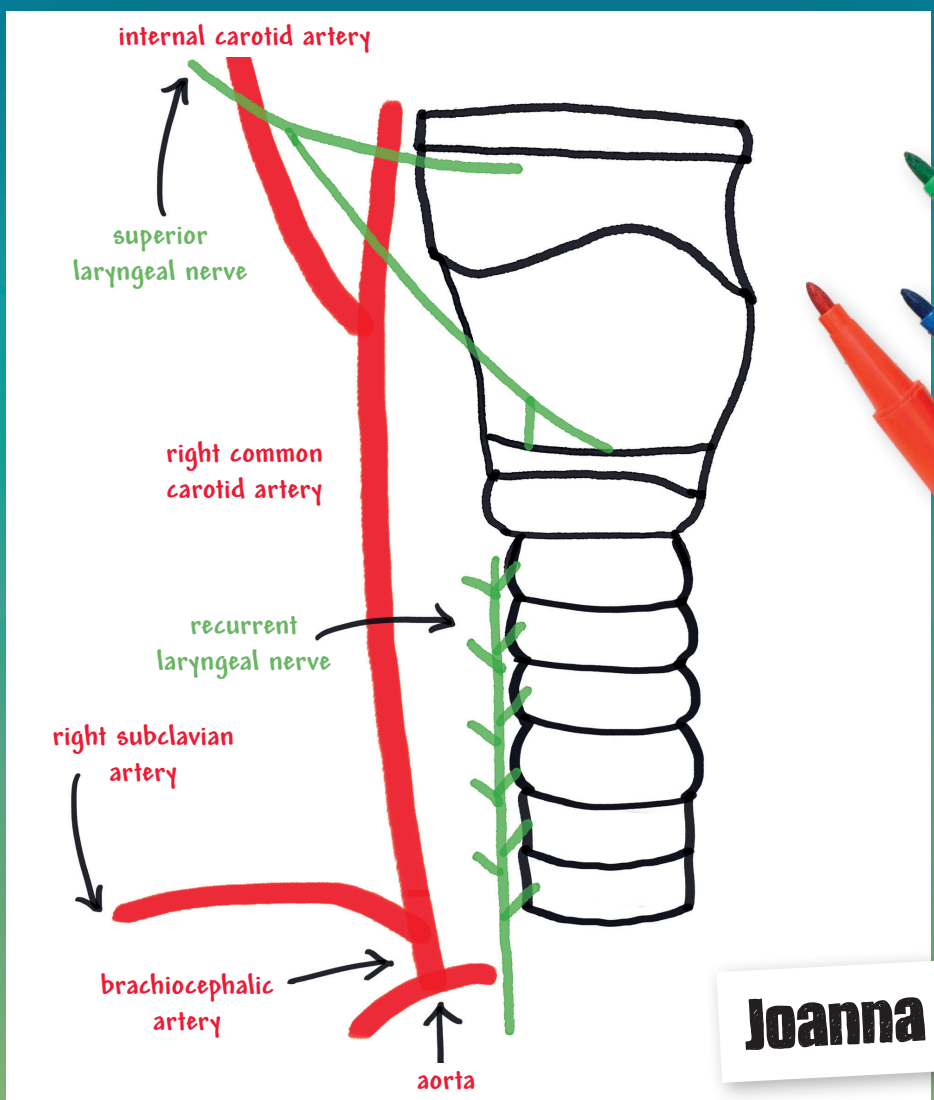
# QUICK DRAW ANATOMY

## for Medical Students




Joanna Oram Fox

Step-by-step instructions on how to draw, learn and interpret anatomy

# QUICK DRAW ANATOMY

## for Medical Students

**Feedback, errors and omissions**

We are always pleased to receive feedback (good and bad) about our books – if you would like to comment on any of our books, please email info@scionpublishing.com.

We've worked really hard with the author and reviewers to ensure that everything in the book is correct. However, errors and ambiguities can still slip through in books as complex as this. If you spot anything you think might be wrong, please email us and we will look into it straight away. If an error has occurred, we will correct it for future printings and post a note about it on our website (under the Resources tab for the book) so that other readers of the book are alerted to this.

Thank you for your help.

# QUICK DRAW ANATOMY

## for Medical Students

**Step-by-step instructions on how to draw, learn and interpret anatomy**


**Joanna Oram Fox**

MBBCh, FRCA, FAcadMEd
Consultant Anaesthetist, Regional Anaesthesia Lead
Cardiff



Scion

First published 2024



A CIP catalogue record for this book is available from the British Library.

ISBN 9781911510512

**Scion Publishing Limited**
The Old Hayloft, Vantage Business Park, Bloxham Road, Banbury OX16 9UX, UK

www.scionpublishing.com

**Important Note from the Publisher**

The information contained within this book was obtained by Scion Publishing Ltd from sources believed by us to be reliable. However, while every effort has been made to ensure its accuracy, no responsibility for loss or injury whatsoever occasioned to any person acting or refraining from action as a result of information contained herein can be accepted by the authors or publishers.

Readers are reminded that medicine is a constantly evolving science and while the authors and publishers have ensured that all dosages, applications and practices are based on current indications, there may be specific practices which differ between communities. You should always follow the guidelines laid down by the manufacturers of specific products and the relevant authorities in the country in which you are practising.

Although every effort has been made to ensure that all owners of copyright material have been acknowledged in this publication, we would be pleased to acknowledge in subsequent reprints or editions any omissions brought to our attention.

Registered names, trademarks, etc. used in this book, even when not marked as such, are not to be considered unprotected by law.

Cover and text design by AM Graphic Design Ltd, Oxford, UK
Illustrations by Hilary Strickland, Bath, UK
Typeset by Medlar Publishing Solutions Pvt Ltd, India
Printed in the UK

Last digit is the print number: 10 9 8 7 6 5 4 3 2 1

# Contents

# Detailed contents

# Dedication

For my wonderful grandparents, Flora and Edmund.

My grandparents met at the bus stop to their shared medical school in Glasgow. My Grannie was from Rothesay, a small island off the west coast of Scotland. It was very unusual for women to become doctors back then. She passed her medical degree and did her registration years before having three children. This is when her journey as a doctor ended. At that time it wasn't easy for women in medicine to have a family and continue to work. I believe my Grannie would have made an excellent doctor. She returned to work in the medical field as a phlebotomist when my mother and her siblings were older.

