this? Suggestion has been used in an endeavour to teach the child "to control the bladder during sleep." But can any child—or adult for that matter—be expected to exercise such control? Hypnotism I have never practised myself, and I have not been impressed by the results it has yielded in the hands of others. There is a form of suggestion for which success has been claimed in America and which consists in the weekly subcutaneous injection of 1 c.cm. of sterile salt solution. It is impressed upon the child at each injection that the treatment will certainly abolish the enuresis, but that if this should persist further injections will be required. For my own part I regard such treatment as a disguised form of punishment hardly to be distinguished from the use of the nurse's palm, and, besides, we should not lie to the young.

Of the more severe psychotherapeutic procedures such as Freudian analysis I cannot speak from any experience, but their use seems to me disproportionate to the object and rather like breaking a butterfly on the wheel. The value and limitations of this as of other methods of treatment in enuresis, however, it is one of the chief objects of this discussion to make clear.

CARE OF THE VOCAL CORDS IN SINGERS AND SPEAKERS*

BY

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In considering the care of the voice it will serve the purpose best if examples are drawn from experience with outstanding artists, just as, along other lines of achievement, one would take those who excelled in sport or politics. Therefore I shall point my moral by reference to some of the world's greatest singers as they have been heard from time to time at the Royal Opera House, Covent Garden, with which I have had a close connexion for over a generation. The same principles will apply to all who make exceptional use of the voice in their professions.

It is necessary first to ask, "What is singing?" and that opens up a previous question, "What is sound?" Sound is defined, from the physical point of view, as vibrations appreciable to the ear. Noise is the beating of the waves of air upon the ear-drum in irregular fashion, while in music the impingement is regular and periodic. In singing or speech the vibrations originate in an expiratory current from the lungs passing the edges of the vocal cords and setting them in motion, just as in the violin or other stringed instrument the pulling of the string creates the air waves and forms the note. The lowest audible vibration is 32 times a second; the highest, one of 76,000 times a second; but in music the vibrations employed range from 40 to 4,800, representing seven octaves.

In chest notes the entire length of the vocal cords vibrates; in head notes the length is shortened according to the note required. Falsetto notes are due to the false vocal cords situated immediately above the true ones acting as a damper on the outer part of the latter. The following table gives numerically the vibrations of the vocal cords for different voices:

	Vibrations per second	Average wave-length
Bass	87-256	12 ft.
Baritone	106-341	
Tenor	128-435	6 ft.
Contralto	160-512	3 ft.
Mezzo-soprano	192-640	
Soprano	Up to 768, occasionally higher..	1½ ft.

The beauty and the carrying power of the voice depend upon the breath control, which produces the requisite vibrations of the cords kept in a properly tense condition by the nerves of the larynx, together with a proper posing of the voice to obtain resonance from the sinuses of the head, these acting as resonating cavities or sounding-boards and also amplifiers. The best voices naturally are those which have the most and finest elastic tissues in the cords. If the edges of the cords are viewed with the laryngoscope during singing they appear as sharp as razor blades in the great sopranos. Bad tuition produces tiredness and redness of the cords, overstretching of the elastic fibres, and occasionally the appearance of nodules, while exceedingly bad tuition may even break the fibres and cause minute haemorrhages.

One inexperienced teacher sent me his first twelve pupils, three of whom had torn vocal cords as a result of his curious methods.

Modern Singing

Modern singing as taught to-day started only two and a half centuries ago. When one bears in mind the very small percentage of the population who can sing in any sense that can be called singing, the much smaller percentage who can sing really well, the relatively few who take up singing professionally, the fewer still who make a success of it even after years of serious training and great expense, one is led to the conclusion that singing is not a natural endowment, that the vocal cords were not constructed by Nature for singing purposes. Singing is an acquired accomplishment, into the service of which have been pressed certain organs not intended for it. The same conclusion is suggested by the multitude of troubles that afflict even the best singers.

If this be true, then there is no such thing as a natural singing voice. I have never heard of a leading opera singer who had not been taught how to sing. Singing is an acquired art, and that being so it follows that with more definite methods of teaching, greater experience, some anatomical knowledge, and care of the vocal cords, the best voices are yet to be heard.

