A Singer's Guide to the Larynx

ANATOMY WITH IMAGINATION
A Singer's Guide to the Larynx

Nicola Harrison and Alan Watson

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Dedication

I will sing with my spirit, but I will also sing with my understanding.
1 Corinthians 14:15.

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Acknowledgements

Particular thanks to Johan Sundberg, Jeanie LoVetri, Gillyanne Kayes and Kerry Obert for offering a variety of suggestions and viewpoints particularly in regard to Section IV where Alan and I make a valiant attempt to nail some cautious definitions to the mast of contention.

Thanks as always to Noel at Compton for his easy-going nature and free rein; To Alan for his forbearance when our singer-scientist discussions became volatile; To Johan and Gillyanne for kindly providing quotes and Foreword. To Louise Hill for cover design and her additional artwork and to our wonderful profession of singing for all the curiosity, joy and endless wonder it has provided me with over so many years. I hope this book shines a light for all those seeking to understand the anatomy of the larynx and how it works.

Finally, thank you for buying this book.

Nicola Harrison

Foreword

Singing teaching has long been a rather competitive profession. In the 21st century the social media conversations and the power of the web provide a handy forum for those who promote themselves as experts in voice, often with minimal knowledge and experience.

The study of voice is multi-faceted and can include the disciplines of medicine, acoustics, psychology and neuroscience as well as the more obvious skills of musical interpretation and performance communication. Between them, the authors are able to cover a number of these areas, having qualifications in neuroscience, anatomy and physiology, psychology of performance, nursing, musical performance and text.

What Nicola Harrison and Alan Watson have set out to do here is to provide a digestible and straightforward guide to the nuts and bolts of vocal anatomy and physiology in relation to commonly used terms in vocal pedagogy. Perhaps it will act as a litmus test for those swimming in a tide of loudly paraded opinions, to help sort the wheat from the chaff and inspire its readers to have the courage to find out more for themselves.

Dr Gillyanne Kayes

Introduction

The vocal instrument is an extraordinary, complicated mechanism that lies hidden within us. It is made up of many different parts and is supported and maintained by so many muscles, joints and cartilages, that its anatomy and function in relation to the act of singing has often been veiled in mystery.

This workbook has been written specifically for singers, students and teachers of singing and has a strong imaginative and pictorial element to help visualise the internal workings of one key part of that instrument: the larynx. Offered as a manual for teachers to work with and share with their students, we hope that the beautiful design and mixed approach to learning will help the reader engage with this complex subject in an interesting way.

In writing this book we have offered up multiple diagrams and views. These are all original work and have been created by the authors specifically for *The Singer's Guide to the Larynx*. We have used a consistent colour scheme for the cartilages, so that the full structure and function of the larynx can be clearly grasped. This is accompanied by concise and scientifically accurate text based on current understanding and, where knowledge is incomplete, we have endeavoured to make that clear.

In the past, some anatomical terms have been used loosely in both scientific and vocal literature which may have led to confusion. We have attempted to clarify this by using the same terms consistently throughout the book. We have given alternative terms in brackets so that readers can see that they are one and the same thing.

Our descriptions here are limited to the larynx only and do not set out to describe the anatomy of the entire vocal instrument, or the different systems that support it. We hope to address this in further volumes.

The larynx is hard to picture from within. We have therefore done our best to produce clear and accurate descriptions of this mechanism in order to lay bare its component parts and show how they work together to produce sound. We have also added some playful images to the first section to help learners associate anatomical structures with known shapes.

Combining anatomy with colourful figures will, we hope, help young singers picture their instrument in a variety of ways. To this end, the book is also supported by imaginative learning games to tease the mind and test knowledge. The questionnaires make fantastic tools for teachers who wish to check their students' knowledge and review their own learning.

As each section develops from the previous one, an element of repetition is used to build on information previously given to gradually extend learning. In the final section, we valiantly attempt to put the previous sections together in terms of physiology and explain the most contentious areas of our profession as best we can. Sometimes, in the absence of hard evidence, this can be tough.

By bringing the wonderful resource of imagination to the teaching of vocal anatomy, we hope to provide singers at varying levels with a visually alluring and mentally stimulating approach to understanding the structure and function of the larynx.