My grandparents and family are my biggest supporters, I think they were rather surprised when I wrote my first book, let alone the three I have now completed! Sadly, my Grandad didn't get to see this, and my Grannie passed away in January 2023 so didn't see the final copy of *Quick Draw Anatomy for Medical Students*. My other books took pride of place in their house. I know they would have been super proud at how much work I have put into this book to try and improve medical student learning of anatomy.

I would like to recognise all the women in medicine who couldn't or can't work due to circumstance, but who now, against the odds, can have both a family and a career. I wish you all the greatest success in both.

# Acknowledgements

This book would not have happened if it weren't for my 'study buddy' (for anaesthetic exams), Dr Kiran Singh Kandola. He helped me understand so many things, and developing early versions of some of these diagrams was part of our revision.

I would also like to thank my editor, Alison Whitehouse, for her meticulous work. She spent a lot of time looking at my drawings and words, making sure they were accurate and made sense.

The artist and team at Scion Publishing who turned my Sharpie pen drawings on graph paper into the electronic versions you now see in the book have done a brilliant job. I am so pleased with how they turned out. I appreciate your skill and also your patience working through my comments and altering the text and illustrations over and over to ensure they were right.

I am so grateful to those staff at Cardiff University Anatomy Department (Jittima Muensoongnoen, Shiby Stephens, Kirsty Richardson, Helen McCarthy, Isaac Myers and Hannah Shaw) who checked through the proofs, making sure that the book was consistent and accurate. It was a pleasure to work with you.

And lastly, I send my love and gratitude to my family and friends who have offered me unwavering support throughout my life. It is so lovely that you are all so proud of me. These books are something I would never have thought I could do, were it not for your encouragement. If my daughter Hope studies medicine/anatomy I look forward to her thoughts and comments!

# Preface

Anatomy was always a subject I found difficult. I've always been someone who does better with remembering things through understanding. When studying for my first anaesthetic exams I followed the norm and left anatomy as one of the last things to learn. I crammed just before and forgot most of what I had learnt fairly quickly afterwards.

For my final FRCA I developed some line diagrams, like Tube maps, so that I could easily apply them to actual anatomical specimens or images. I found this helped me to remember. The diagrams were all different shapes as an additional memory aid; for example, the popliteal fossa was 'the diamond'. Although the diagrams took time for me to develop, I found them really helpful for learning anatomy properly. During my training I developed the diagrams I had and published them all in my first book, *Quick Draw Anatomy for Anaesthetists* (winning first prize in the BMA Book Awards for Anaesthesia along the way). Ironically, I now teach anatomy more than any other subject in anaesthetics.

I knew these anatomy diagrams would have helped me at medical school. I also knew that it would be a lot of work to develop diagrams for all the areas of anatomy not covered in the anaesthetic syllabus, but well worthwhile. The writing of *Quick Draw Anatomy for Medical Students* has been a long, hard job. The first draft was completed in 2018 during a post-fellowship CCT in Australia. I have since revised the material at least five times, working with the editor, publisher, artist and also Cardiff University Anatomy Department staff. I apologise for any errors that remain, but we have all worked extremely hard to minimise these.

I hope this book can help medical and non-medical professionals who want to improve their anatomical knowledge. Good luck with your studying.

*Joanna Oram Fox*

# How to use the book

For the anatomical sections that have step-by-step drawings, the idea is to learn how to draw each diagram quickly and efficiently.

At each stage the diagram follows conventional labelling:

- Green for nerves
- Blue for veins
- Red for arteries
- Black for structures

For subsequent steps the colours are shown as tints to allow you to easily see the new lines drawn in the next step.

Once you can draw diagrams without thinking (e.g. using the shape memos like 'diamond' for the popliteal fossa), then you should learn to label them.

Finally, you should learn to explain what you are drawing. For example, the brachial plexus can be drawn in less than 15 seconds. Then you explain it whilst drawing, which should take around a minute. This will give an excellent impression in viva or OSCE examinations.

Happy drawing!

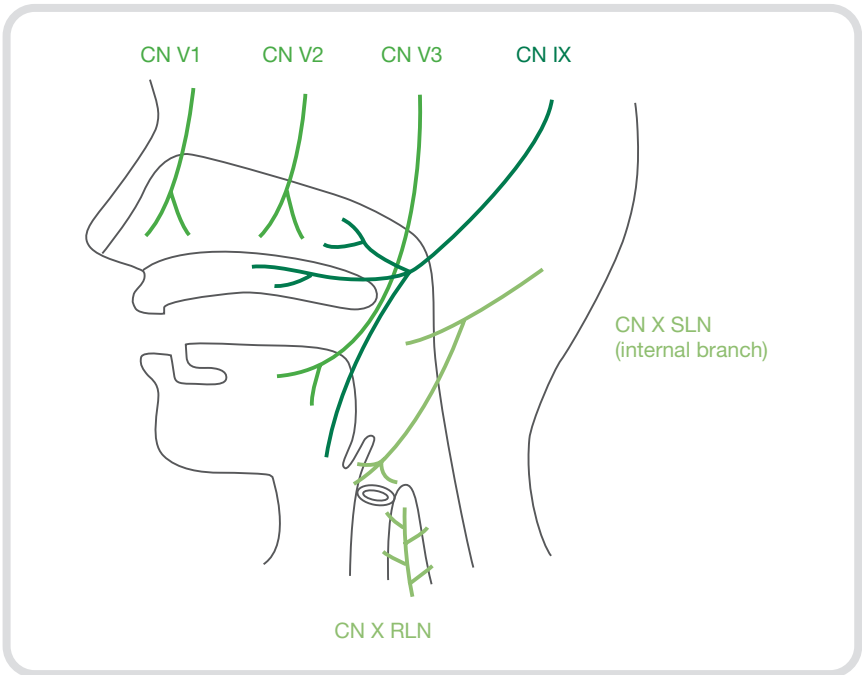
# Chapter 4

# Airway and respiratory system

04

# 4.1 Airway sensation

**CN V** trigeminal nerve
**CN V1** – anterior ethmoidal nerve
**CN V2** – sphenopalatine nerve
**CN V3** – lingual nerve
**CN IX** glossopharyngeal nerve
**CN X** vagus nerve
**CN X RLN** – recurrent laryngeal nerve
**CN X SLN** – superior laryngeal nerve




Airway sensation is from the trigeminal (CN V), glossopharyngeal (CN IX) and vagus (CN X) nerves.

