prefer to use the term 'minute circulation' because it embraces the minute arterial and venous, as well as the capillary circulation.

"The first fact I would notice as common to the action of all vapors used is, that no obvious change in the physical character of the blood-corpuscles, red or white, was ever observable; neither was there any noticeable difference in the relationships of the red and white corpuscles to each other. The red corpuscles held their ways so long as there was motion in the centre of the blood-streams, while the white ones rolled along by the sides of vessels in the same manner as they did before the narcotism.

"Another fact common to the action of all the vapors used was, that the first sign of arrested movement of the circulation commenced in every case on the venous side of the circulation, and consisted of a sort of pulsation or to-and-fro movement of the current through the vein; soon upon this the venous current became obviously slower and the vein dilated, while the arterial current remained, often for a long time, unchanged.

"To sum up, if my observations be correct, the action on the systemic circulation of the narcotic vapors named was seen to be primarily on the venous current or, I should more correctly say, was primarily manifested in the retardation of the venous current, secondly in the capillary, and finally in the arterial current. During recovery, moreover, the return of a steady

onward current was manifested in the veins before it was restored in the capillary channels. This order of events coincides purely with the order of phenomena of death under the influence of narcotic vapors, as observed both in man and the lower animals. It is, I think, the invariable fact that the right side of the heart in such fatal cases is the first to cease its action, and in animals, when the heart is exposed to the air soon after death, the right side is the first to recommence action. From these facts the inference, I think, is clear that the arrest of the circulation begins, during the narcotism, in the retardation of the venous current, secondly in the capillary, and lastly in the arterial current.

"The changes named above were common to the action of all the narcotics named; but there were some striking changes peculiar to the substances themselves to which I must refer. The peculiarities were traceable, as it seems to me, to the weight, the solubility, and the chemical composition of the substance that was employed to produce the narcotic state.

"When the substance was very light, of low boiling-point, and insoluble, the effect of arrest of the circulation was most rapidly developed, and at the same time was most rapidly removed. Thus hydramylo, the lightest, the first to boil on elevation of temperature, and the most insoluble, produced the quickest arrest of the venous current; but from its influence the animal was equally quick to recover, the general signs of recovery being secondary to the local return of the circulation.

"When the substance was light and of low boiling-point, but comparatively soluble in blood, the time required to produce the slowing of the venous circulation was prolonged after the insensibility of the animal was complete; after even respiration had stopped, the extreme changes in the circulation were slowly developed; and although the insensibility might be deep and continuous, like to death itself, the actual temporary arrest of the arterial current was imperfectly pronounced. Absolute ether, which has a very low specific weight (720) and a very low boiling point (94° F.), but which is soluble in blood to the extent of not less than eleven parts in the hundred, produced perfectly all the effects immediately named above. When the substance inhaled was comparatively heavier, of a higher boiling-point, insoluble, and contained as one of its elements an irritant, there was introduced a new phase, that is to say, the arterial vessels, as the animal came under the influ-

ence of the narcotic, were reduced in calibre. The changes of the circulation in this case were first marked in the retardation of the blood through the veins, then the vein increased in diameter, and there were signs of regurgitation of its blood; these indications were followed by what may be called irregular movements in the capillaries, and by reduction of calibre of the arteries. It was observed, nevertheless, that the narrowing of the arterial vessels, though well marked, was never so extreme as to prevent motion of the blood in them; that is to say, the degree of arterial contraction was limited. I consider this to be due to the circumstance that the animal had always ceased to breathe, and the further absorption of the narcotic vapor had consequently also ceased, by the time that the action of the vapor upon the arterial vessels was developed.

"During the period when the size of the arterial vessel was reduced, the motion of the blood in the capillary vessels fed by the arterial supply was modified; the blood flowing through the capillary channels moved less steadily, and was forced, if I may so express the fact, in pushes, as if there were intervals of relaxation of the arterial vessels during which the resistance to the impelling power of the heart slightly and slowly yielded. After a time the circulation of the blood through the artery became slower, the capillaries were left empty, the venous current ceased, and the condition of temporary suspension of all circulation, except slowly, in the arterial supervened. The effects here named were well marked from the action of the chlorides; they were seen under the influence of bichloride of methylene, they were still more definite under chloroform.