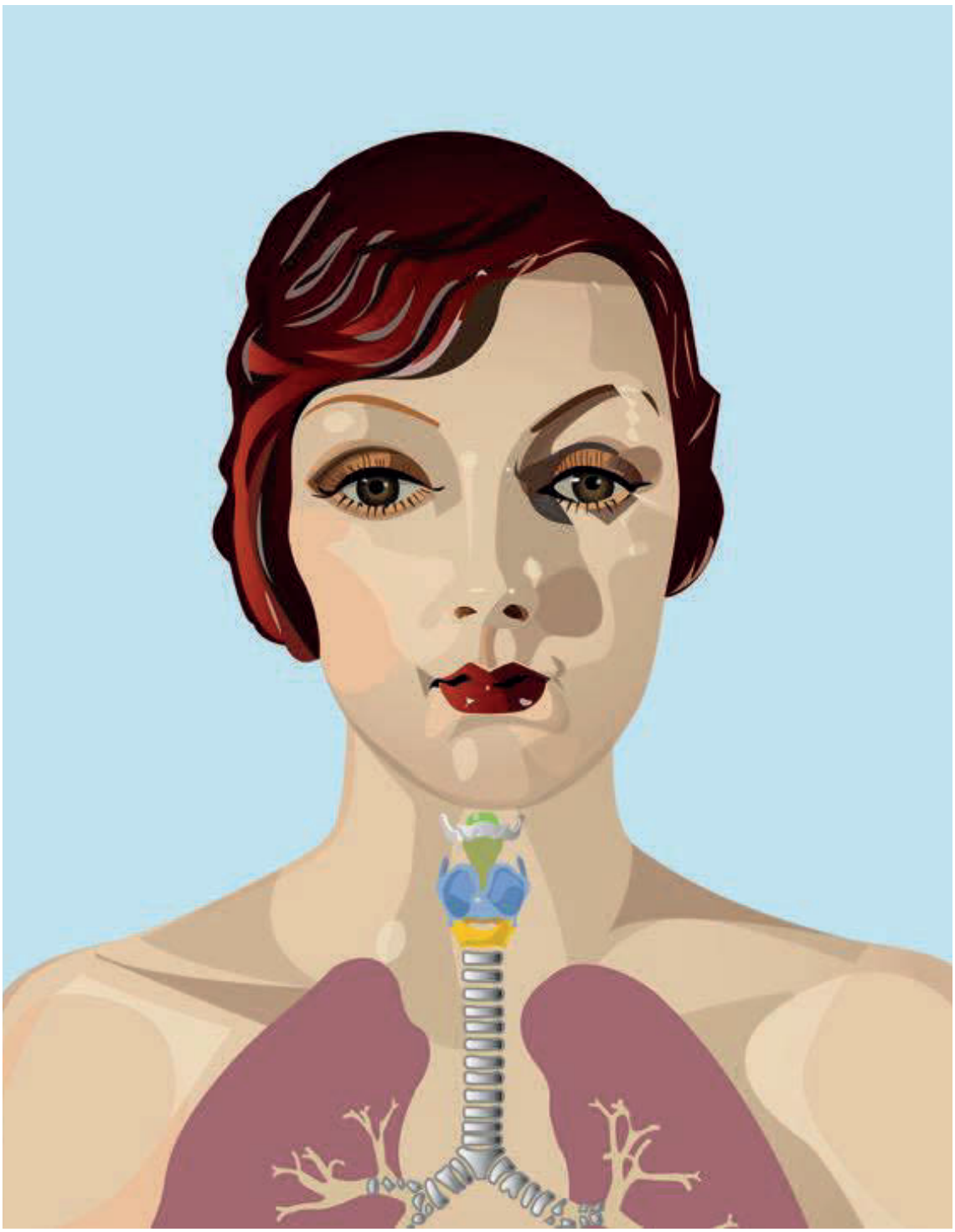
Nicola Harrison and Alan Watson

Note on labelling of figures

We have used simple terms throughout to denote which views we are showing in the figures. These are mainly labelled as front, side and rear views. However, in a couple of figures we have offered other sections of the larynx:

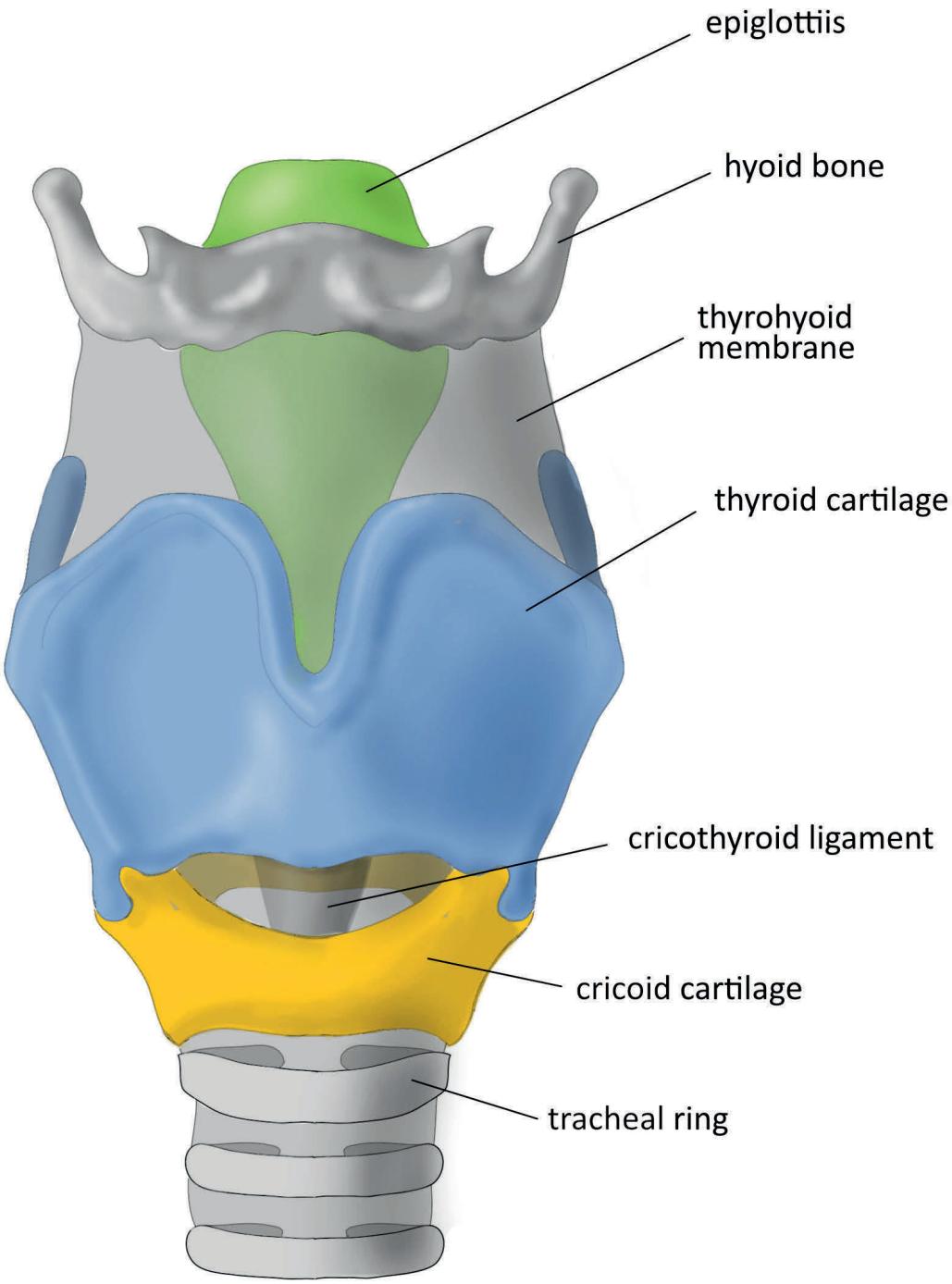
Coronal section – a view of a slice that separates the front of a structure from the back.

Sagittal section – a view of a slice that separates one side of a structure from the other.



This beautiful image of a 1920s fashion mannequin shows the correct position of the larynx and trachea within the body.

