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THE GENIO-HYOID VOCAL INTERFERENCE

THESIS

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By

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W.K.H.

## PREFACE

Both science and empirical knowledge seem to indicate that anatomical considerations relating to potential muscular interferences be established at the incipiency of the serious study of voice. Experience shows that if this aspect of vocal development is not pursued with utmost diligence, an early deterioration of the vocal instrument is possible many years before a normal expectancy. It has been discovered, also, that the study of articulation, pronunciation, modulation, emphasis, gestures and interpretation seem to avoid, primarily, the necessity of muscular training, per se.

This thesis will not include, in detail, the aspects of the use of the breath, except in a perfunctory manner. The same can be said of resonance and diction.

It will endeavor, however, to indicate the muscular differences of the singing and swallowing actions. Furthermore, it will advance some suggestions for the avoidance of constrictive muscular influences which might impede the singing musculature.

Finally, a phonatory process will be presented for consideration as a muscular mechanism to be made operative in connection with a direct control procedure.

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## CHAPTER I

### IN THE BEGINNING

"In the beginning, God created the heavens and the earth . . . .  
So God created man in His own image . . . and God saw that every-  
thing He had made, and, behold, it was very good."

For purposes of origination, it will be assumed that man was created with a vocal mechanism. Still, at the same time, history has not recorded anything as a source of information concerning any type of voice. Since man could not be considered the possessor of any scientific knowledge regarding its use, as it is known today, his communicative ability might have been limited to similar utterances, vocally, of the surrounding primates.

It could be accepted, further, that man used his throat in a natural way for swallowing as well as for language. Since it could be assumed that man was without any means of differentiation as to what was, or was not, aiding him in his normal way of vocal response, everything must have been actuated according to a quasi-voluntary reaction. By that it could be said that when he wished to drink, he just drank. If he desired to imitate the call of animals in order to decoy them in position for the kill, it could be accepted that he pursued this phenomenon and accomplished the task at hand.

Therefore, in the category of natural activities of the throat procedure, any and all examples of vocal response became an action depending only upon muscular mechanisms in the most basic realms thereof. It is an anatomical fact that nature protected man from strangulation by virtue of the automatic process of swallowing and breathing.

Basically, then, this automatic procedure could have originated with man's creation; that a valvular action was designed in the throat, the comprehension of which was beyond the imagination of the Neanderthal man. This muscular action can be learned from the research now being done with reference to the structural reaction between swallowing and singing. Therefore, since the division of the pharynx is basic, it is necessary to examine that structure as inherently used by man for either mastication or phonation. Primarily, the larynx is actuated, automatically, in order to save man's life. This has been discovered and attested to by an eminent vocal authority.<sup>1</sup>

The scientific vocal student will discover, from cadaveric dissections, that there are definite principles of valvular movement, particular to the larynx, which might have been utilized by the Neanderthal man, even as the man of today uses. Furthermore, science purports to demonstrate that man has changed in one aspect, and that is

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<sup>1</sup>Lennox Browne and Emil Behnke, Voice, Song, and Speech, 23rd ed. (London, n.d.), p. 53.

in the formation of the skull.<sup>2</sup> From this it might be deduced that there could be other examples of change of structure. It could be assumed that a development could have been wrought in the pharynx, and also, perhaps, in the larynx. Furthermore, the resonators could have undergone a relative change over the countless millions of years since creation, by virtue of the slight change in the formation of the skull. Notwithstanding the aforementioned, the basic facts of definite structural uses, either of swallowing or phonation, probably have not been altered materially. Likewise, the valvular action of the larynx could not have been changed radically.

Whether or not the definite muscular development of vocal control, as is known today, was ever a reality to be considered by ancient man, the physical act of swallowing is, basically, the same today as it was then. There must have been a definite sphincter act of the tongue in forcing the bolus (food) into the pharynx. There was, also, a direct raising of the larynx to a jamming position<sup>3</sup> up under the tongue. Included in that action, there was a dropping, backward and downward, of the epiglottis in order to cover the trachea, and in that way prevent the bolus from entering therein. In addition to this, simultaneously, there was the forcing of the vocal chords together in the thyroid cartilage as a further protection to the pulmonary freeway.

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<sup>2</sup>Funk & Wagnals, Encyclopedia (New York, 1952), p. 8132.

<sup>3</sup>Browne and Behnke, op. cit., p. 59; and Henry Gray, Anatomy of the Human Body (Philadelphia and New York, 1924), p. 1154, and Fig. 2.



After the bolus has been forced down the aesophagus, the pharyngeal structure assumed its relaxed position.<sup>4</sup>

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<sup>4</sup>ibid.

## CHAPTER II

### THE VALVULAR ACTION OF THE LARYNX

Since the valvular action was primary in the usability of the laryngeal structure, a further investigation into the action thereof will be necessary if there is to be an understanding of that important function. The findings of a few well-known vocal authorities<sup>1</sup> can be introduced to shed a further light upon the structural aspects of the larynx, viz.,

Until a relatively short time ago, it was generally believed that the larynx was specifically designed as a tone producing organ, but informed opinion, today, recognizes the fact that what was, hitherto, termed the vocal organ, is, in reality, a valve, the chief purpose of which is to protect the entrance to the pulmonary airway.<sup>2</sup> Once this is understood, the whole matter of voice production appears in a very different light and the way is opened for a clearer insight into the whole subject. If, instead of regarding the larynx as a tone producing organ, we consider its valvular action, it immediately becomes apparent that, in the larynx, nature has evolved a very efficient closing mechanism which is called into action when we swallow, as it is well known, the larynx can be closed without the aid of the epiglottis.<sup>3</sup> And it is this

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<sup>1</sup>W. A. C. Zerffi, "Search for a Vocal Method," Bulletin of the Hennepin (New Jersey) County Medical Society (June 25, 1939), p. 3; J. H. Muyskens, "The Emergent Voice," Musical Educators National Conference, XXXI (1938), 283; W. Vennard, Singing, The Mechanism and Technique (Los Angeles, 1949), p. 24.

<sup>2</sup>Zerffi, op. cit., as corroborated by Edgar T. Evetts and Robert A. Worthington, The Mechanics of Singing (London, 1928), p. 17.

<sup>3</sup>Ibid.

closing mechanism which is, unwittingly, called into play when a person, who is untrained, endeavors to sing, or even to speak. The muscles used for swallowing, normally, impede the action of the internal or true muscles, and any teaching which does not teach how the interference of these swallowing muscles can be avoided, is not teaching at all.

From this excerpt, it can be understood that correct knowledge of the actuation of the vocal instrument must be attained from a teacher so qualified. If there is any divergence from acquiring such information upon a scientific basis, then there seems to be a rather precarious attitude involved. It is stated by Alda<sup>4</sup> that "Charlantanry is quite common among vocal teachers in this country. Anyone wishing to, can begin to teach voice." Herbert Witherspoon<sup>5</sup> concurs with this statement.

It must be remembered that the functions of the larynx are not purely phonatory.<sup>6</sup> Almost all the peculiarities of the structure of the larynx can be accounted for by necessities of functions other than those of phonation.<sup>7</sup> Therefore, to design exercises for these organs, it is necessary to consider the functions.<sup>8</sup>

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<sup>4</sup>Frances Alda, "The Girl with a Voice," Good Housekeeping, XC (June, 1930), 55.

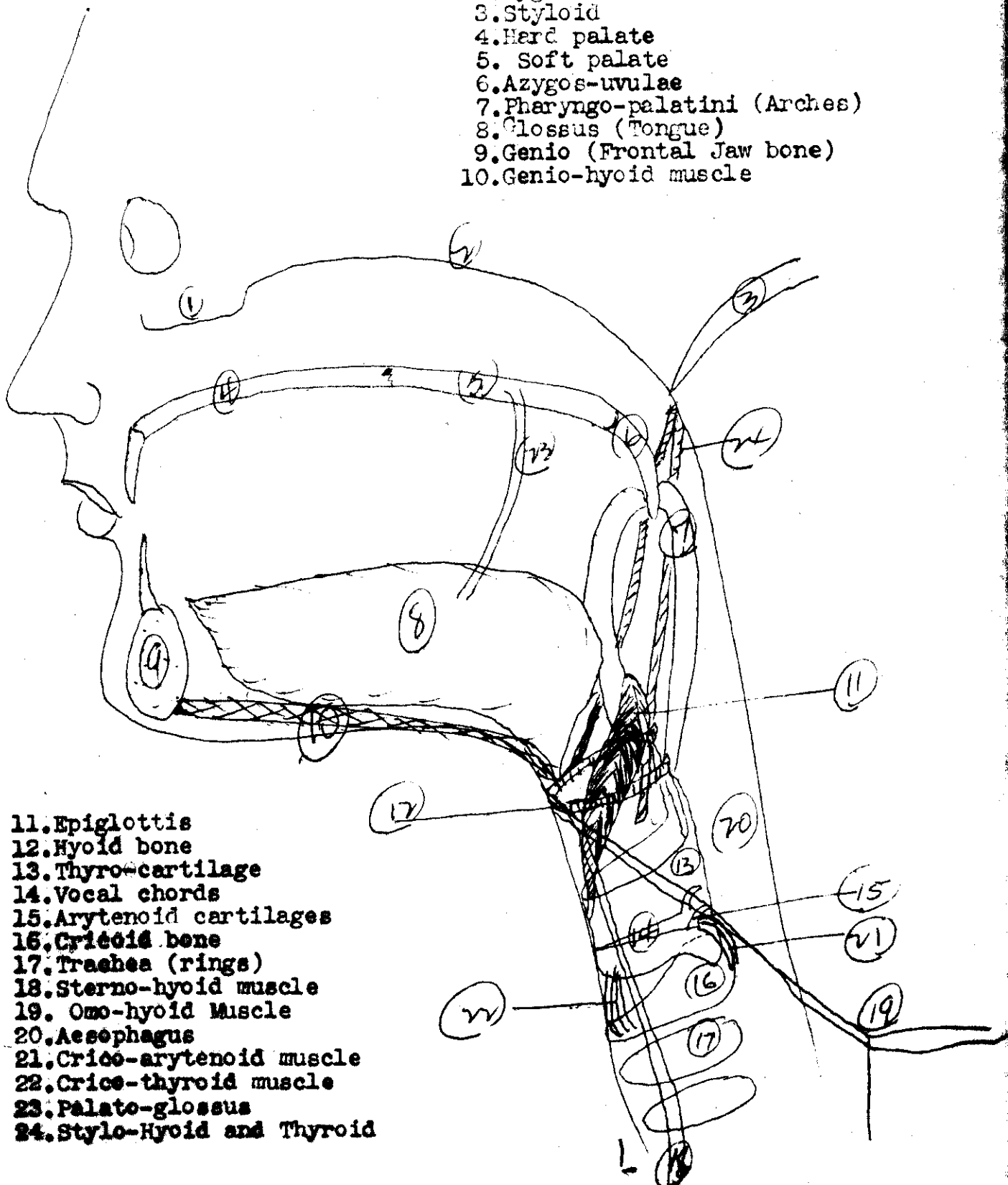
<sup>5</sup>Herbert Witherspoon, Thirty-Six Lessons in Singing for Teachers and Students, Meisner Institute of Music (Chicago, 1930).

<sup>6</sup>Evetts and Worthington, The Mechanics of Singing (London, 1928), p. 17.

<sup>7</sup>V. E. Negus, The Mechanics of the Larynx (St. Louis, 1929), p. 346.

<sup>8</sup>W. S. Drew, Singing (Oxford University Press, London, 1937), p. 174.