"The position then assumed, that the primary arrest of the column of blood during fatal narcotism is in the lesser circulation, we have to ask whether the arrest commences in the heart or in the lungs. The commonly accepted view has been that it commences in failure of the right side of the heart; but I incline to think that this view is incorrect, and that the positive source of failure is in the peripheral circulation of the lung. The vapor inhaled impresses, I think, *immediately* the minute circulation, and acts not by absorption into the blood, but by simple and instant contact with the minute pulmonary vessels, so that there is immediate resistance to the passage of blood through them. Three well-observed facts support this opinion:—1st, the fact already dwelt upon, that in cases

of rapid death the lungs are emptied of blood; 2nd, that the arrest of the systemic circulation commences on the venous side of the circulation, and is attended with filling of the veins; 3d, that immediately after the death of the animal, if the chest be opened and the heart exposed, the right side of the heart, relieved of pressure, will immediately recommence to contract vigorously, showing that it is not itself paralyzed, but is restrained from action by mechanical resistance to its column of blood.

"If the theory of the action of narcotic vapors thus propounded be correct, we ought to draw from it this practical lesson, that in introducing new narcotic vapors into practice, the utmost care should be taken to select those only that are negative in respect to their action upon the vessels of the minute circulation. A gas or vapor that asphyxiates but does not irritate may be safer than a gas or vapor that does not asphyxiate and does irritate; for the former, when it kills, kills by a secondary process that is preceded by a series of symptoms foretelling the danger; while the latter, when it kills, kills often by instantly shutting off the column of blood that is making its way to the air, and by so oppressing the heart that every attempt at action, under the condition produced, increases the injury."

I would gladly add here but a single word as to the fatality of bichloride of methylene, now, according to Dr. Richardson's computation, as he himself told me, already administered some twenty to thirty thousand times. Had I most carefully sifted the hear-say reports which came to my ears while in London, I should have said there had been several, perhaps some eight or ten, deaths from this anæsthetic. Dr. Richardson, however, assured me there had been but *four* cases where methylene could be accused as the fatal cause, and these were not all, as he explained, quite satisfactory in proof. I cannot, however, from what I saw and heard, honestly turn from the use of ether to methylene, at any rate at present. It is to be earnestly hoped that such untiring study and investigations as Dr. Richardson's will not go unrewarded in the search for a *practical anæsthetic* free of the danger of chloroform and methylene and the disagreeabilities of these and of ether.

For years past, I have repeatedly heard many doubts expressed, even by medical men, except, of course, from those who had studied abroad, as to my statements in reference to the lack of acquaintance with

ether on the part of European surgeons. Since my return this time, many persons, both in and out of the profession, have spoken with me on the subject, and still with such a tone of incredulity as to induce me to present these facts and explanations here, and describe what I saw and heard and have done. To the majority of people, it is incomprehensible that ether should not be used and understood in England and on the Continent as it is here, in New England especially. Their doubts would be fully satisfied had they seen, as I did, the astonishment and, I will add, acknowledged satisfaction of the medical gentlemen who witnessed my administration of this anæsthetic in London.

But there is a monitor stands at my elbow in the person of my friend the Autocrat's iconoclast, who, in a stage whisper, says, "Doctor, *cui bono?* Do you really believe you have accomplished anything? Will they at all use ether now in England in preference to chloroform?" This is a fair question, and I will answer it truthfully by saying I really cannot tell, time alone will decide. I may, at least, say that the title heading these brief and desultory remarks, "Re-introduction of Ether into England," was the expression used in reference to my efforts by one of the most distinguished medical men in London. If, also, *causa humanitatis*, medical men going abroad to study, would follow up what I have commenced, I believe chloroform, as an anæsthetic where ether could have been used, will be more dangerous to the physician than the patient.

At the commencement of the International Ophthalmological Congress, August 1st, 1872, I read the following on the value of ether in ophthalmic surgery:—

Every week gives us substantial proof of the fatality of chloroform in operative surgery. A certain degree of anxiety, therefore, must always be present in the operator's mind, from which he cannot free himself, even if an equally competent person administers the anæsthetic. If these propositions are not true, then there is no force in what I have here to say. I do not advocate the use of ether because I come from the city where its employment in surgery was discovered and promulgated, but because I believe that there are others like myself who do not desire to run the risk of killing a patient with chloroform, and who, perhaps, would gladly avail themselves of ether were they rendered as familiar with its administration and harmlessness as we are in America. Let me be clearly un-