Section I The larynx: basic anatomy



Front view of the larynx

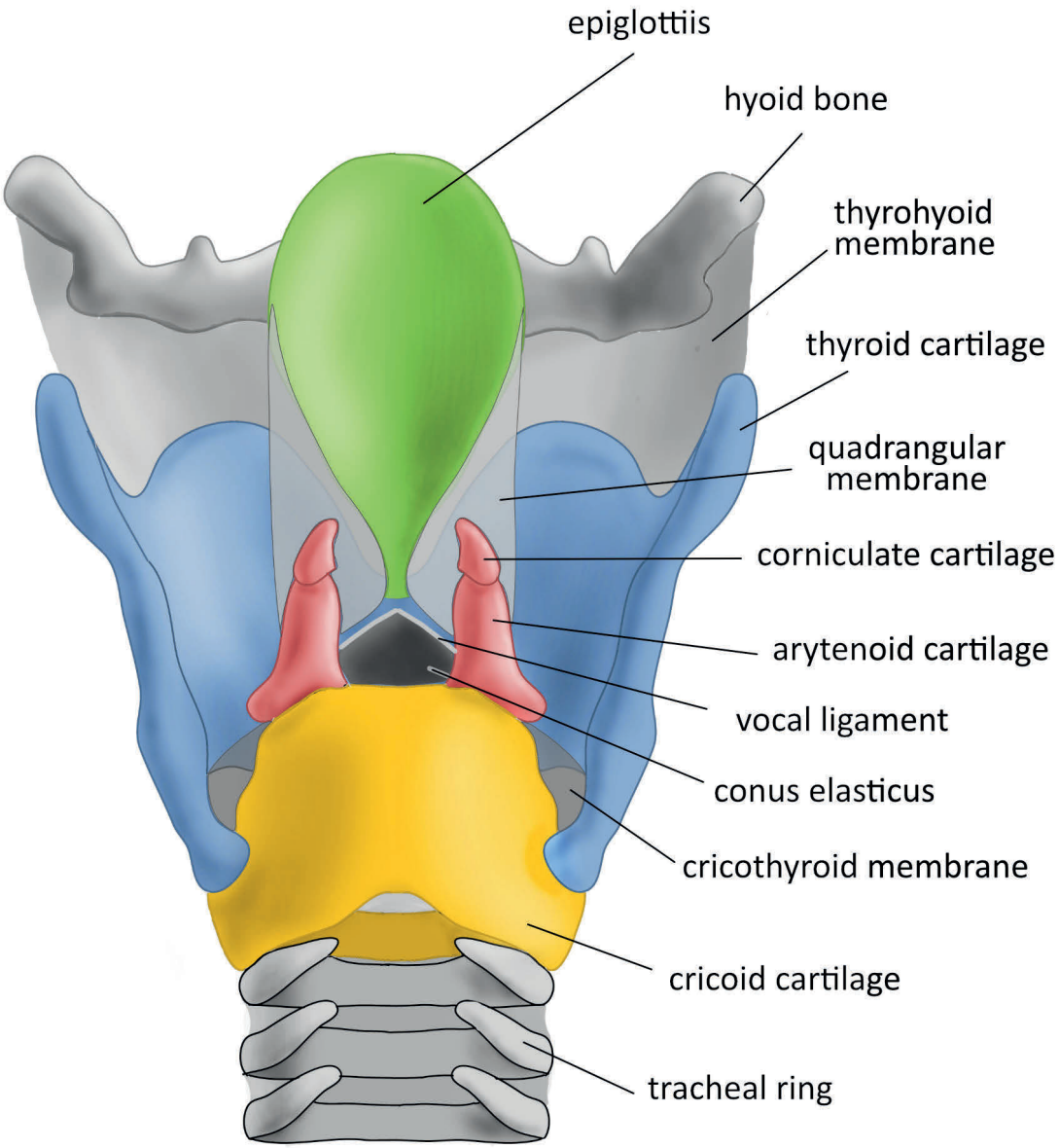
Overview

Position

The larynx is located at the front of the neck and sits directly above the trachea or windpipe. In size, the larynx is around 3.6 cm in length in women and around 4.4 cm in men, although size may vary. It can be seen and felt as a prominent bump in adult males and felt as a firm structure within the neck of adult females. It is less prominent in children.

Behind it lies the oesophagus (food pipe) a flattened tube which sits in front of the cervical (neck) vertebrae.

The larynx is suspended from **the hyoid bone**. This is not part of the larynx but provides attachments for muscles to the tongue, larynx and skull. It sits above the trachea which is held open by a series of cartilaginous rings, known as the **tracheal rings**.



Rear view of the larynx

Description

Cartilages

The larynx is composed of three large cartilages. These are:

1. The **epiglottis**
2. The **thyroid cartilage**
3. The **cricoid cartilage**

It also contains some smaller cartilages. The most important of these are:

4. The **arytenoid cartilages**

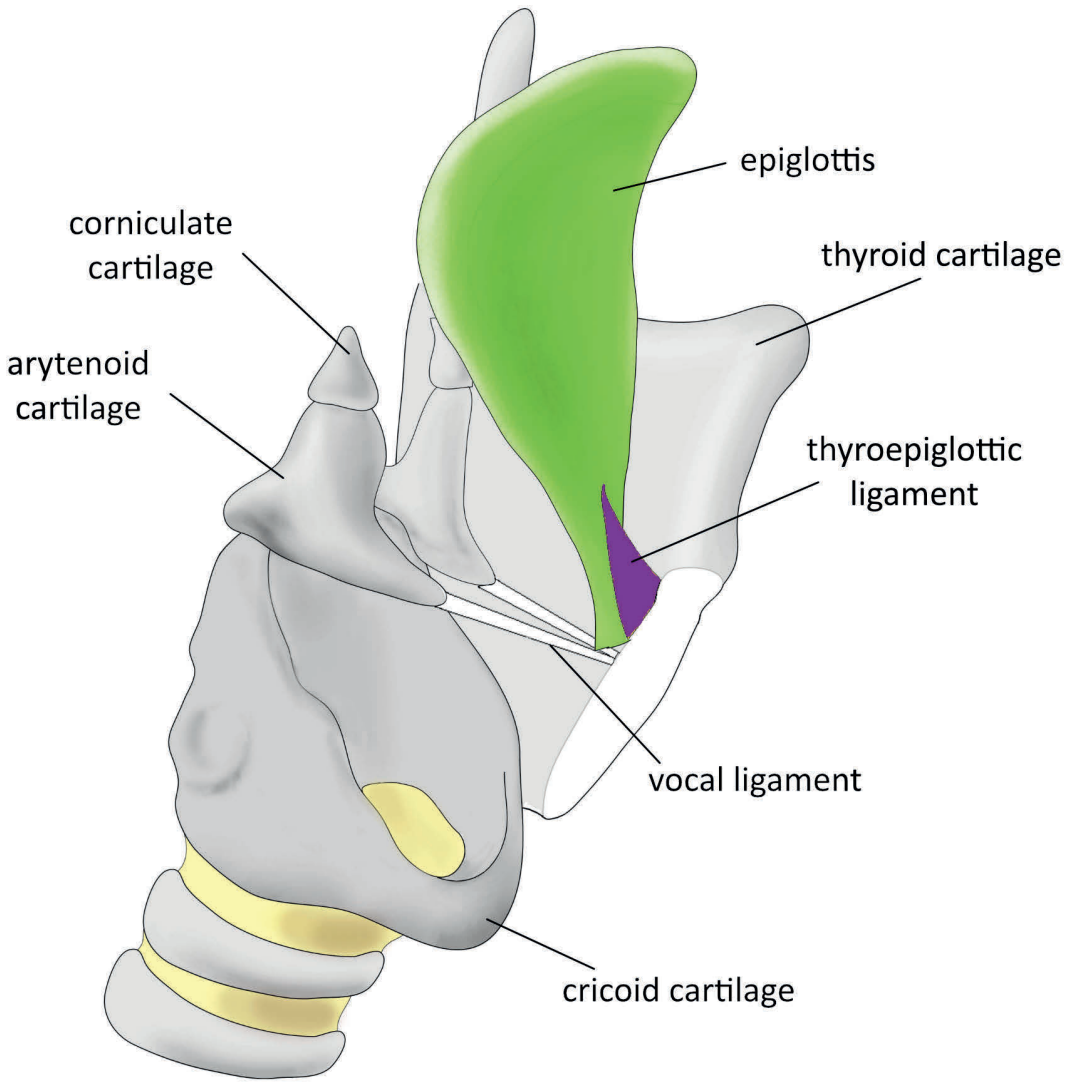
Membranes

The large cartilages of the trachea and larynx are connected by membranes which allow some movement between them and form a continuous tube to contain the air. These are:

1. The **thyrohyoid membrane:** this runs from the upper surface and superior horns of the thyroid cartilage to the hyoid bone.
2. The **cricothyroid membrane**: this has two parts. The largest is the **conus elasticus**, a tent-like membrane which runs upwards from the upper edge of the cricoid cartilage to the vocal folds. The other part is the narrow **cricothyroid ligament** which runs from the front of the cricoid cartilage to the lower edge of the thyroid cartilage (see also Section II).
3. The **quadrangular membranes:** the upper edges of these run from the arytenoid cartilages to the epiglottis. The lower edge is continuous with the vestibular ligament of the false vocal folds the membranes between the **tracheal rings** that link them.

Muscles

Within the larynx there are a number of muscles that move the cartilages, open and close the vocal folds and are responsible for generating sound. These are called the **intrinsic muscles** of the larynx.
Outside the larynx, the **extrinsic muscles** are responsible for controlling its position in the neck.



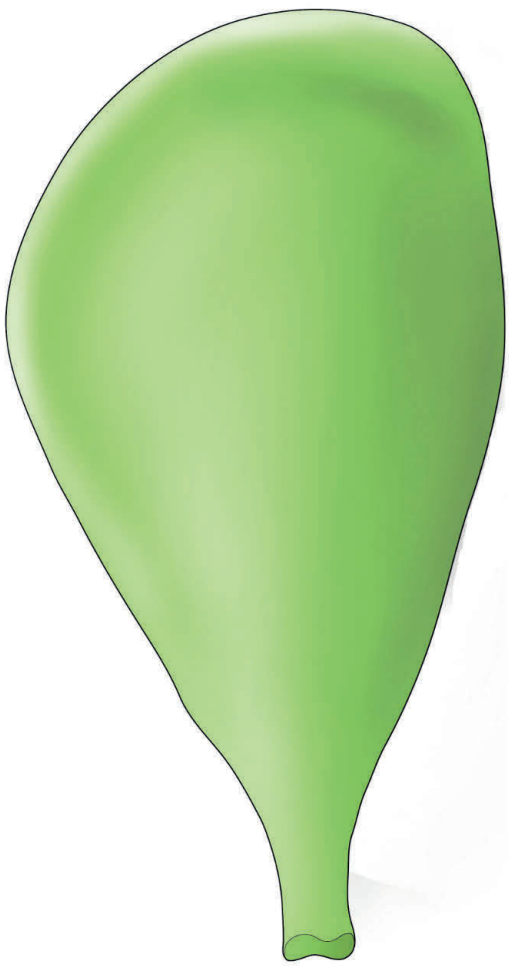
Attachment of the epiglottis from the side. Note that half of the thyroid cartilage has been removed to show the thyroepiglottic ligament

Function of the larynx

Although we now think of the larynx primarily as the organ of voice production, its original function was simply to prevent choking by closing off the trachea during swallowing. This closure was achieved through the action of two muscular flaps within the larynx, known as the **vocal folds.**

During evolution, the **epiglottis** developed to take over this function leaving the vocal folds free for phonation (speaking and singing).

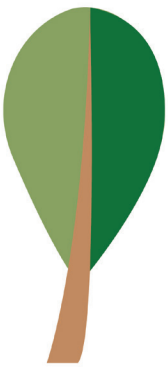
Let us now review the individual components.



The epiglottis

The Epiglottis

Description



The epiglottis is a leaf-shaped structure that lies behind the tongue. The pointed end of the 'leaf' is attached to the front inner surface of the thyroid cartilage by the thyroepiglottic ligament.