1. Malar bone
2. Zygomatic arch
3. Styloid
4. Hard palate
5. Soft palate
6. Azygos-uvulae
7. Pharyngo-palatini (Arches)
8. Glossus (Tongue)
9. Genio (Frontal Jaw bone)
10. Genio-hyoid muscle



11. Epiglottis
12. Hyoid bone
13. Thyro-cartilage
14. Vocal chords
15. Arytenoid cartilages
16. Cricoid bone
17. Trachea (rings)
18. Sterno-hyoid muscle
19. Omo-hyoid Muscle
20. Aesophagus
21. Crico-arytenoid muscle
22. Crico-thyroid muscle
23. Palato-glossus
24. Stylo-Hyoid and Thyroid

Fig. 1-- The normal position of the larynx at repose

As a further development upon the subject of the valvular action, pertaining to the vocal chords (the thyro-arytenoid ligaments), it will be noted, in Figure 2, that they are tightly closed as the pharynx is drawn up under the tongue. This accomplishment is assisted by the tightening of the genio-hyoid muscle which is located between the inside-front of the jaw bone, from where it arises, to the frontal part of the hyoid bone.

In addition to this, it will be seen in Figure 2 that the epiglottis has taken a new position as opposed to that of Figure 1. It has dropped down to cover the opening into the pulmonary airway. In this way it acts as a bridge over which the food (bolus) passes on its way to the esophagus and thence to the stomach.

However, should nature fail to perform this most valuable service, there has been constructed another mechanism, a bit farther down the larynx, called the vocal ligaments. These could be considered an added protection created in the throat as an insurance against a maladjusted epiglottis, as it were. Since these vocal chords are made out of ligamentous fiber, they have the utmost resistance to any object which might try to pass them, when they are tightly closed as in the swallowing action.

Therefore, it is of paramount importance to a singer to be aware, constantly, of any potential swallowing action during the production of tone. Since the singing process does not admit of any such jamming or squeezing activity, it should never be exhibited by any overt muscular action.

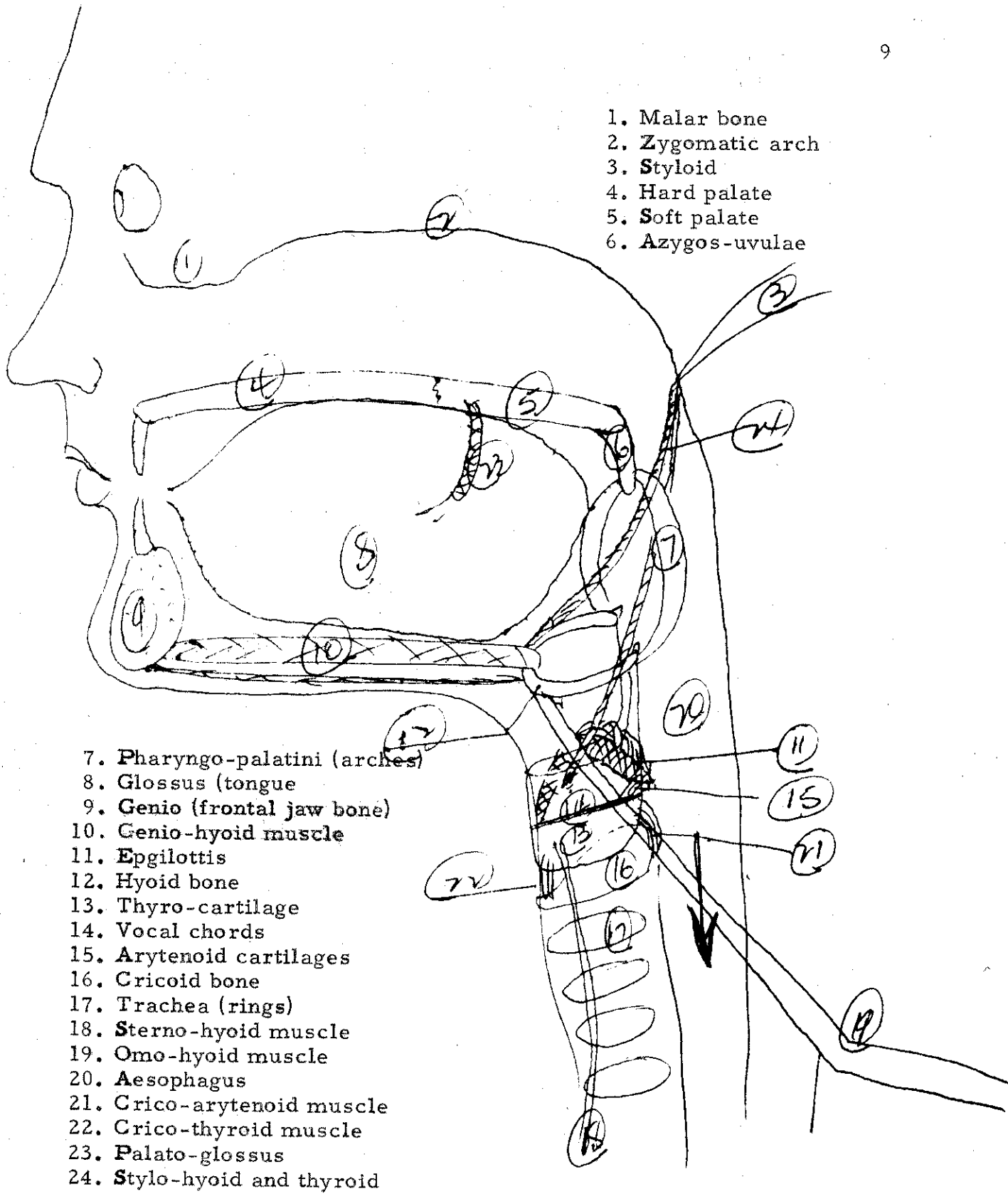
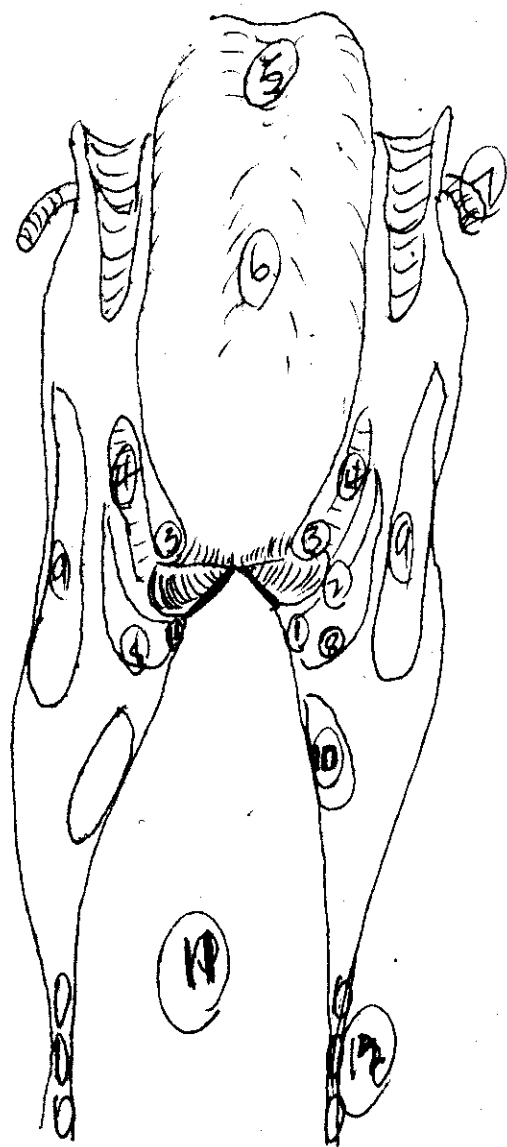


Fig. 2--The jamming position of the swallowing procedures

From Figure 3 it will be noted, in the cross-section of the larynx, that the edges of the vocal chords appear to be relatively sharp. Could there be any valvular reason for this, or was this an accident of nature? Upon analysis, it can be assumed that there must be another action of the vocal chords, extraneous to the necessity of making sounds. Deductively, then, this added utilization must be in the category of some incisive action. If the potentiality of food were excluded, what would be the remaining factor? Could it be that of phlegm? Accepting this viewpoint, for want of a better one, a conclusion is reached which indicates that the vocal chords aid in the dislodging of stringy substances which might impede breathing.

When asleep, persons will clear their throats without any conscious effort. Since the vocal chords are approximated in an action similar to that of scissors, it can only lead to one answer; that the vocal ligaments act as incisors in cutting tenacious, stringy phlegm which might become lodged in the area of the thyro-cartilage.

That this opinion is a new one can be accepted by virtue of the absence of any mention made of similarities upon the subject in the many treatises concerning the anatomy of voice. It is hoped that this viewpoint would contribute further light upon the understanding of the valvular actions of the larynx.



1. Edges of vocal chords
2. Ventricle (of Morgani)
3. Ventricular fold
4. Outline of appendix of ventricle  
(cartilage of Wrisberg)
5. Epiglottis
6. Tubercle
7. Hyoid bone
8. Thyroarytenoideus muscle
9. Thyro-cartilage
10. Cricoid bone
11. Trachea
12. Trachea rings

Fig. 3--The incisive edges of the vocal chords (from Gray's Anatomy)



## CHAPTER III

### THE NATURAL VOICE

When is a voice natural? It would be well to be aware of the meaning of the word "natural," because it could allude to a connotation which could include the interpretation of the term "habitual." Therefore, since everyone has a voice, by creation, it is within the confines of reasoning to assume that all voices are natural, and that they are peculiar to the possessor thereof.

Does the term "natural" mean that every voice should sound naturally alike? On the other hand, could it be said that an untrained voice, similar to an African bushman, would sound as natural as a trained voice? For example, would a great singing artist, such as Lily Pons, sing with a natural voice, or was it trained, muscularly, to sound that way? Could there be a marked difference of tone production between a voice in its natural state and one having had the advantages of a muscularly developed technique? Is it to be an accepted fact that voices are used correctly in their natural state? Would a given singer demonstrate a vocal production which could be considered as being deficient in certain aspects pertaining to a natural voice, per se? Would it be the object, therefore, to train a voice in order that it might approach the level of complete naturalness as such? Is it to be assumed that everyone uses his voice, according to

structural laws, correctly in its untrained, natural state? When a congregation is heard singing a hymn, are only natural voices performing? Or, on the other hand, are only scientifically trained voices being listened to? Could there be an obvious separation of the natural from the trained voices? Is it possible to conclude that a natural voice is always pleasant and beautiful? If this were true, then would there be any necessity for any training?

It must be kept in mind that the throat, per se, was constructed as a perfect, natural mechanism. If this be the case, it would be well to call for a demonstration of that fact by suggesting that one of this given assemblage sing a selection or a song before a few vocal critics. Would the subject of this experimentation declare any lack of training, or would he perform without any such preliminary explanation? Therefore, would the performance be considered upon a basis of a simple naturalness, or would the instrument be subjected to criticism in terms of what the voice should demonstrate if any degree of muscular training could have been applied?

Since the position of the hearers depends upon the category of the voice, natural or trained, it behooves them to be observant as to whether or not there are any extrinsic manifestations of muscular disorders. Would the observers be able to appraise this condition in the light of scientific experience, or would any maladjustments of the vocal organ be apparent? Could it be possible that the critics must depend upon ear alone? Would any obvious muscular incongruities evidence the presence of an antagonistic swallowing activity? Is the

ear to be the sole judge? If the singer or critic depends more upon hearing as the chief source of truth, as it were, would it be possible to differentiate between a physical reaction that was either good or bad?<sup>1</sup> Empirically, it has been found that this reasoning cannot be accepted as a verity, on the whole.

It would be similar to an untrained layman, gazing on an X-ray picture, which would show an obvious malignancy, to a trained observer, yet not be discernible to the uneducated viewer. In this case, the picture would be just a picture.