derstood. I use and advocate ether because it is as effectual as chloroform, and not dangerous to life. I should not hesitate to use chloroform, though perhaps not so freely as ether, did the latter not exist. As we have ether, I do not feel justified in using chloroform, and never have done so. I should not unless forced to; therefore it is that I desire to induce others to familiarize themselves with the use of ether. I believe that those who now use chloroform exclusively, and who can never do it without danger to the patient, would employ ether did they understand how to do so. I would unhesitatingly say that I think this is largely the reason why ether is not made use of; and I opine there is some indefinable dread of it, caused by the fatality of chloroform, simply because ether is an anæsthetic. Now I desire to here say at once that I believe it is difficult to kill any one with ether, and that death never occurs accidentally while it is being inhaled. The accumulated evidence on this point is sufficient for me at least, as the accumulated evidence of the fatality of chloroform is sufficient to deter me from ever using it unless forced by necessity. That ether is more difficult to take and to administer I recognize and appreciate as well as any one. I do not wish to be harsh with my medical brethren either at home or abroad, but I cannot but think that the disagreeabilities of ether induce some to run the risk of the use of chloroform, which may be fatal—when, who can foretell? I do not propose to enter into any discussion as to the action of ether, or the special methods of using it. I would, however, here say, that many of the disagreeabilities of ether—nausea, vomiting, and headache—may be avoided or mitigated by the patients taking no, or but a light, supper the evening previous to the operation, and absolutely *no food whatever* the morning of the operation, which should, if possible, be done not later than 9 or 10 A.M. Ether, at the worst, is but a profound intoxication, and not unlike a drunken fit. On the other hand, thousands inhale it without trouble, as proved by their anxiety to take it a second time if necessary. A towel rolled into a cone, with a napkin or sponge pushed to the top of the inside, is all we need to pour our ether on, whilst our fingers can mould it over any mouth and nose. Some years ago I often heard in Europe medical gentlemen say, "But there are so many people who cannot take ether." I have yet to see one. The truth is, I believe, that surgeons who use chloroform are afraid of ether, and do not

dare to give enough of it at once in the commencement. Now if the patient is warned that the ether will choke him, and told when this occurs to take long breaths to relieve it, and not to struggle and endeavor to push away the sponge, many will go to sleep quietly and without trouble to themselves or the surgeon. I have but one other point to speak of in reference to giving ether. When the patient, whether old or young, struggles, and asks for a respite and fresh air, do not yield. Hold them down by main force if necessary, and at any rate keep the sponge tight over the mouth and nose till they finally take long breaths and then soon go off into ether sleep. Doing this prevents their remembering anything about their struggles. It is absurd to stop the ether and try to reason with adults excited by the anæsthetic, and cruel not to push on quickly with children. This may sound almost puerile to my American brethren, but my personal experience tells me that those who use chloroform have somehow a sort of dread of ether, as if it was to be suddenly fatal, and hence fail to give a patient enough to intoxicate him quickly. This arises from lack of familiarity with its use and administration.

In ophthalmic surgery there are several special reasons for the employment of ether. In the first place, death during any other surgical operation might be allowed to pass without creating undue or severe comment, but no community would let pass without it a death occurring from any anæsthetic during the extraction of a cataract, an iridectomy, or the removal of the globe. A possible fatal result is not included in ophthalmic surgery. In my own community I should not care to have a patient die from chloroform under my hands, and be myself tried for manslaughter afterwards. The prosecuting attorney could put scores of surgeons on the stand, whose evidence to the jury would be unanimous that I might have employed ether, which is not fatal, and hence the responsibility of the fatality of chloroform rested entirely upon me. It would be an ugly case. Another argument for ether is that it leaves the mind of the ophthalmic surgeon entirely free from anxiety or thought of the anæsthetic. When the operation does not require him to have an assistant, he may dispense with one to administer the ether, and give it himself, as a little care will enable him to avoid numbing his fingers with the cold, and any bystander can hold the sponge over the patient's mouth while he sleeps. I do not mean that an assistant is not a convenience,

but that with ether we may dismiss thought for the patient's pulse, &c., since blueness of the face over which we are working tells us when to take off the sponge and when to re-apply it. Moreover, operations are very frequent in ophthalmic practice, and an assistant to whom we may commit the administration of chloroform is not always at hand or readily obtained, whilst the necessity for immediate operation may from various causes be very pressing. For myself, I find there are but few ophthalmic operations which I hesitate to undertake alone under ether, when compelled so to do. I do not find that medical gentlemen feel thus about chloroform. Here let me answer by *experience* the *theory* that ether will not act favorably in many ophthalmic operations, in consequence of the nausea and vomiting liable to follow its use. In the ophthalmic hospital with which I am connected, some fifty Graefe's extractions are annually done, almost always under ether, without the subsequent nausea or vomiting, provided this takes place at all, seeming to interfere with the usual course of the recovery or the final result. Some three hundred other operations are also performed under ether. We never use chloroform. I will say nothing here of the use of ether in the general hospitals of my own city, as I desire to confine my remarks to ophthalmic surgery, in which I consider ether a blessing to both surgeon and patient. Finally, I would sum up what I mean, and would here say that ether is never fatal in surgery, it can always be used in ophthalmic practice, as it does not interfere with the operation or its results, it allows the operator to work alone if compelled to, and free from thought of the patient's condition. I admit that it is not so pleasant to give or take as chloroform. With those who can administer this latter without anxiety, and can rest at peace with their own conscience and the community in which they live after a fatal case under their hands, my remarks can of course have no force, and for such they are not intended.