Although many of the suggestions in this paper apply to the speaking voice as well as to the singing voice, the demands upon the singer are much more critical. An advocate in a court of law may use his voice for five or six hours a day and for several days running with no congestion of the vocal cords. He may permit himself occasional declamation, but apparently his voice is as tireless as, one may hope, is the attention of his auditors. Singers, on the other hand, after a long and heavy opera are often thoroughly exhausted and quite unfit for any renewal of the effort next day. It must be remembered, of course, that they have to act as well as sing, that frequently they are heavily clad, and very generally have more than the normal allowance of flesh. But one has only to consider the immense number of vibrations of their vocal cords, and the force with which their voice is projected, to understand that during their performance they are like engines running at excessive speed. These high notes with heavy volume mean an enormous strain, with subsequent exhaustion.

* Read in opening a discussion in the Section of Oto-rhino-laryngology at the Annual Meeting of the British Medical Association, Belfast, 1937.

Conditions of Modern Opera

Modern opera is more exacting to those who take part in it than it was in the leisurely Victorian and Edwardian days. The aeroplane enables the tenor to fly from Munich, Rome, or Paris to Covent Garden in time for a rehearsal the day before the advertised performance. Frequently the change in a few hours from a dry and warm climate to the wet and cold conditions of London causes a slight catarrh, of which the ordinary member of the community would take no notice, but to the singer and his audience is of crucial importance. The position of the laryngologist in attendance is also onerous. He has to ask himself whether by simple measures he can get the great artist through his performance—a matter to be decided immediately, because in opera it rarely happens that should a breakdown occur another celebrity, knowing the particular role, is at hand to take his place. Last year at the beginning of the season the tenor in *Lohengrin* suddenly developed laryngitis. By a fortunate coincidence Herr Melchior called at the Opera House at 7.30 that evening, and within less than an hour he was in borrowed costume taking the place of the other. But such happy accidents cannot be counted on in opera. When this last season opened in damp weather one after another of the singers became catarrhal, although all got through and were better next day. One artist even went through his performance with acute congestion of the middle ear. It may be mentioned that Dame Nellie Melba made it a rule to have her nose and throat cleansed each morning of her performance, and my friend the late Sir Edward Marshall-Hall found his brain clearer for having his nose and post-nasal space sprayed out each day when conducting his long cases. Such a method also helps the resonance of the voice, one of the principal qualities in voice production. It is not merely a question of regular vibrations of the cords, but in class singers it is the resonance which, when well produced, will distinguish the best from the good.

Sometimes the teacher of music will send a pupil to the laryngologist to discover whether he is a tenor or a baritone or she a soprano or mezzo-soprano. Again and again teachers bring their pupils because of no improvement or, worse still, because of the obvious results of wrong production of the voice. It does not follow that because of a few successes all pupils should be taught alike. It is necessary for the laryngologist to have standards of voices and vocal cords in his mind, such as those of Melba, Patti, Schumann, de Reszke, Caruso, Tauber, etc., if possible. Ask these pupils to sing a few scales, or a few bars of one of their favourite tunes: or, if grand opera singers, a part of their next opera, especially after treatment. Jean de Reszke, whom I have no hesitation in describing as the greatest artist the world has ever heard, was originally a baritone. It was as such that he made his first public appearance in Venice in 1874. Then he retired for a period, during which his voice gained remarkably in the upper register, and when he made his reappearance in Madrid in 1879 it was as a tenor. From that time his great fame as a singer, especially in Wagnerian parts, can be dated. The consequence was that people with indifferent voices went to him during his many years as a teacher—he taught almost until the day of his death in 1925—in the expectation of being made into tenors. Some of them he sent over to me. Very few were genuine tenors—the majority were baritones, and would never be anything else—but all were

desirous of becoming tenors, or of being able to boast that they had been taught by Jean de Reszke.