## TRIGEMINAL NERVE, CN V

- V1 branch: the anterior ethmoidal nerve; innervates the septum and nasal cavity.
- V2 branch: the sphenopalatine, greater and lesser palatine nerves. The greater palatine nerve supplies general sensation to the gingiva (gums) and the mucous membrane of the hard palate. The lesser palatine nerve innervates the nasal cavity, the soft palate, the tonsils and the uvula.
- V3 branch: the lingual nerve; general sensation of the anterior 2/3 of the tongue (special taste sensation is supplied by CN VII).

## GLOSSOPHARYNGEAL NERVE, CN IX

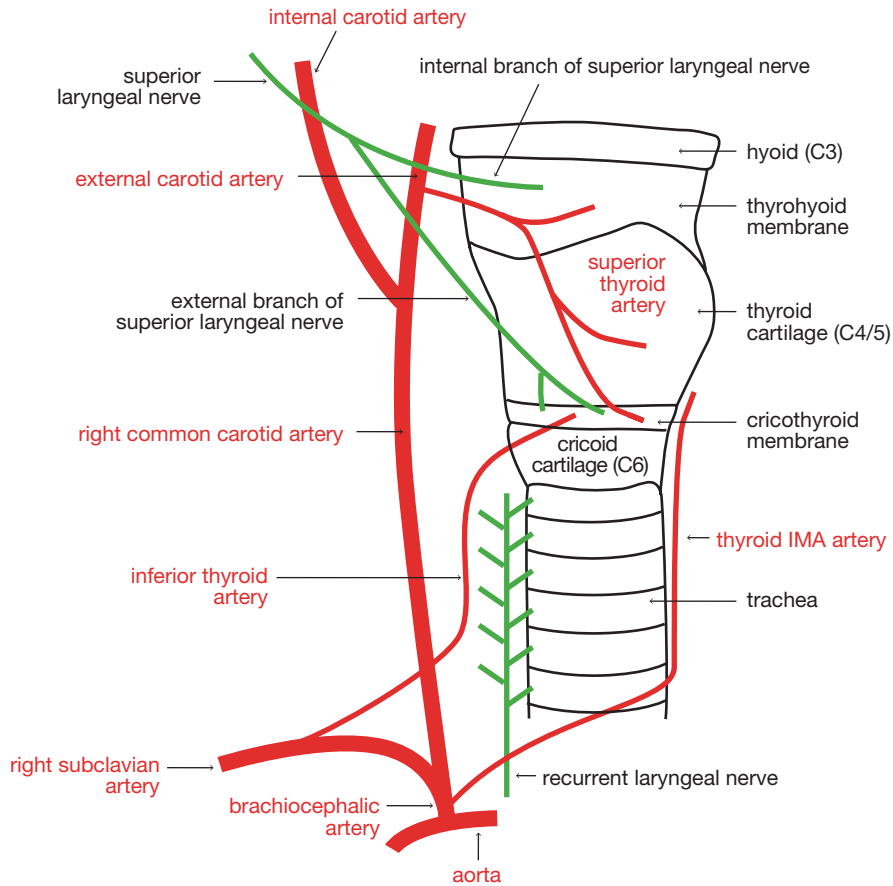
- General sensory innervation to oropharynx and posterior 1/3 of the tongue. Special sensation to posterior 1/3 of the tongue.

## VAGUS NERVE, CN X

- Superior laryngeal nerve: sensory innervation to the lower pharynx, epiglottis, vallecula and piriform fossa.
- Recurrent laryngeal nerve: sensation to vocal cord and subglottic mucosa.

# 4.2 Larynx

## 4.2.1 Anatomy of the larynx

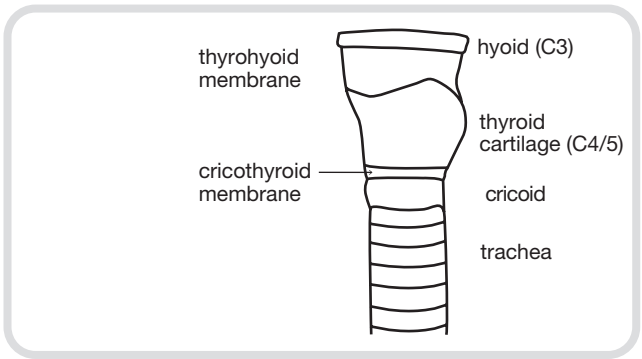


## How to draw

**STEP 1**

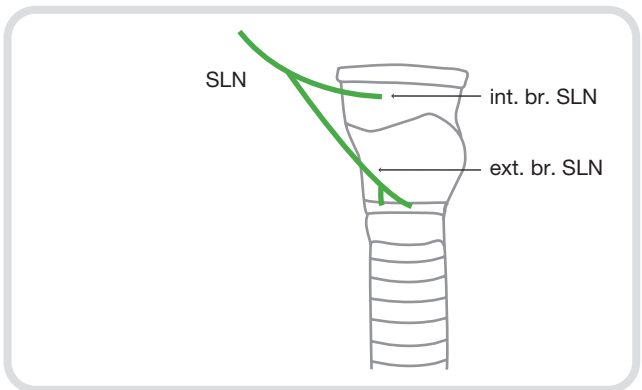
Draw the main structures in black pen.

- Start with the trachea, a rectangle shape with lines to represent the cartilage rings (c-shaped).
- Then add in the cricoid cartilage by drawing a trapezium above the trachea (see image). The cricoid cartilage is actually slightly larger at the back than the front, in the shape of a signet ring.
- Next draw an irregular polygon to represent the thyrohyoid membrane, thyroid cartilage and cricothyroid membrane.
- Draw 2 lines inside this to separate the 3 structures.
- Draw the hyoid bone as a rounded rectangle above the thyrohyoid membrane.