Although flattened, the epiglottis has a slight curve to its surface.

Function

The epiglottis closes off the top of the larynx to prevent food, drink or foreign bodies getting into the airway.

During swallowing the larynx is pulled upwards by the extrinsic muscles (see Section II). At the same time as the larynx is being pulled upwards, the tongue moves backwards, pushing the epiglottis down to close off the upper opening of the larynx.

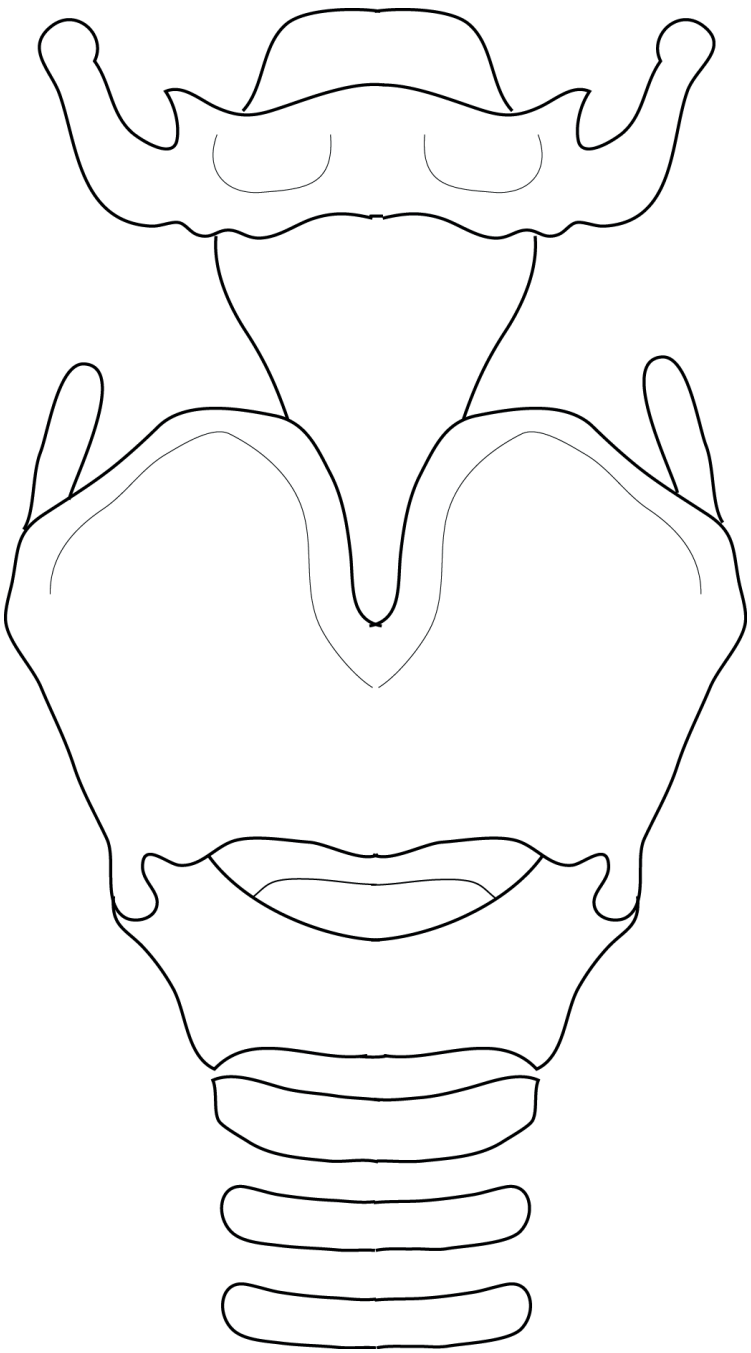
Larynx wordsearch

E H C T L G B L X D M Q E S H E B Z K G I Q J T
D E X Q I L E L B V O C A L P R O C E S S K T M
X F S B I O A R I E P I G L O T T I C V C Q H N
Z Q S G Y G F G D O F V T I O P O K U T E Q Y Y
C S X U A T S K S I H P Y U P M R U M B K G R U
R Z R P E H F A D A M S A P P L E L U H B A O P
W E C R I C O I D T U K H I S Y S Z C J U N I Y
Q Z C R Q G A G W Z X X C V W M Z F O J M O D M
L Q N N Q T T G A R Y T E N O I D P S E Z W Z O
J T Z R H Y E A E T I D D W K S R L A U T J M E
U I G B U Z F J P R F L T P O E Y P Y F Z M H F
D F U X H E C S N A F L W X P I E Z Z V T A G J
Z I O Y V D Z K O C M E N C A R T I L A G E N E
O W A Z T G X M T H E D M W T U F I B T K W E N
N D V Q Z K V Y C E V U A L C L I O S O U T G C
U F Z Z G T G S H A D S F L G L H F A Y W N C M
W I M Z O L N L P Z O O P I T C H A P D E U O G
Y E U R M E W C Y N M E M B R A N E I J C X S E
M Q S N G L A R Y N X W W H P Z I T C F C R S M
O K C F I S R F K N G R C Z D P W A A K E G T E
Q Q W T C Y D I E T X X D P Q O I Y L Y V I G P
K P L W H J T S Z V S H Y O I D N F J H X J E O
N W K A T X M Z O M E Q L R Z L I Z Z F W E R G
B M H O N T F N D M W Q C R T T M T Y O X P H F