The point is that errors of a muscular maladjustment are beginning to be developed which could not be detected by the ear alone. If these discrepancies of phonatory procedures are not recognized immediately, the voice may begin to lose its inherent beauty.

Referring to the soloist, from the congregation, as the song is in progress, a voice would be heard which was natural to that individual. Herbert-Caesari<sup>2</sup> states the following, in point, namely,

A completely natural voice is one, without training, which is able to articulate, enunciate, and sustain, with perfect ease and freedom, all vowels on all pitches in its particular compass. In other words, a voice that has no mechanical defects or difficulties, no matter the pitch or the vowel on that pitch; a voice in which exact laryngo-pharyngeal adjustments obtain automatically at and every pitch with any and every vowel within its compass; sing and

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<sup>1</sup>Carl Emil Seashore, Objective Analysis of Musical Performances, from University of Iowa, Studies in the Psychology of Music (Iowa, 1936), p. 7.

<sup>2</sup>E. F. Herbert-Caesari, The Science and Sensations of Vocal Tone (London, 1936), p. 4.

sustain with ease and freedom. A completely natural voice, while acoustically perfect and physiologically balanced, is not, necessarily, beautiful (although it often is); it can possess mechanical perfection and yet be divorced from beauty.

It will be deduced from the above that every natural voice is supposed to be able to accomplish the feats expressed, within the limits of its compass or range. With this point of view, this thesis can be in agreement. Still, at the same time, if the desire of a potential singer is to obtain training which will produce a natural voice, then why training in the first place, if everyone has a natural voice in the beginning? Of course, it could be logical to assume that the natural voice might possess physical limitations, whether they be of under-developed muscular peculiarities, or gross interferences of the swallowing musculatures.

Everything else to the contrary notwithstanding, an opinion could be advanced that a natural voice is one which, in the act of singing, is being actuated in its basic limits and devoid of any specialized muscular training.

## CHAPTER IV

### THE TRAINED VOICE

As a further step, it is incumbent to present a viewpoint as to what is meant by a trained voice. Stanley<sup>1</sup> states a premise which admits of a connecting link between the natural and trained instrument, namely,

A fine natural voice is not an anatomical phenomenon, but a technical one, inasmuch as any healthy voice can, theoretically, become a great natural voice, if it is really well produced, i. e., properly trained. . . . the correct use of the voice depends upon the proper development and coordination of all the muscles which should be used in the act of phonation, and non-interference by the muscles which should not be so used, and, since coordination depends upon mental concepts, a great natural voice is, in the final analysis, primarily, a psychological and physiological phenomenon.

At the outset, this thesis agrees with the statement that a trained voice is a technical one. It is by the correct kinesthetic development of the proper muscular activities that a voice can attain its absolute potential. The phonatory process then could increase in strength and durability. Fatigue would be minimized after a lengthy vocal performance.

However, such degrees of progress are dependent upon the singer in order to prevent the growth of an interfering musculature,

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<sup>1</sup>Douglas Stanley, The Voice; Its Production and Reproduction (New York, 1938), p. 41.

such as the swallowing process upon the vocal instrument. However, should a voice develop incorrect habits, they can be eliminated by corrective exercises. This opinion is held by Gescheit<sup>2</sup> who states that, "If the vocal mechanism is faulty, it can be adjusted through corrective exercises."

Furthermore, Bartholomew<sup>3</sup> agrees with this opinion when he advances the idea that, as a matter of there being other musculatures involved in the training of the voice, corrective exercise entails the development of the stretching process. To quote, "The palate-to-pharynx muscles aid the small laryngeal muscles to stretch the vocal chords for higher pitches." It becomes apparent that a definite procedure is demanded, which must be adhered to with utmost diligence.

Since a specific, muscular development is imperative, there cannot be any encroachment of incorrect muscular activities. Therefore, there cannot be any doubt that a trained voice has the advantage over the so-called natural one. This is most obvious on the opera and concert stages. It can be an accepted fact, then, that a natural voice could not compete against such specialized training. In other words, there has been something added to the limited activity of the natural voice. Obviously the training has developed the vocal musculatures to the extent of increasing range, pitch security, volume and quality. In

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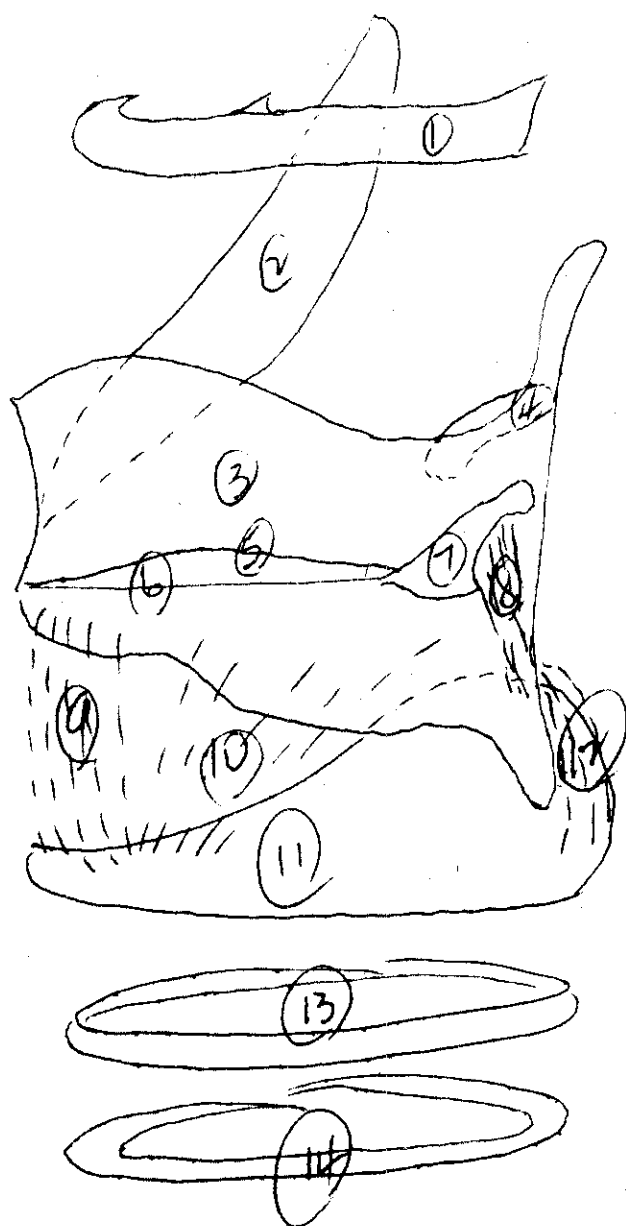
<sup>2</sup>Adelaide Gescheit, "In Defense of a Scientific Basis of Voice Training," Musician, XXXVI (1931), 27.

<sup>3</sup>Wilmer T. Bartholomew, "A Survey of Recent Voice Research," Music Teachers National Association Proceedings for 1937, XXXII (1938), 130.

some cases, voices have been able to seek their proper categories naturally. By that is meant that quite a few instruments have been suppressed to such an anatomical extent that the quality changed accordingly. But when the proper singing muscles were developed and the interfering ones were decimated in their effectiveness, some voices changed from bass to tenor, and vice-versa.

Therefore, an opinion could be advanced that a trained voice is one having all the vocal mechanisms fully developed and under intelligent control. Deductively, this means that all potential interfering musculatures must be in a state of relaxation when the phonatory system is in operation. This training refers, primarily, to the physical structure. As far as the artistic use thereof is concerned, it will not be considered, in the main, in this thesis.

Finally, could it be said that the great singing artists of our time exhibit only natural voices, as it were, as opposed to the trained ones?



1. Hyoid bone
2. Epiglottis
3. Thyroid-cartilage
4. Wrisberg cartilage
5. False chord
6. True vocal chord
7. Arytenoid cartilages
8. Oblique arytenoid m
9. Frontal crico-thyroid
10. Lateral " "
11. Cricoid
12. Crico-arytenoid m.
13. Trachea
14. Trachea ring

Fig. 4--A general outline of the automatic vocal system (from Vennard).



## CHAPTER V

### INTERFERENCES

According to Spouse,<sup>1</sup> "Most troubles, vocally, originate in interferences, that is, in the tightness or rigidity of the vocal mechanism." The question confronts the singer, constantly, that there might be a possibility of error with a given vocal production. Despite the fact that there has been an awareness of the correct breathing attitude, and that the interpretation factors are acceptable, still at the same time vocal freedom cannot be claimed. Upon close examination of the muscular process, both extrinsically and intrinsically, it is discovered that there is a state of interfering muscular activities. These are chronic conditions of strain induced by an operational use of incorrect vocal, structural procedures. These were utilized in tone production in conflict with the laws of normal muscular action pertinent to the task at hand.

A binding situation is, therefore, set up in the vocal tract which induces physical resistance to a freely produced tone. Shaw<sup>2</sup> states that interference can also be defined as any muscular contraction

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<sup>1</sup>Alfred Spouse, "Voice and Training Classes," Supervisors Service Bulletin, XII (September, 1932), 22.

<sup>2</sup>W. Warren Shaw, "Interference Applied to Singing," Musician, XLIII (1938), 88.

which prevents the unhampered vibration of the vocal chords and the free motion of the cartilages and muscles of the larynx, or the free use of the resonance space. Wilcox<sup>3</sup> believes that technical training is a matter of removing interferences and also of developing proper coordinations of the vocal musculature. Therefore, these authors state, substantially, that only the normal use of the vocal chords can be tolerated during phonation. Bartholemew<sup>4</sup> firmly believes that the vocal art involves the inhibition of one of the most powerful, automatic and constantly used reflexes, the swallowing coordination. He also states that these muscles are constantly, in many individuals, in a state of partial tension.

In addition to the above, Stanley<sup>5</sup> adds that nearly every vocal fault is associated with some sort of throat constriction. To quote, viz.,

Unfortunately, the average individual maintains either a too high or too low a degree of muscle tone. In either case, the reflex vocal impulse immediately engages extraneous muscles, causing a great inefficiency of action and producing considerable fatigue. ...the remedy lies in the corrective exercises that are designed to strengthen weak muscles and loosen tight muscles.

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<sup>3</sup>John C. Wilcox, The Living Voice (New York, 1935), p. 19.

<sup>4</sup>Wilmer T. Bartholemew, "The Role of the Imagery in Voice Teaching," Music Teachers National Association Proceedings for 1935, XXX (1936), 78.

<sup>5</sup>Douglas Stanley, "The Science of Voice," Journal of the Franklin Institute, XXII (1931), 405.

It will be noted that the above reference points to a general idea that there is something to be corrected, but as to the specific area of disturbance, little has been offered. Therefore, in order to more nearly pinpoint the position of one of the causes of disorder, reference is made to De Bar<sup>6</sup> who states that, "Any lump or hard spot under the chin is dangerous to pure tone." This observation refers to a muscular action that can be seen as well as felt. It would be reasonable to conclude that there would be a question asked concerning the relationship of this apparent situation to that of the singing action. In reply, it could be advanced that this lump or hard spot is in the immediate area of the genio-hyoid muscle. It is an important function of this muscle to assist in raising the pharynx to a jamming position in the act of swallowing. Deductively, then, if this muscle is being actuated, it is only logical to assume that the swallowing procedure is in operation. Since it has been stated on page 4 of this thesis that, "The muscles used for swallowing, normally, impede the action of the internal or true muscles, . . ." the action of the genio-hyoid muscle would act as a deterrent against the singing process. Figure 2 clearly shows this action. It will be seen that, since the hyoid bone is firmly attached to nearly the top of the musculature of the complete vocal tract, it can be assumed that the entire mechanism will be drawn upward as a result of the constricting of this genio-hyoid muscle.<sup>7</sup>

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<sup>6</sup>Dorothy De Bar, "Foundation Work in Voice Development," Etude, XLVI (Philadelphia, 1928), 468.