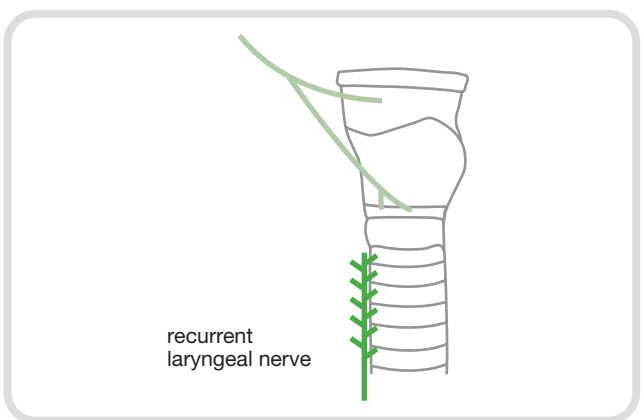

**STEP 2**

- Draw the superior laryngeal nerve (SLN), a branch of the vagus nerve (CN X). The SLN branches from the vagus nerve at approximately C2. It then divides into the internal branch and external branch at the level of hyoid (C3).
- The internal branch pierces the thyrohyoid membrane with the superior laryngeal artery. It supplies sensation to the mucosa above the vocal cords.
- The external branch supplies the cricothyroid muscle (see where it ends on the diagram).



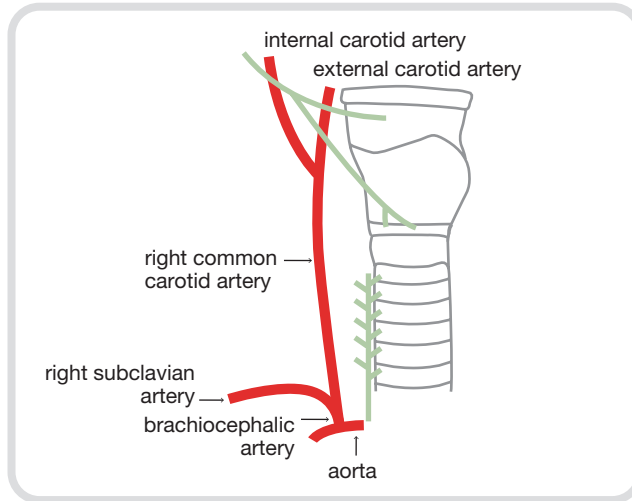

**STEP 3**

- Draw in the recurrent laryngeal nerve, a branch of the vagus nerve. It runs in the groove between the oesophagus and the trachea and supplies sensation to the mucosa of the larynx below the vocal cords. It also innervates the remainder of the intrinsic muscles of the pharynx.



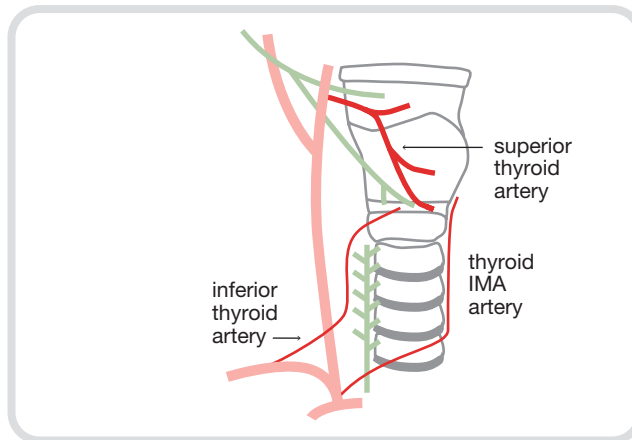
**STEP 4**

- Draw in the arch of the aorta inferiorly. The brachiocephalic artery arises here and then divides into the right subclavian artery and the right common carotid artery.
- The common carotid artery ascends and divides into the internal and external carotid arteries at the level of the thyroid cartilage (approximately C4).
- The left carotid and left subclavian arteries arise directly from the aortic arch (not shown here).



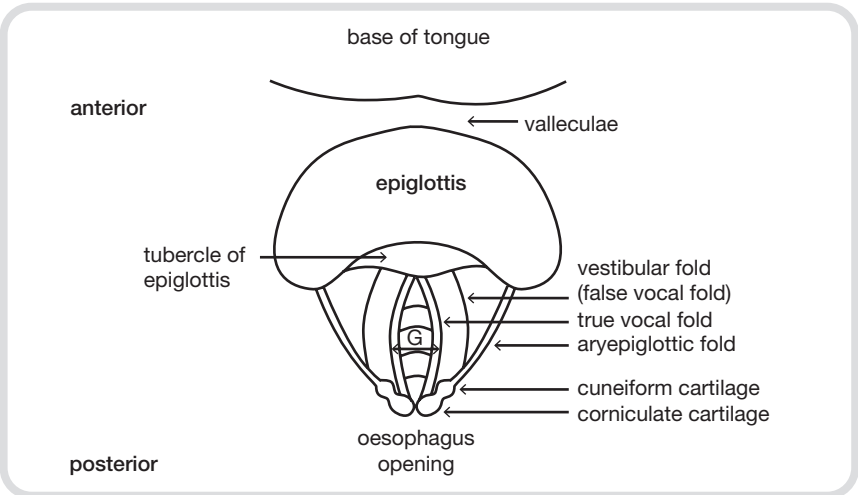

**STEP 5**

- Draw in the inferior thyroid artery, a branch of the thyrocervical trunk which arises in the subclavian.
- Draw in the superior thyroid artery, a branch of the external carotid artery (at approximately C3). Finally draw in the thyroid IMA artery, a variable branch of the brachiocephalic artery. This artery is only present in 3–10% of the population. It can be the reason for bleeding during a tracheostomy.

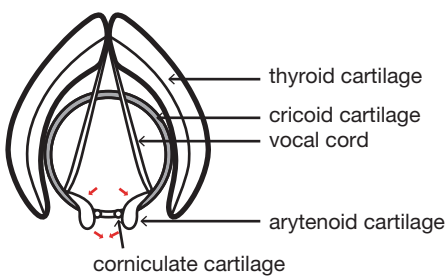


# 4.2.2 Laryngoscopy

**G** glottis




Looking through the mouth at the larynx with a laryngoscope is an essential skill. The first image shows exactly what you will see, the tongue base superiorly and the corniculate cartilage (in front of the oesophagus) posteriorly.