In the great operas, especially the German, practically all the tenors have baritone cords to enable them to carry on their tremendously heavy work, forcing their voices through perhaps an orchestra of 120. One has only to listen to the voice of a Siegfried—or a Brünnhilde—bursting through a huge orchestra to realize the strain it must impose. Only a few can take such parts without injury to their cords. That is why singers, particularly tenors, have a very short singing life.

Another point to remember is the frequency of injury to the cords in sopranos. Melba, when near the end of her career, would very occasionally in the last act of *Faust* make an error in her production, and twenty minutes later a little mucous vesicle might have been noticed at the edge of one of her vocal cords, disappearing in a few days after rest and treatment. Tetrizzini had haemorrhages of the vocal cords on two occasions, due to a slight tearing of the fibres. Another trouble, found more especially in tenors, is the development of nodules that remain until the end of their career if they go on working, as they usually do, with insufficient rest and treatment. Yet another trouble is loss of elasticity of the fibres through overstrain by using the chest notes instead of the head notes in the high passages. This was particularly shown in the very outstanding tenor Saleza, who would have been more famous had his period not coincided with that of Jean de Reszke. Singers' voices inevitably deteriorate with age, though in this country that is perhaps less appreciated owing to the extraordinary fascination which old favourites continue to inspire. The British public always wanted Patti for as long as she would sing even "Home Sweet Home" when she was turned seventy.

Treatment

The laryngologist called to attend a singer has first to determine the nature of the complaint. It may be local or general, or both. Dismissing general or chest conditions, and confining ourselves to this department of rhino-laryngology, we find that of all local troubles by far the most common come under the head of catarrhal, affecting the nose, post-nasal space, pharynx, larynx, and trachea, or it may be only the nose and post-nasal space, or only the trachea. In this respect we are fortunate in that the vocal cords themselves are the last part of this delicate apparatus to be affected. If therefore the congestion of these areas can be reduced it may be assumed that the vocal cords will remain free. The procedure I have found most helpful is to douche the post-nasal space through the nose with an alkaline solution to which a little menthol is added. The pharynx also should be well sprayed. My usual procedure is as follows: I use an inhalation of No. 2 nebulizing compound with a coarse vaporizer, and finally an inhalation through the nose, and likewise through the mouth, of kasemol in paroleine (K.P.) and menthol in paroleine (M.P.) 1 per cent. in equal parts. Before douching through the nose I spray the inferior and middle turbinate by means of a fine spray with a very small amount of 1 per cent. cocaine. My 1-oz. spray suffices for at least thirty patients; so the amount used is particularly small. Should the pharynx be in a chronic condition then a slight spray consisting of

R. Tinct. ferri perchlor....	...	...	...	5 ss
Stovaine	...	...	...	gr. v
Menthol	...	...	...	gr. v
Sp. vini rect.	...	...	...	5 iii
Glycerin	...	...	...	5 iii
Aq. dest.	...	...	...	ad 3 i

may be recommended. This mixture, which must be shaken before spraying, proves very useful in all chronic catarrhal conditions of the throat.

Should there be nodules on the cords the mixture should be sprayed direct on to the cords daily, and the patient himself should be instructed to practise inhalation of K.P. and M.P. through a coarse spray from four to six times each day. If the nose alone is congested the solution may be employed plus drops of a mixture consisting of stovaine, carbolic acid, and ephedrine, 0.5 per cent. of each in paroleine. When there is tonsillar trouble a thorough washing with the alkaline solution mentioned should be given, followed by any antiseptic which is favoured.

Tonsil Operations

A word may be added about the undesirability of operations on the tonsils in the case of established artists. These people have taken years of study to obtain their form of voice production. In a large proportion of cases a tonsil operation will bring about some alteration of the voice, and when deterioration of the voice eventually occurs, as it does naturally, it is very likely that the surgeon's intervention will be blamed. The largest tonsils I have ever seen were those of a world-famous tenor and of a world-famous contralto. The time for tonsillar operation, if this is advisable, is during the early period of training before the tone production has been permanently set. Removal of the inferior turbinates should be avoided in singers. Enlarged inferior turbinates should be treated with the galvano-cautery. Deviated septa, save in exceptional cases, should remain untouched.