<sup>7</sup>Gray, op. cit., p. 1149.

To assist further in this operation, there are other activities. For example, there are the palato-glossus, stylo-hyoid, palato-pharyngeus, mylo-hoid, together with the muscles of the velum and the area of the pillars of the throat.<sup>8</sup> There are others, but because of the limitations of this treatise, only a general muscular reference will be presented.

Therefore, it can be assumed that there is a tremendous muscular action necessary in the swallowing procedure.<sup>9</sup> Also, that the entire vocal tract can assume a different position in the throat when dominated by the swallowing actuation, can be attested to by Edwards<sup>10</sup> when he states,

The muscles and parts of the larynx that are not entirely contained within it, but extend to it from other parts of the body, are referred to as extrinsic mechanisms, to distinguish them from intrinsic mechanisms that are included wholly within the larynx. In its function as a generator of vocal tone for singing, the larynx is not a fixture. It is freely moveable and is suspended in the throat by means of flexible, extrinsic muscles that connect it with the cranium, tongue, hyoid and jaw bone, and with the breast bone and the shoulder bones below.

It would be well to indicate, here, some of the limiting musculature which controls the balance necessary in permitting the throat to release itself from the swallowing position. Strangulation might

<sup>8</sup>Gray, *op. cit.*, p. 1138.

<sup>9</sup>Brown and Behnke, *op. cit.*, p. 69.

<sup>10</sup>Fassett Edwards, "Some Secrets of Good Singing," *Etude*, L (1932), 506.

result if the entire pharynx would not be able to return to a normal position of repose after the squeezing action, peculiar to swallowing, had been accomplished.

It is an accepted fact, in the study of anatomy,<sup>11</sup> that there are important muscular activities being utilized in a downward pulling action which limits an upward pulling one. In other words, the balance of structural musculature must be an ever-present situation, in that a return to a relaxed condition is demanded after the brain calls for any specific action of swallowing or singing. This is noted when a singer must swallow an excessive amount of saliva very quickly, or moisten the throat, between phrases in a given song. From this it can be assumed that the swallowing action is interspersed between two definite actions of singing with lightning rapidity. Therefore, if it were not for a balancing of actions, the throat would become helplessly jammed. Another viewpoint would be that of synchronous activities being utilized in accordance with demands of correct muscular procedures, peculiar to each in its own category.

This downward balancing activity, generally speaking, contains the use of the sterno-hyoid, thyro-sternum, omo-hyoid, with the anterior and posterior bellies,<sup>12</sup> and others.<sup>13</sup> In opposition to

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<sup>11</sup>Gray, op. cit.

<sup>12</sup>Vennard, op. cit., pp. 58-59.

<sup>13</sup>See Figure 3.

these, in the upward pulling mechanism, there are the genio-hyoid and stylo-hyoid processes in the main. Therefore, it can be understood that the pharynx is in a constant state of suspension, and whenever any musculature is utilized, this balance is disturbed by either the singing or swallowing process. From this it can be deduced that the phrase, "either a swallowing or singing mechanism," connotes a degree of peculiarity, especially within the category of a definite action. Consequently, when a swallowing action is demanded, the singing process must be at repose. Conversely, at the call of the singing action, the swallowing activity should not interfere.

Orton<sup>14</sup> gives an elaborate description of the extrinsic mechanism of the voice. He claims that the downward pulling muscles are counter-balanced by the upward pulling ones which connect the hyoid bone with the styloid and pharyngo-palatini so as to establish the correct position of the voice box during phonation. As will be seen in Figure 1, the hyoid bone is connected by ligaments to the superior cornu of the thyro-cartilage. Therefore, both are actuated simultaneously.<sup>15</sup>

It is imperative, then, that the functions of swallowing and singing operate alternately. Otherwise there would be a constant state of confusion exemplified by both mechanisms pulling against

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<sup>14</sup>James Louis Orton, Voice Culture Made Easy (London, 1938), p. 34.

<sup>15</sup>David Alva Clippinger, Class Method of Voice Culture (Boston, 1932), p. 10.

each other. William Shakespeare<sup>16</sup> states that for every direction of pull, there is one to counteract it.

Since these writers have done extensive research relating to the antagonistic reaction of muscular activities, particularly that pertaining to the vocal mechanism, it would be well to allow considerable thought to the results of their findings.

An example of this antagonism in operation would be the following experiment: allow the arm to hang limp at the side of the body, with the palm extended forward. Then, keeping the forearm perfectly relaxed, try to raise it. It will be noticed immediately that, in order to accomplish any movement whatsoever, there must be a definite muscular action involved peculiar to the task at hand. Therefore, in order to raise the forearm, it will be necessary to tense the biceps. Conversely, if the forearm is to be pulled backward, then the musculature of the back of the upper arm must, likewise, affect a tensing action. However, if the biceps and the back of the upper arm are tensed simultaneously, the forearm cannot be elevated because of the balancing restriction of the both parts of the upper arm. It is deductive, then, that the biceps must be tensed while, at the same time, the back of the upper arm is relaxed.

Therefore, substituting either the swallowing or singing action for the operation of either the biceps or the back of the upper arm, the

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<sup>16</sup>William Shakespeare, Plain Words on Singing, new edition (London, 1938), p. xiv.

application becomes similar, in effect. Muscular activities, peculiar to the phonatory control, must be allowed to function free of any musculatures which could be classified as antagonistic. If this is adhered to with strict obedience, the vocal mechanism will be able to affect a perfect activity which will enable the singer to demonstrate clearly that balance most desirable to perfect tone emission.

Deductively, then, the only other process, per se, for the throat is that of the swallowing activity. Since this action began just after man took breath into his lungs, it is reasonable to assume that this operation has been developed these many years. It could also be deduced that some voices have, for a given length of time, been abused. This could be construed to mean that as the voice was called upon to perform, every and any muscular mechanism was, somehow, put into service. Therefore, it could be meant that both the singing and the swallowing activity were being utilized simultaneously. As a result, the swallowing action must have predominated, since it is the stronger. In other words, it could be said that, since some singers inadvertently call upon any and every form of musculature for the manufacture of a tone, the swallowing activity could also be included along with the singing.

At this juncture, let it be recalled to mind the situation concerning the natural voice of the singer from the congregation. Would it be correct to assume that the performer was mindful, vocally, of his method of vocal emission? The critics could say, basically, that



the voice was one of natural beauty. In that, the judgement could be accepted as a verity, but would the same hearers be appraised of a possible injury to the voice, in the future, if the present way of making the tone were continued? Would this same voice be capable, in the future, of emitting tones which might be considered to be harsh, shrill, flat, of excess vibrato, and other defects? Still, at the same time, experience shows that if the correct vocal procedure shall not have been taught as an integral part of the training,<sup>17</sup> muscular antagonisms will develop and cause deleterious results.

Referring to page 6 of this thesis, there was a quotation presented which stated a point of view concerning an obvious lump under the chin. Would the auditors of the congregational singer be able to recognize any visible evidence of tone production, be it correct or incorrect? If such a lump under the chin was in evidence, would that mean anything to the listeners, so long as the voice, at this moment, sounded beautiful to them?

To proceed further, let it be assumed that this singer would perform before a vocal technician. It could be deduced that any obvious incorrect manifestations of tonal emission would be discovered at once. Therefore, to detect the movement of an activity which has been deemed to be incorrect, a simple procedure would be to place one's index finger rather forcefully at a point approximately one half the distance between the frontal jaw bone and the hyoid bone.

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<sup>17</sup>Browne and Behneke, *op. cit.*, p. 2.

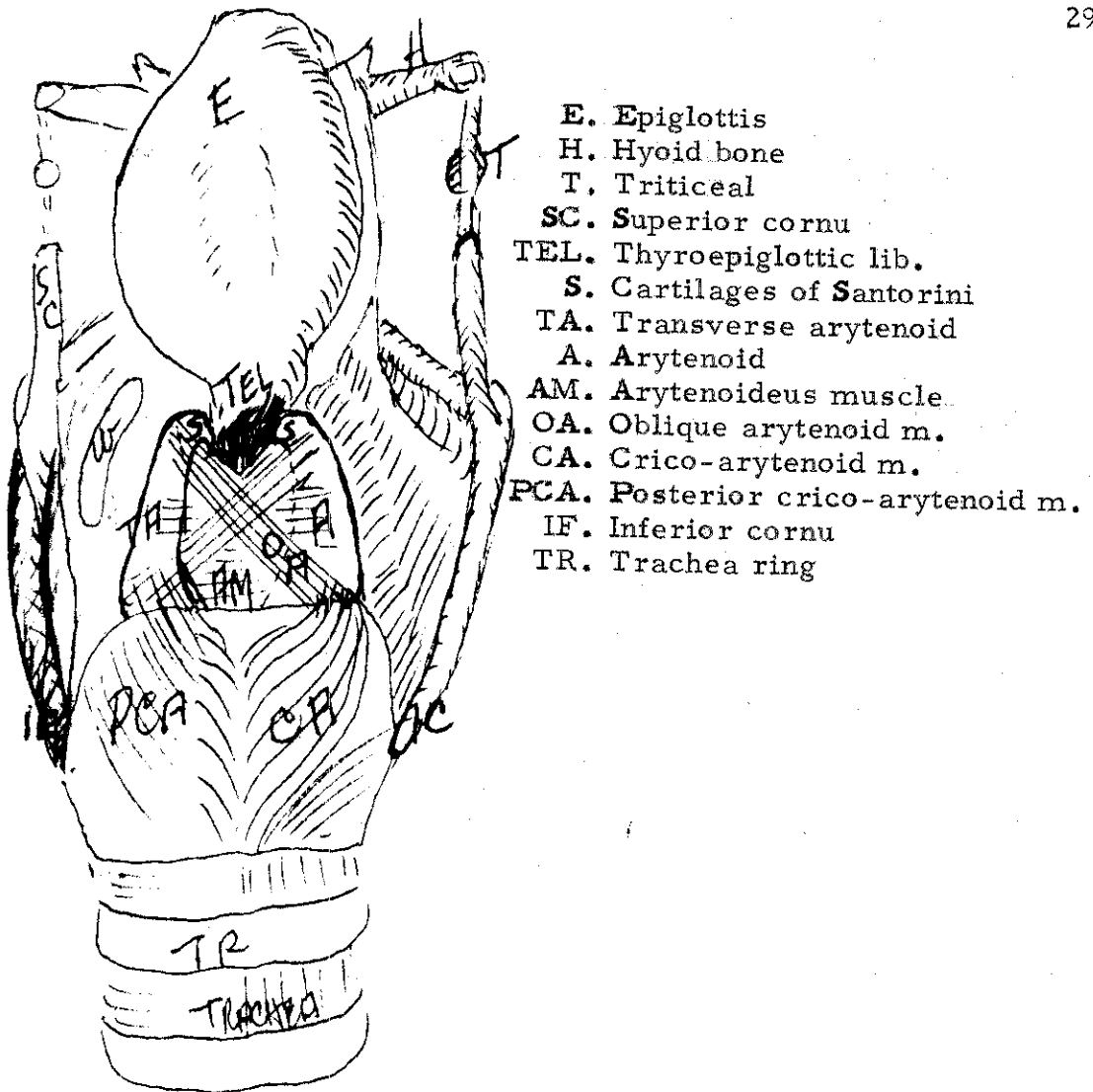


Fig. 5--Rear view of the auditory musculature (from Vennard)

According to the statement concerning the lump under the chin, this place would be the area of greatest manifestation of genio-hyoid activity, that is, a swallowing musculature. If there were evidences of resistance to finger pressure during the emission of a tone, it could be accepted that this condition is the result of extraneous muscular interference to the singing tone.