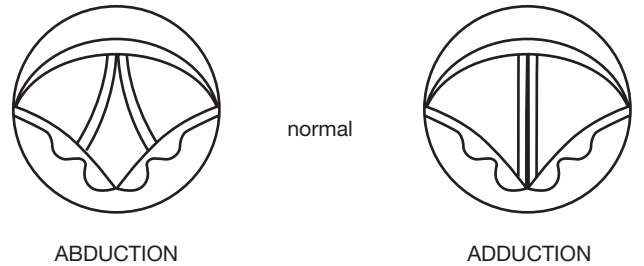

The second image shows what the view would look like with no soft tissue and shows how the cartilage is moved to open and close the vocal cords.

## NERVE SUPPLY TO THE LARYNX

The nervous supply to the larynx is by the internal branch of the superior laryngeal nerve above the vocal folds and the recurrent (inferior) laryngeal nerve below the folds. Both are branches of the vagus nerve (CN X).

The external branch of the superior laryngeal nerve only supplies the cricothyroid muscle and the recurrent laryngeal nerve supplies all other intrinsic muscles of the larynx. Damage to the recurrent laryngeal nerve can lead to vocal fold palsy (see next page for more detail).

The vocal cords are used to generate sound by vibration of air passing between the adducted cords. Abducted cords are for breathing/breathy sounds and whispering. The vocal cords oscillate due to increased pressure beneath the vocal folds. The lower part of the vocal cords move before the upper part and this creates a wave-like motion. The pitch of a person's voice depends on length, size and tension of their vocal cords.




## SUPERIOR LARYNGEAL NERVE DAMAGE

- The external branch of the superior laryngeal nerve may be damaged during thyroid surgery.
- It supplies cricothyroid muscle.
- Damage leads to a loss of vocal cord tension and hence a hoarse voice.
- If unilateral the other side often compensates.

## RECURRENT LARYNGEAL NERVE DAMAGE

This causes vocal fold palsy / paresis which results in a hoarse voice, and this can cause bilateral and unilateral paralysis as shown in the following images.

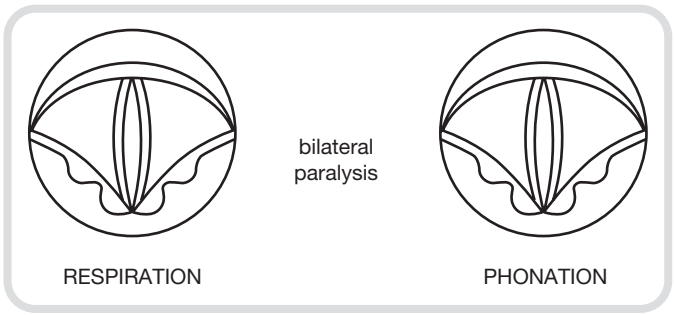
## Bilateral damage

Complete transection of the recurrent laryngeal nerve causes complete paralysis of most muscles except cricothyroid (innervated by the external branch of the superior laryngeal nerve). This leads to a half abducted, half adducted position—the cadaveric position.

**Symptoms:** patient cannot speak or cough.

Trauma/partial transection leads to partial paralysis. This leaves the cords in an adducted position.

**Symptoms:** respiratory distress, stridor, life threatening.

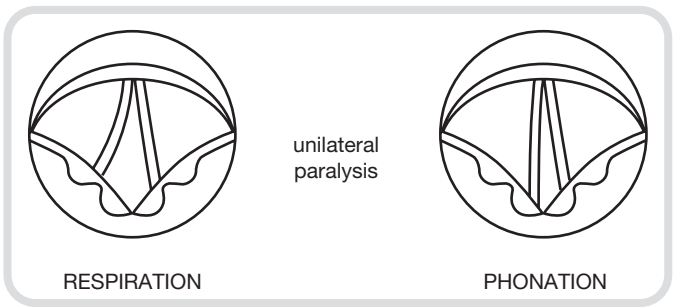



## Unilateral damage

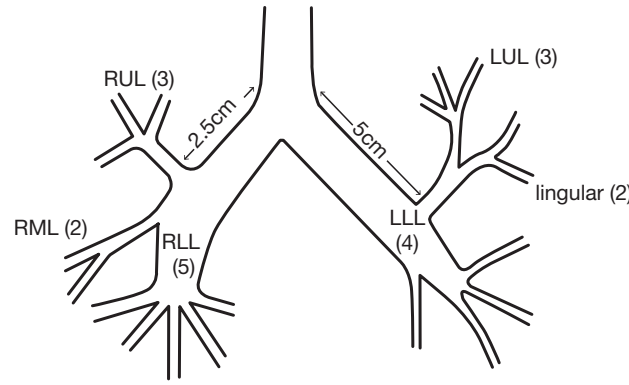
Image shows right-sided recurrent laryngeal nerve palsy; note that the left cord moves in the image and the right cord stays still.

If one cord is damaged then the other cord will partially compensate. The damaged cord will sit in an adducted position and the cricothyroid muscle should still work (due to innervation by the superior laryngeal nerve).

**Symptoms:** breathy voice, weak cough, sensation of shortness of breath and sometimes swallowing difficulties.



# 4.3 Bronchial tree




LLL - left lower lobe
LUL - left upper lobe
RLL - right lower lobe
RML - right middle lobe
RUL - right upper lobe

**19 Segments**

| | | | |
|---|---|---|---|
| - Right | - upper | - 3 | |
| | - middle | - 2 | |
| | - lower | - 5 | |
| | | **10** | |
| - Left | - upper | - 3 | |
| | - lingular | - 2 | |
| | - lower | - 4 | |
| | | **9** | |

Knowing the number of segments and their names is useful. I remember it as '325, 324'. This adds up to 19 segments in total, 10 on the right and 9 on the left.

The right main bronchus is approximately 2.5 cm long and straight, about 25° off the midline.

The left main bronchus is approximately 5 cm long and lies more horizontally over the heart, about 45° off the midline.

## RIGHT SIDE

- 3: APA – Apical, Posterior, Anterior
- 2: LM: Lateral, Medial
- 5: APALM: Apical, Posterior, Anterior, Lateral, Medial

## LEFT SIDE

- 3: APA – Apical, Posterior, Anterior
- 2: IS – Inferior, Superior
- 4: APAL – Apical, Posterior, Anterior, Lateral (there is no medial one – this can be remembered by thinking that the heart lies where it would have been!)