Larynx	Trachea	Aryepiglottic
Mucosa	Notch	Apical
Adam's apple	Cricoid	Cartilage
Thyroid	Pitch	Vocal process
Hyoid	Membrane	Arytenoid

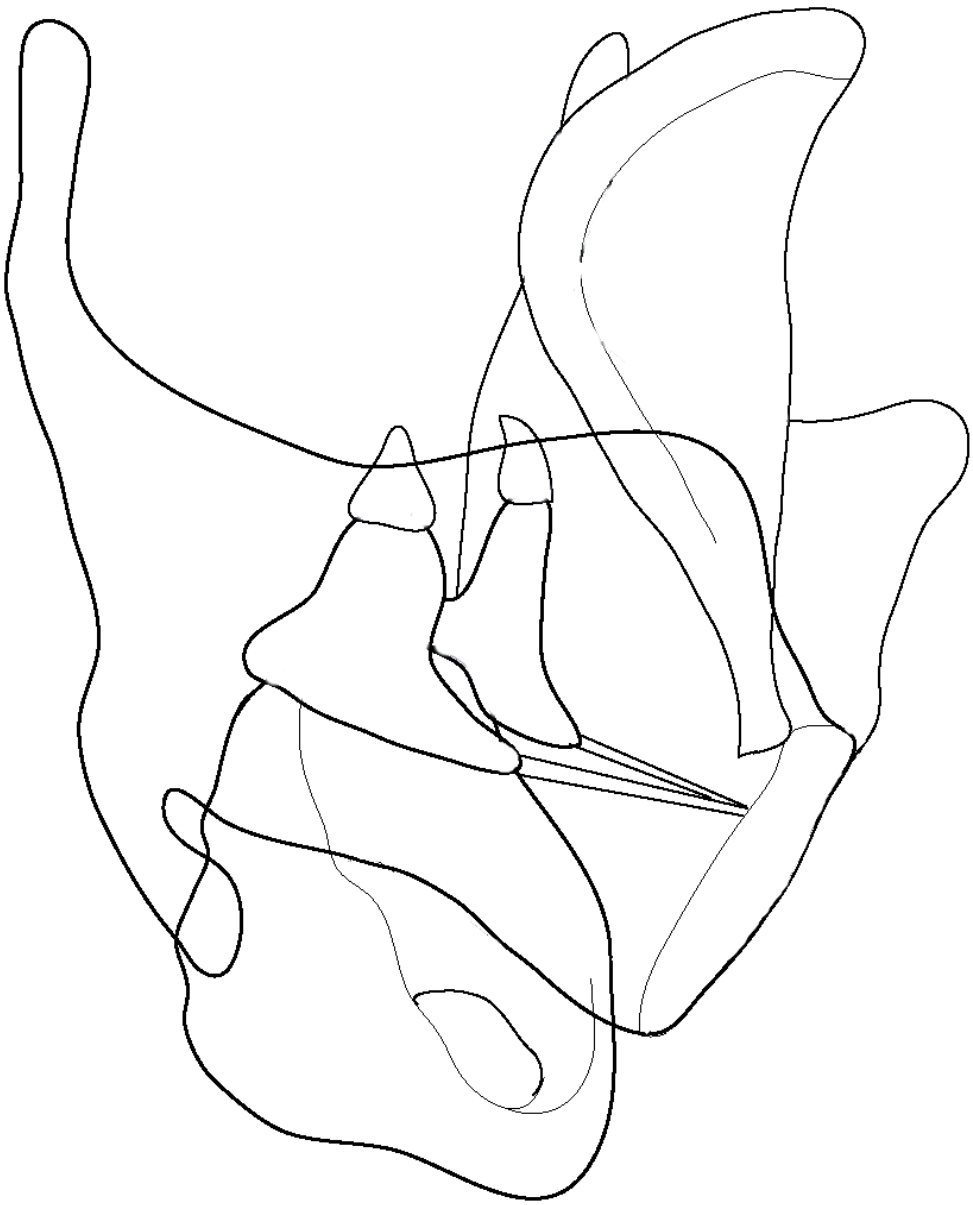
Colouring anatomy of the larynx 1

Colour and label the separate parts of the diagram



Colouring anatomy of the larynx 3

Colour and label the separate parts of the diagram



Questionnaire section III

1. Where are the vocal folds situated?
2. Which structures are they attached to?
3. What covers the surface of the true and false vocal folds?
4. What forms the central core of the vocal folds?
5. How are the edges of the vocal folds protected?
6. What is the name of the space that lies beneath the epithelium. covering the vocal folds?
7. What is the vocal ligament?
8. Where do the vocal ligaments lie?
9. What is the driving force for vocalisation?
10. What causes the Bernoulli Effect?
11. Why is 'the mucosal wave important?'
12. What lies between the true and the false vocal folds?
13. What is the role of the mucosal epithelium?
14. List the stages of vocal fold movement.