In the swallowing process, this muscular reaction is correct because nature ordained it that way. Therefore, since the complete laryngeal mechanism must be lifted up to a tight position under the tongue whenever the swallowing action is demanded, this hardening or lump under the chin is a natural one.<sup>18</sup>

It follows, then, that if this condition is present during the operation of the phonatory process, it is incorrect. It must be decimated as quickly as possible by corrective exercises. Should it not be so dealt with, the embryonic artist will stay at a mediocre level, instead of being able to be advanced to the high level of vocal environment commensurate with correct muscular procedures.

A further quotation from W. A. C. Zerffi<sup>19</sup> will aid this viewpoint, namely,

And now we come to one of the most amazing paradoxes which can be imagined. As has been stated above, the larynx is closed when swallowing. But if it is only partially closed and sufficient breath be forced between the chords, a tone of considerable volume can be produced. All shouts and screams

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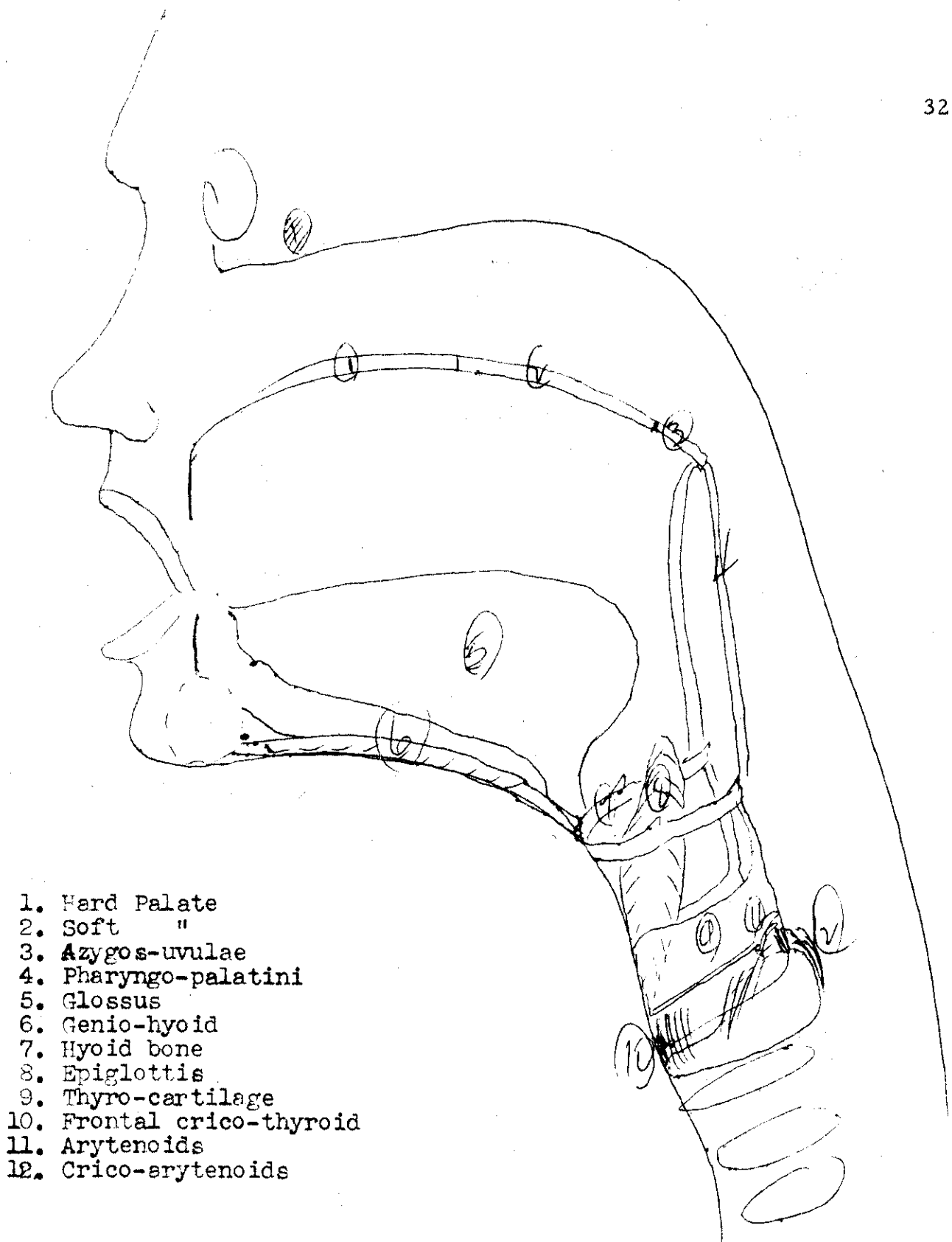
<sup>18</sup>Gray, *op. cit.*, p. 1140, and Figure 2.

<sup>19</sup>Zerffi, *op. cit.*, p. 3.

are produced in this manner. Strangely enough, it is also possible to produce singing tones in this way, and, provided the subject has a fair vocal equipment, such tones are, very often surprisingly good. In fact, they are frequently good enough to deceive the vast majority of listeners. Critics and musicians often fail to detect the faulty manner in which they are produced. But this type of tone production brings serious troubles in its wake. The singer becomes, more and more, dependent upon these swallowing muscles and in due time the internal or true vocal muscles become weakened to the extent of making effective singing impossible. How difficult the detection of forced production is, even to those who are trained musicians, was outlined by Clarence Lucas, formerly associate editor of the Musical Courier. Mr. Lucas said, "Many a young singer does all sorts of foolish things with the voice making hardly a protest from the vocal chords and no warning at all from the music critics. The freshness of the young voice lasts long enough for the bad habits of production to become fixed, and then the bloom begins to wear off the peach. The tones get woolly or hard like a brass reed, or whoopy like a nocturnal owl." Once such a condition has been reached, it is only by eliminating the existing interference and a re-education of the true vocal muscles that a voice can be saved from complete disaster.

In Figure 6, a general view of the singing process is presented. It can be observed that such is devoid of any genio-hyoid activity. Therefore, if a squeezing action is added, as in Figure 2, it would present a turbulent state of affairs, as opposed to the calm procedure of the singing process. Therefore, it would seem to present a difficulty in the presentation of a free tone. In referring to the article mentioned above, "All shouts and screams are produced in this manner" (that is, without any tonal consideration), it would seem that additional tensions of extraneous musculature must be added to the phonatory process in order to accomplish the task at hand.

It is to be remembered that in singing, there is a gentle approximation of the vocal chords, according to Figure 7, but, in Figure 2,



1. Hard Palate
2. Soft "
3. Azygos-uvulae
4. Pharyngo-palatini
5. Glossus
6. Genio-hyoid
7. Hyoid bone
8. Epiglottis
9. Thyro-cartilage
10. Frontal crico-thyroid
11. Arytenoids
12. Crico-arytenoids

Fig. 6--Phonatory process in action

the opposite action is the case. That this is natural in the situation involving swallowing can be seen as a necessary precaution in order to prevent food from entering the trachea. Therefore, that added element of pressure on the phonatory process is the beginning of the deterioration of voices. It, necessarily, demands more breath pressure to open the vocal chords. Furthermore, there are other assisting constrictive factors which hamper the free emission of tone, and these are the dropping of the epiglottis, the jamming of the tongue, et cetera, as was indicated previously in this thesis.

That an antagonistic action is being used simultaneously against the singing process, is similar to the braking action as a car is being driven up a hill, or stopping, as it were. Except for stopping, it would not be considered a wise procedure to add the brakes on a car when absolute freedom of action is necessary in order to obtain maximum efficiency of the motor, in such a situation. Therefore, since it is incorrect mechanically, it can be deduced that such a vocal tightening action in singing would not be advisable in the activity of the phonatory process.

Similarly, if it is found that such antagonistic procedures are being utilized as the singer is singing up the scale, it is only a question of time when the swallowing activity will predominate the singing. This might be the reason why so many small voices, which might be free of restrictive elements, sound better than large ones which demonstrate constrictive influences.

Because of the lack of the ability to synchronize the muscular activities peculiar to a given sphere of isolated demands, many a singer begins to lose range. It then becomes necessary to lower a given selection a tone or two. Not only that but it is discovered that a given pianissimo is difficult to accomplish, whereas it was rather easy a few years ago. Has the interfering musculature become the predominating factor in tone production? If the instrument is becoming abused, muscularly, by adding any restrictive elements thereto, disastrous results will begin to present themselves in one way or another. There is a certain life to a voice, and it must not be curtailed by incorrect muscular action.<sup>20</sup>

Therefore, the interfering activities must be clearly understood, otherwise the results from precarious preparation might not be desired. Could it be that every time a singer prepares for a concert or undertakes to enter vocal competitions, the swallowing activity predominates? Many an auditionist, in competitive circumstances, has sung the first round of auditions in the afternoon only to discover that it is impossible to enter the second time that evening because of the voice becoming tightened, muscularly. The high notes have been endangered and this leads to a tremendously amplified psychological reaction producing unusual nervousness and insecurity. This could have been averted had the proper vocal kinesthenics been developed at

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<sup>20</sup>Evetts, op. cit., p. 59.

the beginning of the training period.<sup>21</sup> If the correct chain of control had been emphasized and the interfering musculatures by-passed, every voice would develop to its fullest muscular extent.<sup>22</sup> This would give both freedom and beauty to it. This would tend to vitiate any complications, imagined or otherwise, concerning the response of the mechanism.

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<sup>21</sup>Brown and Behneke, op. cit., p. 5.

<sup>22</sup>ibid., p. 10.



## CHAPTER VI

### THE POSITION OF THE LARYNX DURING PHONATION

As a matter of recapitulation, it has been advanced that whenever the brain calls for a singing action, a definite set of muscular activities, peculiar to that operation, is set in motion. Conversely, if a demand for the swallowing activity is desired, an appropriate musculature is brought into being. Furthermore, since there is an antagonism present in every set of muscular activities, according to Shakespeare,<sup>1</sup> it is incumbent upon every singer to be alert, lest any opposing or interfering activity be imposed which might divert or impede perfect phonation.

However, observation shows that this is not the case with a vast majority of singing artists. This is clearly made manifest by obviously constricted mechanisms. It has been stated before, in this treatise, that the larynx is raised to a jamming position under the tongue during the swallowing action. This would indicate that the thyroid cartilage, a frontal part of the larynx, would be raised, also, automatically.

However, during the singing action, according to Figure 7, the thyro-cartilage appears to affect a slight tilting position.

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<sup>1</sup>Shakespeare, *op. cit.*

G. A. Forest<sup>2</sup> says to retain the Adam's apple (thyro-cartilage) in one position for singing. It will be assumed that the reference alludes to a veritable position in agreement with this thesis, in that the attitude of the thyro-cartilage is practically stationary, with a slight exception of the tilting action. In concurrence with this viewpoint, Feuchinger<sup>3</sup> can be quoted when he states, "No matter how high or low you sing, the larynx must not go up or down."

Naturally, there is a question, since the thyro-cartilage is the seat of the vocal chords, as to what difference it makes whether or not it is high or low.

At the outset, it can be answered that if the muscular activity which raises the larynx is brought into play while the phonatory process is in operation, there has been added a degree of the swallowing musculature. Since this has been advanced as an incorrect procedure to be utilized during the singing manifestation, it follows, then, that the balance of the phonatory juxtaposition has been altered.

If the larynx is raised during the emission of a tone, then that production must be a result of a superimposed squeezing action induced as a part of the interfering musculature which is part and parcel of the swallowing activity. Now since the later action is beginning to manifest itself, an automatic jamming procedure will

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<sup>2</sup>G. A. Forest, The Master Principle (Massachusetts, 1928), p. 151.