# 4.4 Lungs and lung pleurae

## 4.4.1 Pleurae

The pleurae comprise two distinct layers: visceral and parietal. These are continuous with each other around the root of the lung, forming a loose cuff called the pulmonary ligament.

The space between the layers is the pleural space and contains approximately 10 ml of pleural fluid.

### VISCERAL PLEURA

Sensitive to stretch only; supplied by autonomic nervous system. Covers the lung.

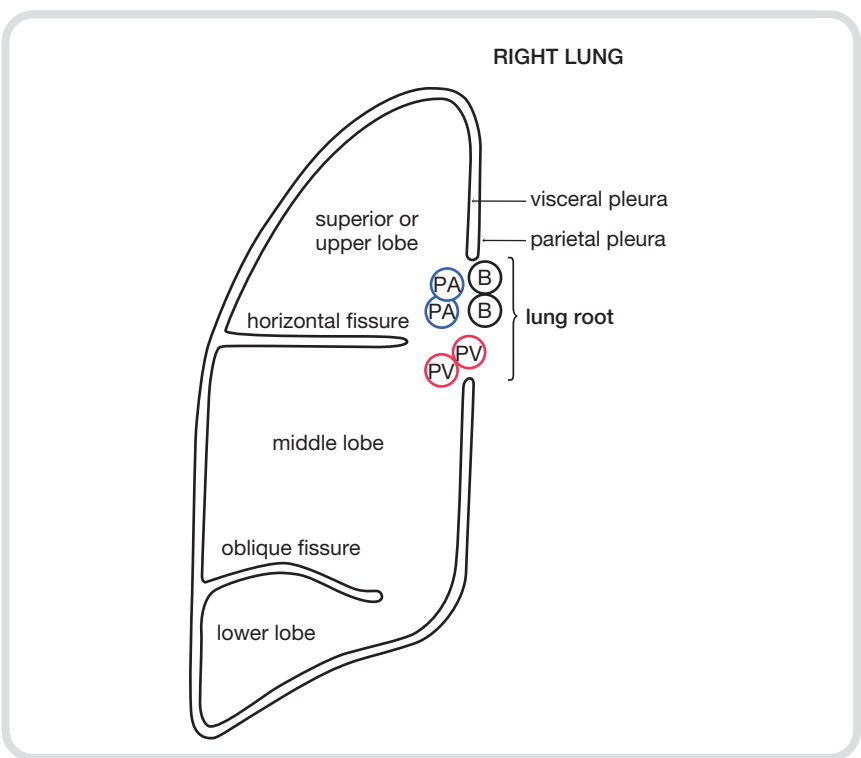
### PARIETAL PLEURA

Sensitive to pain, pressure, temperature and touch.

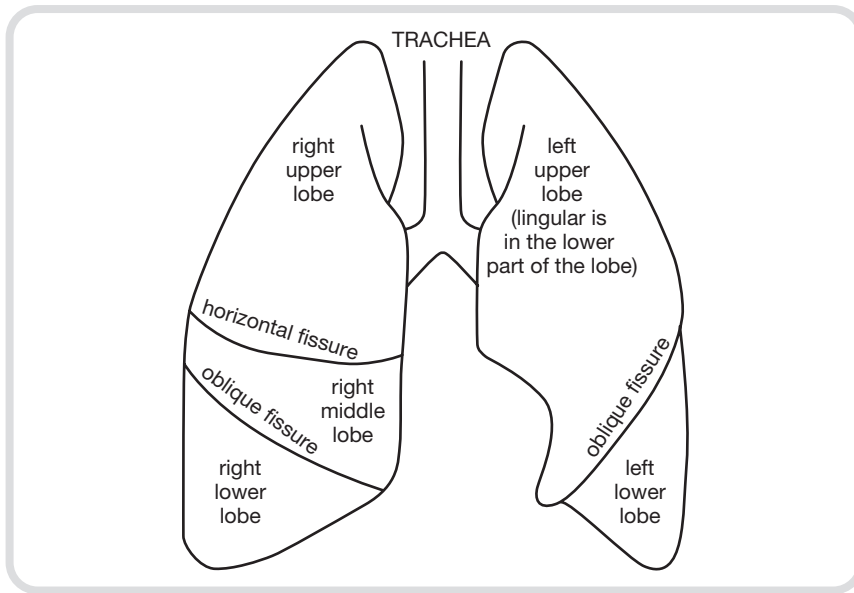
4 areas:

1. **Cervical**: projects into neck about an inch above medial 1/3 of clavicle.
2. **Costal**: lines back of sternum, ribs, costal cartilages, intercostal spaces and sides of vertebral bodies. Innervated by intercostal nerves.
3. **Mediastinal**: covers mediastinum. Reflects onto bronchi and vessels entering lungs. Continuous with visceral pleura. Innervate by phrenic nerve.
4. **Diaphragmatic**: covers diaphragm. Innervated by phrenic nerve over dome and intercostal nerves around edge.