Finally, the laryngologist in this special field has occasionally to deal with a type of patient of whom specialists in other branches of medicine are generally free. Acute stage fright is not unknown in all classes and callings, but when the patient is a prima donna the case becomes formidable. It does sometimes happen that a lady of repute in the operatic world who wishes to create a sensation does so, not by singing but by refusing to sing. The disturbing announcement is usually telephoned to the Opera House on the morning of the performance. It has the highly satisfactory result for the lady that her name is written large in the evening papers, but for the management it is a matter of grave concern. Even if another prima donna be nearer than the next capital she has to be solicited to sing; she is naturally reluctant to take another's place when she has had no previous publicity, and the very idea of being a substitute may offend her *amour propre*. The public, too, have to be considered. They have paid to hear one particular lady, and they demand a return of their money. To put on another opera means great difficulties in engaging fresh artists and chorus and obtaining scenery which may be under some railway arch miles away. The delicacy of the task of the laryngologist who has to give an opinion on the lady in question will be readily appreciated, as well as his courage in facing her wrath should he pronounce her fit to fulfil her contract—but as her arias remain unsung perhaps the story is better unwritten.

The Duchess of Portland has issued an appeal for "the many old trained nurses who worked for very small salaries in the past, and whose tiny savings were used to help relatives or dwindled away as they themselves became old and ill. Not many people realize that there are hundreds of them living in great poverty in lonely rooms, without enough food and warmth." Gifts, large or small, should be sent to the Duchess of Portland, c/o The Nurses' Fund for Nurses, 95, Dean Street, W.1.

THE OBSTETRICAL SIGNIFICANCE OF PELVIC VARIATIONS*

A STUDY OF 450 PRIMIPAROUS WOMEN†

BY

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During the past decade the development of roentgenological methods for measuring the dimensions of the bony birth canal has brought about a revival of interest in pelvic architecture, particularly in its relation to childbirth. The present study of pelvic mensuration represents the findings in a series of 450 primiparous white women consecutively delivered at term (their children weighing 2,500 grammes or more) in the New Haven Hospital. The system of roentgen pelvimetry we have adopted is the so-called "grid method" (Thoms, 1933; 1935), which was developed in this clinic. In addition we have employed roentgenometry of the lateral aspect of the pelvis in many instances, and in the latter part of the series we have used a newly modified lateral technique as a routine (Thoms and Wilson, 1937). The observations extend over the past three years, and the group represents all the white primiparous women who during that time have been registered for pre-natal care prior to their delivery in the hospital.

Types of Pelvis

That the bony pelvis is subject to variations in contour is not a new concept. A half-century ago William Turner (1886; 1886a) emphasized the frequent occurrence of pelvic variations, particularly as related to the superior strait. This author divided pelvises into three groups—namely, dolichopellic, mesatipellic, and platypellic types—according to the pelvic index—that is,

$$\frac{\text{A.P. diameter} \times 100}{\text{Transverse diameter}}$$
 Our own classification is based largely on that of Turner; however, we employ as a criterion the length of the antero-posterior diameter of the superior strait in its relation to the length of the transverse diameter. We suggest, therefore, that for clinical purposes there are four variations in which the majority of pelvises may be grouped for classification. These are:

1. Dolichopellic or anthropoid type.—The antero-posterior diameter is longer than the transverse.
2. Mesatipellic or round type.—The antero-posterior diameter is equal to or only slightly less than the transverse (the difference never more than 1 cm.).
3. Brachypellic or oval type.—The antero-posterior diameter is between 1 and 3 cm. shorter than the transverse.
4. Platypellic or flat type.—The antero-posterior diameter is excessively shorter than the transverse—3 cm. or more.

On the basis of the length of the antero-posterior diameter these first three groups (which more commonly occur) may be divided for purposes of clinical use into large, average, and small pelvises, as follows:

1. Dolichopellic type: A.P. diameter 14 cm. or more, large pelvis; between 12 and 14 cm., average pelvis; 12 cm. or less, small pelvis.

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