<sup>3</sup>Eugene Feuchinger, "The Open Throat," Etude, LI (1933), 339.

begin to be put in operation. One of the principal actions of the squeezing procedure is the dropping down of the epiglottis to cover the pulmonary airway. Therefore, this complicates the free emission of tone. With all this confusion being in evidence, it seems impossible to produce a beautiful tone of any lasting quality.

Furthermore, another result of this squeezing activity is the resultant closing of the vocal chords. Therefore, since this action demands the vocal chords to be pressed tightly together in order to prevent food from entering the trachea, it adds a further restrictive element to the free emission of tone. It will be observed from Figure 2 that all this occurs while the thyro-cartilage is jammed up under the tongue. It will be discovered at once that this increase in interference, per se, will mitigate against the production of a beautiful tone.

If the utilization of an incorrect muscular activity does not yet appear to be injurious to the production of tone, it is only a question of time when such undetected interference begins to predominate the complete phonatory process, causing almost irreparable damage thereto.

Therefore, with it all, it can be considered to be a fact that the position of the larynx seems to be in a state of uncertainty. With the demand of the swallowing action, which is the stronger, pulling the thyro-cartilage, and therefore the larynx, one way and at the same time, the singing action attempting to accomplish its task, is it any wonder that disastrous results usually occur to the vocal mechanism?

Technical education, physiologically, would tend to eliminate such inconsistencies. It should be perfectly admitted, then, that a career should not be built on a foundation of muscular interferences which are obviated by the ever changing position of the larynx caused by any jamming activity.

Carl Limback, of New York City, has examined many throats and found quite a number of epiglotti swollen to many times the normal size. In fact, the bursting or hemorrhaging of one is a famous case; it being that of the great operatic tenor Enrico Caruso. According to one of Caruso's physicians, the throat of Caruso necessitated many stitches in the area of the epiglottus after that memorable performance of Samson et Delilah, in the Academy of Music, in Brooklyn, New York, in 1921.

Of course, this is an extreme case. Still, at the same time, there is always the potential threat to anyone who abuses the vocal mechanism.

Therefore, one of the most glaring examples of muscular interference, pertaining to the vocal instrument, is the uncontrolled movement of the larynx or thyro-cartilage, since it is the most prominent.

Let it be reiterated here that during phonation, the position of the larynx should be almost stationary, with the exception of a slight tilting thereof.<sup>4</sup> Figure 7 illustrates this action.

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<sup>4</sup>Vennard, op. cit., p. 39.

## CHAPTER VII

### THE CONTROL OF THE SINGING MUSCULATURE

Inasmuch as the foregoing advances the viewpoint concerning the avoidance of the use of certain definite musculatures during the act of phonation, it would be well to present here suggestions which would be in accordance with the correct manifestations of vocal procedure.

One of the facets of this thesis tends to demonstrate the proposition that if the interfering musculatures are not utilized during the exhibition of the vocal process, and also that if the proper singing activity is developed and controlled, the career of the singing artist shall not have been concluded prematurely, but shall continue well into the sixties. The great Russian basso, Feodor Ivanovitch Chaliapin, Ezio Pinza and Maggie Teyte attest to that verity, as well as many other well-known singers.<sup>1</sup>

It is to be deduced, then, that man can demonstrate the direction and preservation of the voice if interfering activities are held to a minimum. Since this demonstration could be considered a verity, it could be reasoned that there is a definite controlling procedure of the vocal mechanism which could include that of the pitch and range manifestation. Experience shows, however, that many singers are

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<sup>1</sup>Evetts and Worthington, *op. cit.*, p. 59.

not aware of this very important actuation. Evidence of this is most common. It can be observed in many throats as well as felt, by the physical reaction of the larynx. The movement of the thyro-cartilage is a glaring example of correct or incorrect controlling attitudes.

Since this was discussed at length in the preceding chapter, it is only mentioned here in order to continue the exploration of the premise that there are some extrinsic evidences of incorrect muscular procedures, and the attitude of the thyro-cartilage is one of them. Another would be the obvious activity of the surrounding muscular responses when the throat is exhibiting definite straining reactions during incorrect vocal endeavors.

However, with all these exhibitions of what could be considered a malfunctioning process, many singing-artists inadvertently commit these structural errors, especially when ascending the scale to the higher notes. In many cases, it will be observed that the higher the note, the tighter the throat. Yet is it any wonder that the singer has difficulty with his voice; that he must cancel programs because of self-induced vocal irritations?

It has been stated before, in this thesis, that since the swallowing activity is stronger by virtue of its being developed many years previous to any thought of singing, the former is the stronger. If that is accepted as a fact, then it can be understood that any controlling activity of the singing musculature would be powerless against such a predominance of antagonistic, muscular activity. Therefore, the isolation of all such extraneous musculature is an imperative

necessity. Otherwise, the vocal process could not operate in such a strangled situation.

However, if a given vocal mechanism were free of any such interferences, it could be activated by a means of direct muscular control. A part of that controlling activity is found in the actuation of the pharyngo-palatini (the fauces or pillars of the throat) together with the operation of the azygos-uvulae. These muscular activities perform as a result of a conscious control. This is also corroborated by Lissfelt<sup>2</sup> and MacKenzie.<sup>3</sup> Brown and Behnke further agree as to the uvular movement.<sup>4</sup>

As a matter of continuation, it can be noted that the introducing of this incipient controlling procedure seems to gradually place the voice in a technical category rather than a natural one. Therefore, since all voices are, by creation, natural, it seems incumbent upon the possessor thereof to train, muscularly, the physical instrument in order to accomplish greater vocal control. Deductively, then, developmental, muscular calisthenics must be desired by the artist.

This demands, then, that greater attention be paid to the direction of definite muscular reactions concerning the vocal mechanism. Therefore, all that can be stated concerning breathing,

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<sup>2</sup>John Frederick Lissfelt, The Basic Principles of Artistic Singing (Boston, 1938), p. 19.

<sup>3</sup>Sir Morell MacKenzie, Hygiene of the Vocal Organ, 9th ed., (Melmar, New Jersey, 1928), p. 117.

<sup>4</sup>Browne and Behnke, op. cit., p. 166.

articulation, diction, posture, et cetera, is of little value if there is evidence of any crippling action superimposed on the controlling activity of the phonatory process.

Since all training ought to begin with the physical instrument in mind, the natural voice could not be led to any fields in which this attitude of proper muscular kinesthetics does not abide. It is stated very clearly by Browne and Behnke<sup>5</sup> that, "The knowledge of physiology is necessary to prevent all damages that might be done through ignorance." Therefore, on page 42 of this thesis, mention was made concerning the rear pillars of the throat and the azygosuvulae. This was introduced in order to have a starting point for discussion of a possible controlling activity having to do with the construction of a pitch-stretching mechanism latent in the throat.

It will be observed from Figure 6 that there is a definite mechanism put into operation during phonation. Specific perusal will show that at the top of this musculature the pillars of the throat are in operation.<sup>6</sup> Further, it will be noted that, depending upon the impulses from the brain, this direct activity is put into operation. This thesis advances the proposition that there is one continual muscular activity which when put in motion, will control the pitch and range manifestations of the voice. Bartholemew,<sup>7</sup> and Browne and Behnke<sup>8</sup> are in

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<sup>5</sup>Browne and Behnke, op. cit., p. 5.

<sup>6</sup>W. T. Bartholemew, "A Survey of Recent Voice Research," Music Teachers National Association Proceedings for 1935, XXXII (Ohio, 1936), p. 130.

<sup>7</sup>Ibid.

<sup>8</sup>Browne and Behnke, op. cit., pp. 65-166.



accord with this point of view. Could it be accepted, then, that without any technical training a natural voice would perform just as well? Since every voice possesses this particular musculature, it is necessary that the utilization thereof be accomplished.

However, this coordination is impossible without direct vocal control areas being established. To have all the greatest potentials at one's command without their being actuated, would seem to be a travesty on the scientific aspects of singing. Could it be an accepted fact that some singing-artists do operate the vocal instrument from this vantage point of control? Would this be the reason why some bass voices can sing a brilliant high A flat above the staff, while others, possessing the same physical potentialities, can barely manage to sing an E flat, with forcing? Could this control mechanism be the missing quotient which might determine whether or not a mezzo-soprano could sing a ringing, high B flat, while others would have to be content with an F above the staff?

If the assumptions, mentioned above, are dependent upon the utilization of all the physical equipment of the vocal mechanism per se, it can be said that by the proper, motivating muscular coordination, beyond the natural state, "singing involves correct, physical action."<sup>9</sup> Another writer upon the subject offers this statement: "One of the teacher's greatest problems is to develop in the pupil the ability to

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<sup>9</sup>Herbert Witherspoon, Thirty-Six Lessons in Singing for Teachers and Students (Chicago, 1930), pp. 16-675.

maintain the correct degree of muscle tone."<sup>10</sup> Furthermore, "Good tone results from the vibration of surfaces that are tense."<sup>11</sup> This refers to a similarity to the taut strings of a violin, for example.

From the above quotations, it could be considered that there must be operative, during phonation, a definite control system far and above the effectiveness of any natural voice, as such. To maintain a correct physical action with the proper degree of muscle tone in order to obtain results from surfaces that are tense, demands a concentrated control of the vocal manifestations of the throat.

Returning to Figure 6, it could be asked: just what is the stretching process which controls the important factor of tone control? In answer, it could be said that after the brain conceives the idea of the pitch and tone desired, it is safe to assume, then, that the automatic stretching process is immediately put into operation in the larynx. Assisting in this actuation are musculatures of the thyrocartilage.

This sensitive area is as finely constructed as a most delicate watch. Its minute mechanisms act with lightning rapidity. Furthermore, since this cartilage is suspended in the throat by a balanced muscular activity, it can be susceptible to a slightest pull from any

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<sup>10</sup>Douglas Stanley, "The Science of Voice," Journal of the Franklin Institute, CCH (1930), 45.

<sup>11</sup>Louis Graveur (Billy Douthit) "New Theories of Vocalism," Etude, XLIX (1931), 128.

given direction. It can be deduced, then, that any degree of control, automatically induced, or otherwise, is an important consideration.

Not only are extrinsically musculatures to be dealt with, but those of the intrinsic nature as well. Since the stretching action of the vocal mechanism begins primarily in the thyro-cartilage, it would be well to delve into a closer inspection of the internal workings of that area.

Figure 7 confirms the findings of Stanley<sup>12</sup> who states that "two opposing sets of muscles tense the vocal chords." These are found to be the crico-thyroid, in the front, and the crico-arytenoid, in the rear of the thyroid-cartilage." Figure 4 gives a more detailed view of this later assemblage. The findings of Vennard,<sup>13</sup> Browne and Behnke<sup>14</sup> and Gray<sup>15</sup> confirm this opinion.