**B** bronchus
**PA** pulmonary artery
**PV** pulmonary vein



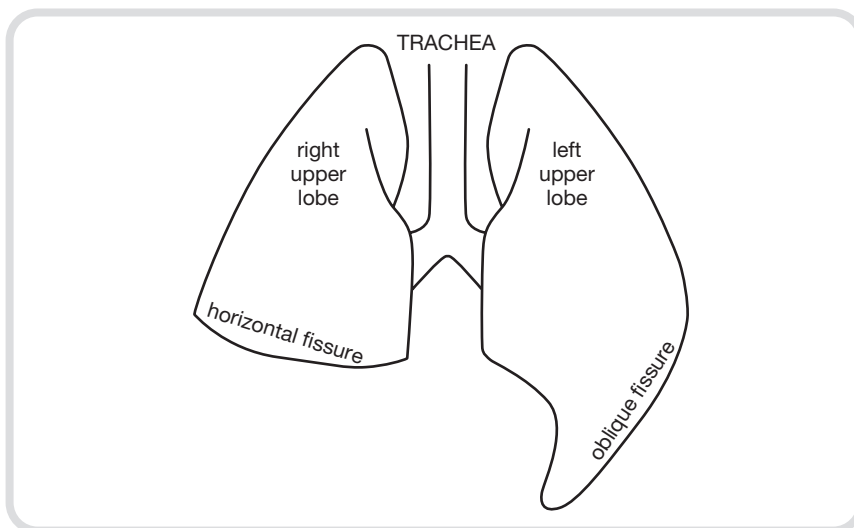
# 4.4.2 Lungs




## How to draw

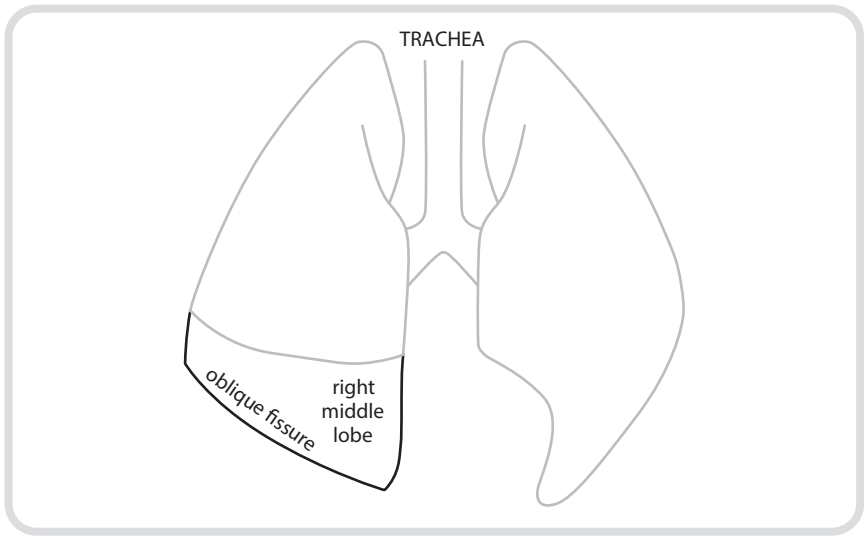
**STEP 1**

- Draw the left and right upper lobes and the trachea. In the left lobe, use a concave shape for the lower part of the medial border, where the heart sits; this is the cardiac impression.
- The inferior border on the right side is the horizontal fissure and the inferior border on the left side is the oblique fissure.



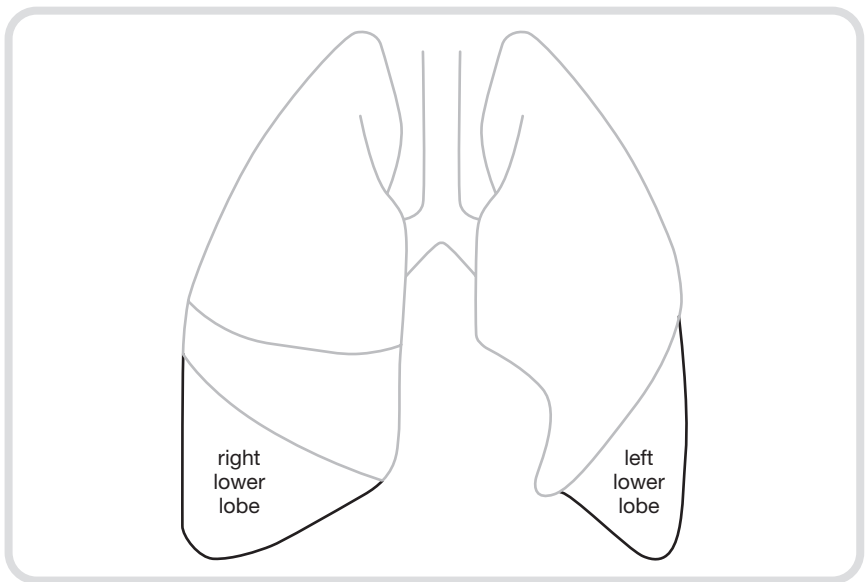
**STEP 2**

- Draw the middle lobe on the right only. Its inferior border is the oblique fissure.
- The left does not have a middle lobe.



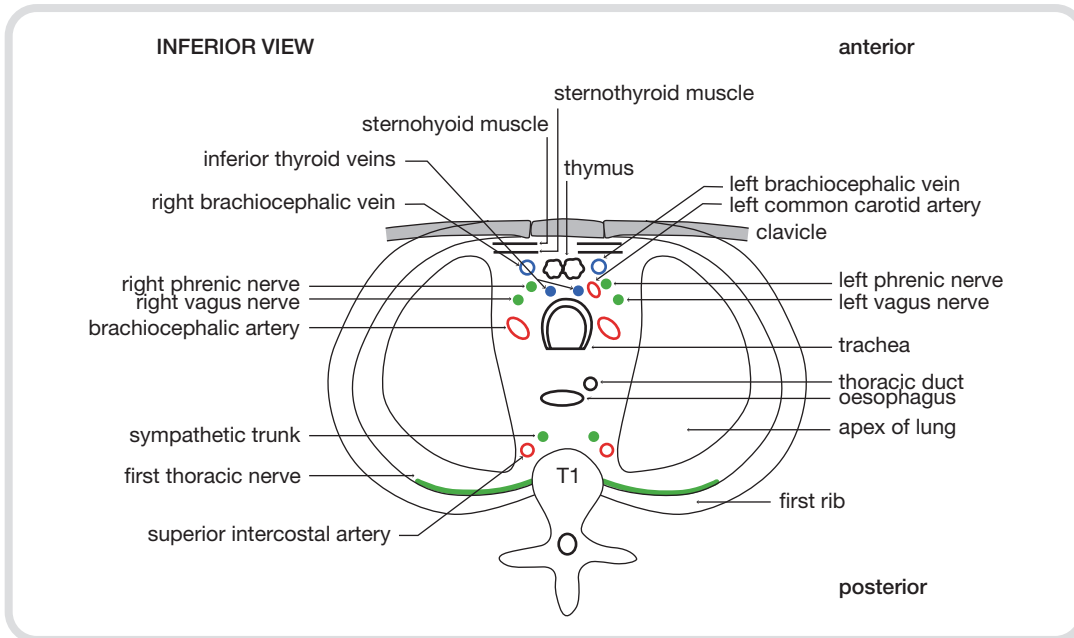

**STEP 3**

Draw the left and right lower lobes.