Mr. Brudenell Carter said: "I much regret, Sir, the absence from among us of a gentleman who, more than any other in London, is in the habit of administering ether—Mr. Warrington Hayward, the surgical registrar and chloroformist to St. George's Hospital. He has advocated very strongly the use of ether in general surgery, but his experience is, and I must say that mine entirely coincides with it, that ether as an anæsthetic agent does not produce sufficient muscular relaxation to fulfil

all the requirements of the ophthalmic operator. As we have had it administered at St. George's Hospital, we have certainly found that the recti muscles have not been rendered passive in the degree that I should desire, and after some experience both Mr. Hayward and myself have determined to lay it aside, and return to our old and trusted friend chloroform, of which I must say we have no fear, and which we have never had any reason to regret using. It is with great deference that I venture to question the statement of Dr. Joy Jeffries about the safety of ether, but unless my memory plays me altogether false, there have been deaths from ether recorded in surgical history. I think that when anæsthetic agents were first introduced, and ether was the only one considered to be of any practical value, certain deaths did occur. I shall be grateful, Sir, if Dr. Jeffries will come to St. George's Hospital and administer ether for us, that we may see whether our past dissatisfaction with it may be in any way due to our faults of administration."

Dr. O'Leary observed that many differences in the effect of ether, when administered as an anæsthetic, were due to differences in the purity of the drug. He believed it to be a perfectly safe remedy, provided it be pure.

Mr. Jabez Hogg said that after much experience with various anæsthetics he preferred to operate without any anæsthetic. The resistance of the recti muscles was the best possible aid to extraction.

I replied, in answer to Mr. Carter, that a Medical Society in Boston appointed a committee some years ago to investigate all the reported cases of deaths by ether. That was done, and they could not find that any one of those reported deaths was due to the anæsthetic. When the muscles are too tense for the operation, I doubt if ether enough has been given.

BOLDO.—This is the name of a new remedy which has been recently introduced into Europe. It is imported from Chili, where it is distilled from the leaves of a tree, of the genus *Monimiaceæ*. Its reputation appears to rest upon a pretty slender basis, and not upon the results of any trustworthy experiments. Thus far, it has been administered empirically for the more frequent affections of the liver. As in the case of *cundurango*, its use is most strongly recommended by charlatans, pecuniarily interested in its success, and like that drug, its popularity will probably be of very short duration.

Progress in Medicine.

REPORT ON OTOTOLOGY.

By J. ORNE GREEN, M.D.

An Investigation concerning the Mechanism of the Ossicles of Hearing and the Membrane of the Round Window.—BURNETT. (*Archives of Ophthalmology and Otology* vol ii., No. 2.)

Burnett has still further confirmed the theories of Ed. Weber and Helmholtz in regard to the mechanism of the ossicles of hearing, by some very exact experiments to determine the condition of the membrane of the round window during the conducting of waves of sound through these bones, and also to determine the effect of altered labyrinthine pressure upon the chain of bones and upon the membrane.

The preparations were made by removing the floor of the tympanum, leaving the membrana tympani, the ossicles and the labyrinth uninjured, and then placing them so that the movements of grains of starch, with which the parts were sprinkled, could be accurately examined and measured with a microscope.

The vibrations of different notes were then conducted against the membrana tympani, and the vibrations of the different ossicles and of the membrane of the round window observed. When the sound waves struck directly against the membrana tympani and the hammer, the ossicles and labyrinth responded to the vibration; but when the waves first struck the wall of the meatus, so as to be deflected, they were found to be destroyed, which seems to show that the bony walls of the auditory canal have no effect in conducting sound to the labyrinth. The excursions of the ossicles and of the membrane of the round window always bore a fixed relation to each other, and also to the pitch of the note, the longer excursion corresponding to the deeper note.

The experiments on labyrinthine pressure were made by opening one of the semicircular canals and attaching to this opening a column of water, the height of which could be varied, and it was found that when the pressure was increased or diminished beyond a certain point the excursions both of the ossicles and of the membrane of the round window ceased; sooner, however, during the occurrence of a high than of a low note. These experiments demonstrated a condition not unfrequently found in