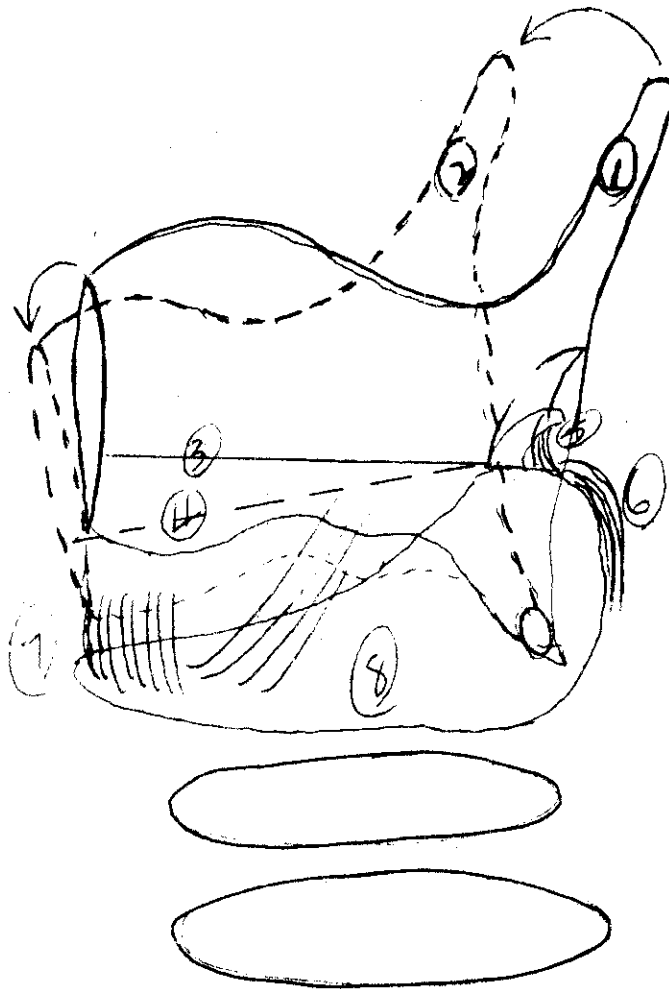
Furthermore, it will be noted, also in Figure 8, that the cricoid bone is beveled toward the front. Browne and Behnke<sup>16</sup> call this foundation cartilage the signet-ring bone because of its shape. Could it be a matter of conjecture concerning the use of this bone other than being a part of the larynx, per se? It will be noted, from Figure 7, that the narrowing frontal edge of the cricoid bone allows the thyroid

<sup>12</sup>Stanley, op. cit., CCXI, 405.   <sup>13</sup>Vennard, op. cit., p. 39.

<sup>14</sup>Browne and Behnke, op. cit., p. 49.

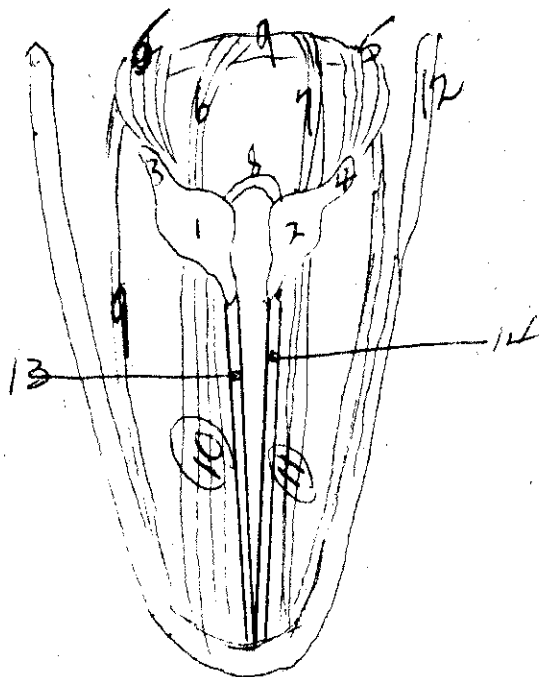
<sup>15</sup>Gray, op. cit., p. 1092.

<sup>16</sup>Browne and Behnke, op. cit., p. 42.



1. & 2. Positions of Superior Cornu of Thyro-cartilage.
3. & 4. Positions of vocal chords
5. Oblique Arytenoids
6. Posterior crico-arytenoids
7. Constricted crico-thyroid
8. Cricoid

Fig. 7--The tilting action of the thyroid cartilage (from Vennard).



- 1. & 2. Arytenoid cartilages
- 3. & 4. Cartilages of Santorini
- 3. & 5. Posterior crico-arytenoids
- 6. & 7. Oblique arytenoids
- 8. Arytenoideus-transversus
- 9. & 9. Cricoid
- 10. & 11. Thyro-arytenoideus
- 12. Thyro-cartilage
- 13. & 14. Vocal chords

Fig. 8--Vocal process of the thyroid cartilage (from Browne and Behnke).

cartilage to tip forward. In that way, the freedom of the stretching of the vocal chords is accomplished. If there were not any beveling of this bone to the front, and if it were shaped as a square object, it could be seen that it would be impossible to permit any tilting action of the thyroid cartilage. "The drawing of the shield (thyro-cartilage) downward and forward is brought about by a pair of muscles ascending on either side, in the shape of a fan, from the ring to the shield," is stated by Browne and Behnke.<sup>17</sup> Another quotation from the same work states, "The ring muscles stretch the vocal ligaments."

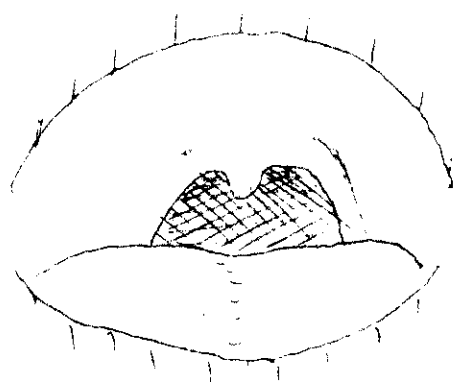
The assisting musculature which aids in causing the vocal ligaments to be stretched is the crico-arytenoid activity. These muscles are attached to the cricoid bone, in the rear, and extend upward, and are attached to the arytenoid cartilages. Since the vocal chords are attached to the inside frontal part of the thyro-cartilage and extend back to attach to the arytenoid cartilages, it is a matter of deduction that the tilting action of the thyro-cartilage must be resisted by a reverse holding of the muscles which prevent the arytenoids from being drawn downward and forward.<sup>18</sup> Otherwise there would not be any stretching action. Figure 9 will show the structural viewpoint in order to illustrate the picture clearly.

To do an experiment which would closely resemble the stretching action of the vocal chords would be to inflate a large toy balloon.

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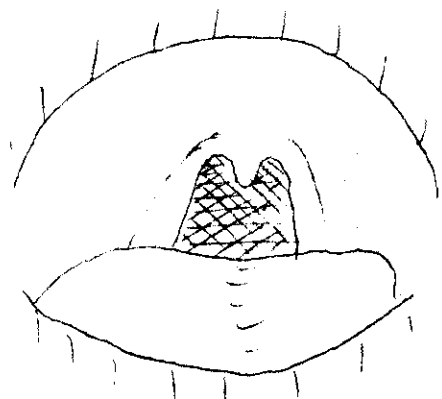
<sup>17</sup>Browne and Behnke, op. cit., p. 48.

<sup>18</sup>Vennard, op. cit., p. 38.



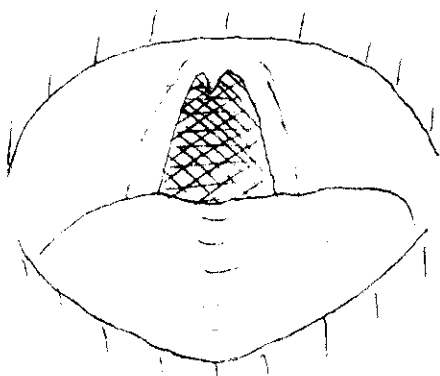
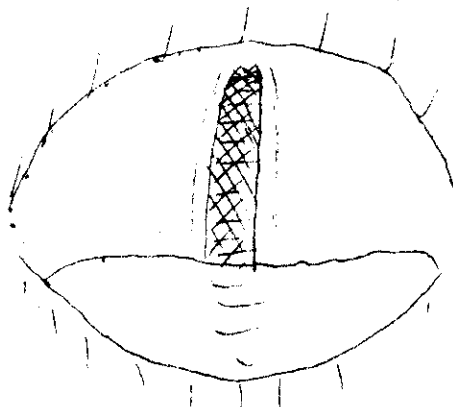
A

medium low note



B

medium range

medium high note

D

top of range.

L

Fig. 9--Azygos-uvulae (velum) action with pharyngo-palatini (from Browne and Behnke).

Place it between the upper arm and body, and slightly press in order to simulate the diaphragmatic pressure applied to the lungs. Then, with the thumb and index finger of one hand holding the lips of the neck, manage to hold an end of the lips with the thumb and index finger of the other hand. Pull the lips apart and notice that when they are stretched the greatest, the resulting sound is of a higher pitch than when the lips are relaxed. This stretching and relaxing, manifested by the experiment, demonstrates, in a rather crude way, the activity of the tilting of the thyro-cartilage, at one end of the vocal chords, and the resistance of the arytenoids, to this pull, at the other end. To the effect of this experiment, Herbert-Caesari<sup>19</sup> concurs.

Since it has been mentioned above that this sensitive area is as finely constructed as a most delicate watch, it will be readily understood why a jamming action of the swallowing process would seriously impair any free movement of the vocal actuation. It will be remembered that the swallowing action is one of violent, squeezing attitudes, which is opposed to the smooth, unrestricted operation of the singing activity.

However, that such has not been the case in many instances can be attested by the development of nodules in the vocal chords. Could it be said that they are formed as a result of the natural operation of the vocal instrument, or that these are evidences of misuses thereof? If the viewpoint is taken that they became apparent because of the latter

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<sup>19</sup>Herbert-Caesari, op. cit., p. 34.



reason, what could cause them to form? W. C. Hendrix,<sup>20</sup> an ear, nose and throat specialist, will state that there has been excessive irritation of the vocal ligaments. That as a result of violent vocal chord attitudes of one against the other, nature grew a protective shield over the affected area in order to prevent further damage to the vocal processes. This protective shield developed in the form of a calus or nodule. The presence of these nodules can be detected by the continual roughness of tone being heard every time the vocal organ is used. Also, they can be removed by surgery, but if the same manifestation of incorrect vocal procedure is pursued, the nodules will reappear.

A well-known popular singer, Betty Hutton, had to terminate her activities, temporarily, in a vocal way, because of the formation of nodules upon her vocal chords.<sup>21</sup> Could this be the result of correct usage of the vocal instrument? Was the excessive irritation of the vocal chords a necessity in the operation of the vocal processes? It could be assumed, then, that an obvious forcing of the voice to emit tones could be the cause. Or, by utilizing the swallowing action, was there another contributing factor simultaneously with the singing activity? It has been stated before, on page 38 of this thesis, that the swallowing action, being the stronger, would predominate. Deductively, from the Hutton case, this could have been the reason for the disastrous results thereof.

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<sup>20</sup>W. C. Hendrix, M. D., Fort Worth, Texas.

<sup>21</sup>Fort Worth Star Telegram, June 27, 1957.

Therefore, in order to cease such an abuse, a complete physical rejuvenation should be introduced. In the first place, the decimation of the use of the genio-hyoid muscle should be considered. Secondly, a development of the controlling process of vocal emission should be undertaken immediately in order to build a strong muscular instrument.

Since the internal workings of the thyro-cartilage cannot be seen in operation, there is one branch of this muscular mechanism which can be observed. It will be recalled, from page 42 of this thesis, that mention was made of the rear pillars of the throat. These are the pharyngo-palatini and are attached to the rear horns (superior cornu) of the thyro-cartilage. Figure 6 shows them from a side view, whereas Figure 9 presents them from a frontal aspect of the mouth only.

It will be noted that the higher the note, the relatively higher will be the raising of the uvula. This in turn elongates the opening of the spaces between the arches or pharyngo-palatini. Because of their attachment to the upper horns of the thyro-cartilage, it can be observed that as they, the pharyngo-palatini, are pulled upward by the azygos-uvulae, there could be a relative movement of that cartilage, or, in other words, an assisting action, in aiding the tipping thereof, would be an accomplished fact.

On page 44 of this thesis, the question of the differences of ranges of given voices was discussed. Could it be possible, then, that if this added stretching mechanism were brought into being during

phonation, these same limited-range voices would be able to encompass the high notes? This point of view is corroborated by X-ray pictures taken by Wheeler<sup>22</sup> who finds that those voices, which produce the beautiful tones and high ranges, are the ones which demonstrate the high, palatal arches.