# 4.5 Thoracic inlet

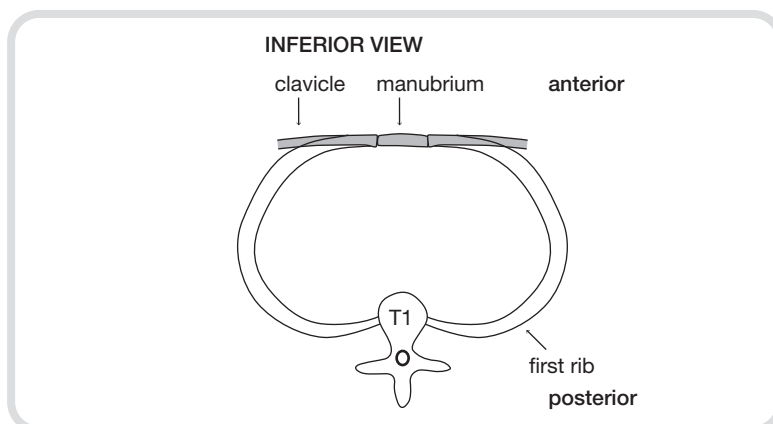
The thoracic inlet is at the level of the 1st rib. It is a complicated area and drawing it will help you visualise and remember it.




## How to draw

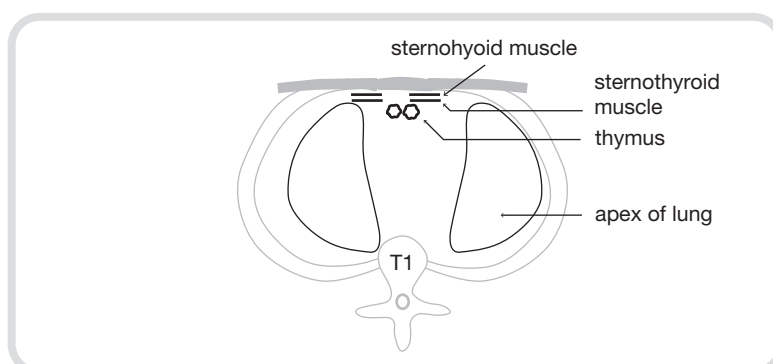
**STEP 1**

- Draw an oval shape with T1 in the centre at the back.
- Draw a second oval inside this; the outer area is the first rib.
- Draw a straight line at the front that represents the manubrium and the clavicle.



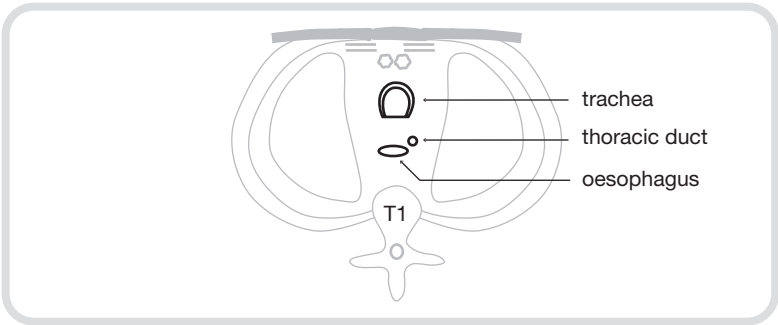

**STEP 2**

Draw an enclosed semicircle on each side to represent the apex of each lung. Draw 2 sets of small parallel lines at the front just behind the manubrium. These are the sternohyoid and sternothyroid muscles. Just behind these draw two little fluffy cloud shapes to represent the thymus.



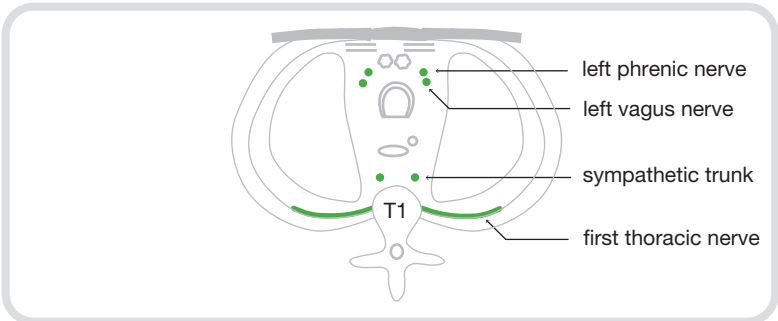
**STEP 3**

Add in a trachea behind the thymus and then draw the oesophagus and thoracic duct behind the trachea.



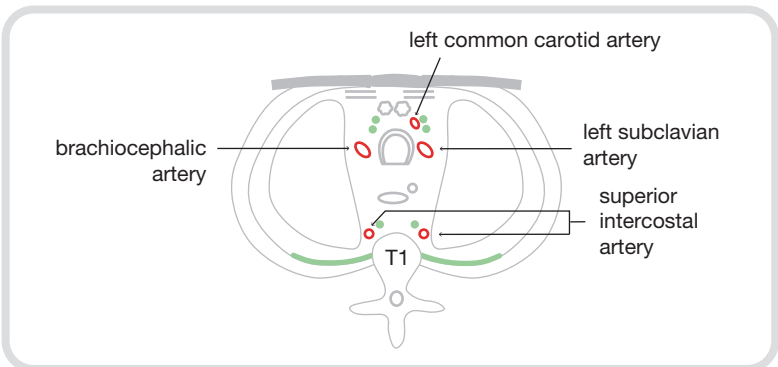

**STEP 4**

- Draw 2 green lines from T1 to just in front of the posterior first rib; these represent the first thoracic nerves.
- Draw 2 green dots anterior to T1 body; these are the sympathetic trunks.
- Draw 2 green dots just in front of and lateral to the trachea; these are the right and left vagus nerves.
- Draw 2 green dots just in front of the vagus nerves; these are the phrenic nerves.




**STEP 5**

- Draw 2 red circles just lateral and behind the sympathetic trunks; these are the superior intercostal arteries.
- Draw 2 red ovals lateral to the trachea; these represent the brachiocephalic artery and the left subclavian artery.
- Draw a red circle just anterior to the left subclavian artery and medial to the phrenic and vagus nerves; this is the left common carotid artery.




**STEP 6**

- Draw 2 blue dots just in front of the trachea; these are the inferior thyroid veins.
- Draw 2 blue circles anterior to these and lateral to the thymus; these are the brachiocephalic veins.