About the Authors

Nicola Harrison, mezzo-soprano, is a passionate teacher of singing with a strong interest in all aspects of singing and performance from anatomy to artistry, and all that lies between. Her unique portfolio of skills in vocal, literary, medical, musical and pedagogical disciplines informs this book in many ways and her joint expertise as both a creative and an academic writer come together in this book, co-authored with Dr Alan Watson, and her third book written specifically for singers. With specialisms in anatomy, ENT and voice clinic following a degree in nursing, a second degree in English from University of Oxford and subsequent career as singer, performer and vocal pedagogue, her research into the vocal instrument, focusing on clarifying the language we use to teach singing and the use of imagery in accessing the muscles of vocal support has been presented nationally and internationally and is the subject of a future book on the singer's imagination. This research has included several years of collaborative work with Alan Watson as well as other projects involving three major universities, and a wide number of vocal experts and singers from several music colleges and conservatoires.

Her specialism in poetry and music was fostered by a BA and MA in English Literature at Oxford University and has led to an extensive portfolio of original writing, with multiple shows of words, song and music arranged for small bands and ensembles, a touring company, and two published books of poetry. She is in demand as both a singer and performance poet, with a particular focus on the Spanish and English song repertoire.

She has written two books about poetry and music for singers – The Wordsmith's Guide: Poetry, Music and Imagination. For many years she wrote a personal column in The Singer and Classical Music Magazine about poetry and music and performance. As a former journalist she has also written for other music-related media such as British Music magazine, and a variety of newspapers, journals and radio on matters of words and music. She is currently Lecturer in Singing and Interpretation at Pembroke College Oxford, where she teaches singing with a strong focus on vocal anatomy and technique, and continues her writing and research. She has taught at other Oxford colleges and universities and teaches privately, runs vocal workshops and teaches academics in both speaking and singing. Previous students have won international prizes, scholarships and Olivier Awards. She was also involved in setting up the singing course at the Billy Elliot Academy in Leeds with Mary Hammond, where she also taught for several years. She holds certificates in Adult, Further and Higher Education and has a PGCE.

Nicola won a Major Award to Oxford University. She also won the prestigious Wolfson Prize from Westminster Hospital, and two further scholarships, one of them to study singing with Pamela Bowden with whom she studied classical singing. She continued her vocal studies with the acclaimed vocal pedagogue and mentor, Pam Cook, MBE (RNCM), and subsequently with the legendary Spanish mezzo-soprano Teresa Berganza in Madrid.

Alan Watson is a reader in anatomy and neuroscience at the School of Biosciences, Cardiff University and has a lifelong interest in music. He plays the flute and French horn and has an interest in musical instrument construction. He took a B.Sc. in Zoology at Edinburgh University followed by a Ph.D. in Neuroscience from St. Andrews University and postdoctoral research at Cambridge University. He teaches anatomy and neuroscience to medical and science students and carries out research in neuroscience and physiology on which he has published extensively. As recently as August 2019, he was awarded an Honorary Fellowship of the Royal Welsh College of Music and Drama (RWCMD) where he runs a module on the biological principles underlying musical performance and works with staff and students on projects dealing with performance physiology. He has collaborated over many years with Nicola Harrison on patterns of respiratory and abdominal muscle 'support' activity in singers. His other research involves brass players and deals with respiratory physiology, posture and embouchure function. This work has received public engagement funding from the Wellcome Trust. He is currently involved in a multi-conservatoire research project (Musical Impact) funded by the Arts and Humanities Research Council.

Alan lectures widely on the musicians' health and performance physiology at UK conservatoires and at science and arts festivals. This has included presentations on the science of singing and on breathing in singers for the BVA, AOTOS, the Three Choirs Festival, the Hay Festival and the Cheltenham Music Festival, and he has given lectures on singing-related anatomy and on breathing for courses for singers and voice therapists. He frequently lectures for clinicians at the British Association of Performing Arts Medicine and has had a long association with an M.Sc. degree course on Performing Arts Medicine at University

College London. His book on "The Biology of Musical Performance and Performance-related Injury" was published by Scarecrow press in 2009. He recently produced a chapter on Breathing in Singers for the Oxford Handbook on Singing (G. Welch, D.M. Howard. [eds.]) and has contributed to forthcoming editions of The Musician's Hand (I. Winspur [ed.] and the Cambridge Encyclopaedia of Brass (Herbert, T., Wallace, J., Myers, A. [eds.]) as well as publishing a number of papers on performance physiology. He is also interested in anatomical illustration and has provided his own figures for publications and books.