Furthermore, it can be said that there would be little chance of nodules forming on vocal chords if a stretching procedure were adopted instead of the squeezing. It could be reasoned that nodules could be decimated by the introduction of corrective stretching exercises.

However, numerous corrective potentialities are of no importance if the mental directive is not utilized. It has been stated by McClean<sup>23</sup> that voices are under the controls from headquarters, the human brain. Concurring is Seashore<sup>24</sup> who maintains that the nerve impulses that control the act of phonation can now be traced along their entire route to their very origin in the brain. It is, therefore, understandable, from research along the course of neurological evidence, that the entire vocal musculature functions as one united system. That it is governed by psychological controls which, in turn, regulate the

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<sup>22</sup>Francis Wheeler, "The Relation of the Parnasal Sinuses to the Singing Voice," Science, LXXIII (1930), 630.

<sup>23</sup>Cameron McClean, "The Vocal Interference and Its Elimination," Music Teachers National Proceedings, XXXI (1936), 172.

<sup>24</sup>Carl Emil Seashore, "New Approches to the Science of Voice," Scientific Monthly, XLIX (1939), 340.

muscular reactions, is corroborated by Garnetti-Forbes<sup>25</sup> who states that, "The training of the voice involves deep-seated coordinations that can only be affected by a psychological approach." Brouillet<sup>26</sup> adds to this by indicating that a mental picture should be formed before any attempted physical action. To this, this thesis agrees, but would add that mental pictures, per se, are of little value if they do not portray the correct physical manifestation of the phonatory process as distinct from the swallowing activity.

Basically, then, the complete control of the vocal organ resides in a sense of a duality of purpose; one of the automatic, having to do with the operation of the activities of the thyroid cartilage, and the other with the direct control of the upper musculature, which is the area of the pharyngo-palatini. Both should function simultaneously. If the lower manifestation of vocal response is operating, the upper should be in action in order to complete the chain of control. Since experience shows that it is usually this upper segment of vocal activity to be untrained, it can be deduced that the chief burden of tonal response will fall on the limited activity of the thyroid cartilage. This could be another reason why many great, natural voices never quite reach a goal in keeping with their potentialities.

The Bell Telephone Company had a film made which purports to show the workings of the vocal organ, especially the activity of the

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<sup>25</sup>Eleana Garnetti-Forbes, The Amazing Phenomenon of Voice, (London, 1936), p. 79.

<sup>26</sup>Georges A. Brouillet, Voice Manual (Boston, 1936), p. 65.

vocal chords in the thyro-cartilage. By focusing a strong light into the throat and by adjusting a laryngoscope under the uvula, the vocal chords were brought into view. Because the film was run at slow motion speeds, it was possible to see the movement of the vocal lips as they came together and then separated as if to allow a puff of air pass by them. By virtue of the film being a silent one, it was impossible to tell whether or not the tones emitted were that of a groan, moan, shriek, or a mellow vibration. Despite the fact that this film was made to demonstrate the voice proper at its seat of activity, it was very difficult to agree that the mechanism really performed as such. It was assumed that it would be impossible for a voice to operate normally with a mirror touching the back of the throat; that the throat could not be in that position when there was an emission of a correctly produced tone. With the mouth distended as such, it was thought by the viewers that only a scream could come forth, et cetera.

Finally, let it be reiterated that the phonatory process must operate with all the component musculatures in being, otherwise there is likely to be a missing quotient toward perfection. As a further precautionary measure, the complete isolation of the swallowing activity is imperative during the emission of tone. If this is manifested, then there is the free muscular movement of the singing mechanism. The degree to which any extraneous muscular activity is super-imposed upon the vocal instrument, will be that degree of

decimation of control. Such impeding artificialities shall gradually assume leadership in tone production, thereby causing an early deterioration of the phonatory process.

## CHAPTER VIII

### CONCLUSION

It will be observed that the central point of view of this dissertation has been the recognition of the difference between the swallowing and singing mechanisms, together with suggested procedures for the development of the latter. Suffice it to say, however, that what has been presented must be considered, generally, in the light of a viewpoint based upon an attitude pertaining to the physiology of singing. This would admit of many points to be explained further, and this could be done if the length of this thesis might have been extended beyond the scope of a master category. For example, the intricate detail concerning the functional use of the false vocal chords as a lubricating agent for the true vocal chords has not been covered, except to show them in Figure 3 on page 11. H. W. Gray's book on anatomy is recommended for a further study of that phase.

Therefore, the singing activity is a distinct physical operation which is manifested as a result of the laws of structural response being actuated. In a similar manner, the swallowing mechanism accomplishes the task at hand by virtue of an automatic action of muscular obedience peculiar to the demands of that situation. But if both act simultaneously, confusion reigns. It has been demonstrated that tones should be produced by the correct utilizations of the proper activity,

especially that of singing. Since the swallowing procedure has been developed in man from birth, it is incumbent upon him, therefore, to become aware that this physical operation cannot be identified with singing. It can be accepted that there are two main categories of action in the throat--one a swallowing and the other a vibrational producing manifestation.

Therefore, science demands that only one mechanism be utilized for a given reaction. If both are used simultaneously, it is only a question of time in which one will dominate the other, and it is usually the swallowing which succeeds.

Furthermore, the musculatures peculiar to that of singing must be developed by using the correct kinesthetic action if a proper physical foundation of the vocal mechanism is to be demonstrated. On this point, it would be well to quote Browne and Behnke<sup>1</sup> who state that,

Teachers are needed who have gone through a regular course of physiological and anatomical training; who have learnt the way in which all the muscles of the vocal apparatus act, so that on hearing a faulty voice they may be able to say which muscle or set of muscles requires to be brought into play, or subdued in action, as the case may be.

The opinion of this thesis agrees with the foregoing quotation. However, since such has not been the case in an untold number of shortened careers, this classification of proper vocal pedagogy should be the sine qua non of the teaching profession. Even a cursory survey

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<sup>1</sup>Browne and Behnke, op. cit., p. 11.



of literature upon the subject reveals astonishing inconsistencies and conflicts of pedagogical opinion. From a general point of view, this diversity of viewpoints apparently arises from the fact that a multiplicity of specific teaching procedures is being developed by instructors without reference to the physical pedagogical principles underlying them. Most singing teachers readily admit that the field of vocal pedagogy stands badly in need of clarification; that sooner or later a pioneering effort must be launched that will help set up frontiers of rational thinking in this all too neglected educational field.

Despite the fact that there are many who opposed standardization of vocal pedagogy, one of the concepts of this thesis holds that with the exception of the color of the vocal chords and the size of certain bone or cartilage dimensions, all vocal apparati are constructed, fundamentally, the same. To support this viewpoint, books on anatomy<sup>2</sup> do not differentiate between the male and female vocal organ. Therefore, it is deductible that the physical operation for every instrument, should be similar.

With reference to the use of the vocal mechanism in order to attain a certain vocal effect, as in interpretation of vocal literature, dramatically or otherwise, the purport of this treatise is not in contention.

That a definite mechanism of the operation of the vocal instrument has been presented, can be observed from the corroborated

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<sup>2</sup>Gray, *op. cit.*

viewpoints of quoted, prime opinions. If, therefore, a complete physical perspective indicates that there are definite laws of procedure to be utilized, during phonation, it is imperatively necessary for such to be an operative fact.

Finally, a quotation from a recent work of Vennard<sup>3</sup> seems a fitting conclusion to this thesis,

I believe an eclectic philosophy of voice production is possible to all who have the tolerance to learn from those with whom they seem to disagree. In this spirit I have tried to describe not only the mechanism of voice production, but also those principles which make for the best technique. A knowledge of the mechanism is the foundation of an objective pedagogy, and a mastery of the technique is the prerequisite for artistic expression.

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<sup>3</sup>Vennard, op. cit., p. 135.

## BIBLIOGRAPHY

### Books

- Brouillet, Georges A., Voice Manual, Boston, Bruce Humphries, Inc., 1936.
- Browne, L. and Behnke, E., Voice, Song, and Speech, London, Marston and Co., and New York, G. P. Putnam's Sons, n.d.
- Clippinger, D. A., Class Method of Voice Culture, new edition, Boston, Oliver Ditson, 1932.
- Drew, W. S., Singing, the Art and the Craft, London, Oxford Press, 1937.
- Evetts, E. T. and Worthington, R. A., The Mechanics of Singing, London, J. M. Dent & Sons, 1928.
- Frederick, J., The Basic Principles of Artistic Singing, Boston, E. C. Schirmer, 1938.
- Garnetti-Forbes, E., The Amazing Phenomenon of Voice, London, Rider & Co., 1936.
- Forest, G. A., The Master Principle, Massachusetts, Chestnut Hill, published by the author, 1928.
- Gray, H., The Anatomy of the Human Body, Philadelphia and New York, Lea & Febriger, 1924.
- Herbert-Caesari, E. F., The Science and Sensations of Vocal Tone, London, J. M. Dent & Sons, 1936.
- MacKenzie, Sir Morell, Hygiene of the Vocal Organ, 9th ed., Melmar, N. J., Edgar S. Werner & Co., 1928.
- Negus, V. E., The Mechanics of the Larynx, St. Louis, C. V. Mosby Co., 1929.
- Orton, J. L., Voice Culture Made Easy, London, Thronstons, 1938.
- Seashore, C. E., Object Analysis of Musical Performances, Iowa, University of Iowa Press, 1936.

- Shakespeare, W., Plain Words on Singing, London, Putnam, 1938.
- Stanley, D., The Voice, New York, Pitman, 1938.
- Vennard, W., Singing, the Mechanism and Technique, Los Angeles, Edwards Brothers, 1950.
- Wilcox, J., The Living Voice, New York, Carl Fischer, 1935.
- Witherspoon, H., Thirty-Six Lessons in Singing for Teachers and Students, Chicago, Meisner Institute of Music, 1930.

#### Articles

- Alda, F., "The Girl with a Voice," Good Housekeeping, XC (June, 1930), 283.
- Bartholomew, W. T., "A Survey of Recent Voice Research," Music Teachers National Association Proceedings for 1935, XXX (1936), 78.
- Bartholomew, W. T., "A Survey of Recent Voice Research," Music Teachers National Association Proceedings for 1935, XXXII (1936), 130.
- Bartholomew, W. T., "A Survey of Recent Voice Research," Music Teachers National Association Proceedings for 1937, XXXII (1938), 130.
- De Bar, D., "Foundation Work in Voice Development," Etude, XLVI (1928), 468.
- Edwards, F., "Some Secrets of Good Singing," Etude, L (1932) 506.
- Feuchinger, E., "The Open Throat," Etude, LI (1933), 339.
- Gescheit, A., "In Defense of a Scientific Basis of Voice Training," Musician, XXXVI (1931), 27.
- McClellan, C., "The Vocal Interference and Its Elimination," Music Teachers National Association Proceedings, XXXI (1937), 172.
- Muyskens, J. H., "The Emergent Voice," Music Educators National Conference, XXXI (1938), 283.

- Seashore, C. E., "New Approaches to the Science of Voice," Scientific Monthly, LIX (1939), 340.
- Shaw, W. W., "Interference Applied to Singing," Musician, XLIII (1938), 88.
- Stanley, D., "The Science of Voice," Journal of the Franklin Institute, CCXII (1931), 405.
- Wheeler, F., "The Relation of the Parnasal Sinuses to the Singing Voice," Science, n. s., LXXIII (1930), 630.
- Zerffi, W. A. C., "A Search for a Vocal Method," Bulletin of the Hennepin County (N. J.) Medical Society (June, 1939), p. 3.