BSMS MODULE: 102, FOUNDATIONS OF HEALTH AND DISEASE

DR SESSION:

1. EXAMINATION OF THE THORACIC WALL AND PECTORAL MUSCLES

BSMS MODULE: **102, FOUNDATIONS OF HEALTH AND DISEASE**

THEME: **THE HUMAN BODY**

DR SESSION: **1. EXAMINATION OF THE THORACIC WALL AND PECTORAL MUSCLES**

Welcome to Anatomy Laboratory

The anatomy team is excited to welcome you to the anatomy laboratory and to your first dissection session as part of the human body theme of module 102. Each dissection session in this and all modules in Phase 1 has a number of component parts and objectives to be achieved:

1. Introductory demonstration from the faculty lead
2. Dissection and investigation of the cadaver
3. Answering of the handout questions
4. Exploration of the models, prosected specimens and other demonstration materials
5. Completion of the checklist with anatomy staff

LEARNING OUTCOMES

By the end of the practical session students should be able to:

1. Identify and demonstrate the named landmarks of the chest wall on a skeleton and cadaver
2. Describe the concept of investing fascia
3. Identify pectoralis major, its parameters and indicate its function
4. Identify pectoralis minor, its parameters and indicate its function

Time to designate your team leader

Before you start you must designate a team leader from your group for this particular anatomy session. The team leader will leader will act as the guide using this handout and will ensure each member of the group is able to participate in all aspects of the session including dissecting. There will be a new team leader for each dissection session.

Task 1.

Your first task is to uncover your cadaver using the techniques demonstrated to you by the Head of Anatomy. To aid you in the dissection process, the skin overlying the pectoral region has already been cut. These incisions reveal the underlying muscles and tissues which you are going to examine today. Each member of the group should take a few moments to examine the skin and underlying muscles and to feel the consistency of each tissue.

Question 1.

What does the structure of the skin layer feel like? Is it the same on a neighbouring cadaver?

Task 2.

The second task is to work with a demonstrator to inspect one of the laboratory skeletons and within your team to identify as many of the boney structures making up the thoracic cage including the:

- **clavicles**
- **ribs**
- **sternum**
- **costal cartilages**
- **scapula**
- **thoracic vertebrae**

To aid you in the dissection, it is important for you to also identify a number of landmark features:

- **jugular notch**
- **acromium process**
- **xiphoid process**
- **coracoid process**
- **lower costal margin**

Question 2.
The acromium process is part of which bone?

Task 3.

In this practical session you will study the anatomy of the ***thoracic wall*** and the ***pectoral muscles***. For this session you will be performing much of the dissection and will work on the cadaver that has been assigned to your group. So let's turn our attention back to the cadaver. The skin incisions that have been made are:

1. a midline incision extending from the jugular notch to the xiphoid process
2. a perpendicular incision from the xiphoid process towards the lateral wall of the thoracic cage.
3. an incision along the clavicle from the jugular notch to the acromion

Once you have identified on the skeleton the anatomical landmarks listed above, find the same on your cadaver. Once you have done this you can now begin the examination of the muscles on the cadaver. As there are two identical sides to the thorax, you can work in two groups around the cadaver to identify the structures.

You need to reflect the incised skin laterally to reveal the underlying muscles. The demonstrators will show each group how to load a scalpel handle with its blade safely. It is very important that you follow this technique to avoid injury to you and others. Each member of the group should take turns in carefully cutting away a small piece of fat from the skin with the scalpel in order to see what technique is necessary. Your demonstrator will help guide you.

Question 3.
Of which bone is the xiphoid process part of?

Task 4.

All muscles of the body are invested and surrounded by connective tissue – this connective tissue is called the ***investing fascia***. Some of the cadavers have the investing fascia removed from the underlying muscle whereas in others the investing fascia has been retained or is naturally extensive. By examining a neighbouring body ensure that you have seen the investing fascia if it has been removed from the cadaver on which you are working. If the cadaver you are working on has the investing fascia intact, carefully remove the fascia from the muscles of the chest wall. Your demonstrator will help you with this task and you should take turns in completing this.

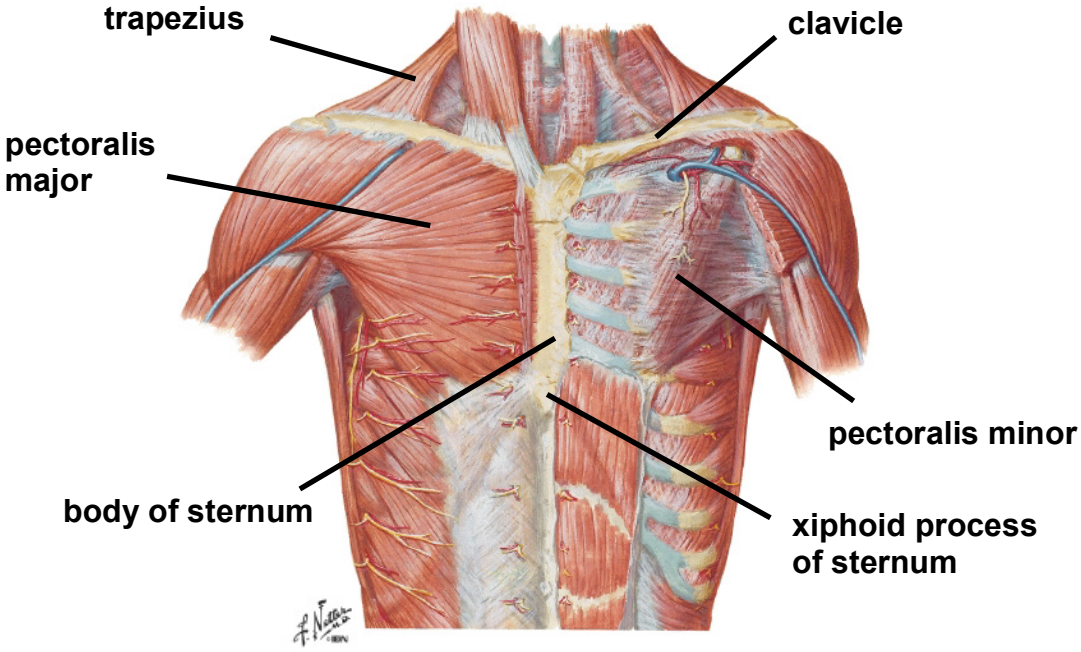
The exposed muscle is ***pectoralis major***. This large 'convergent' muscle covers much of the anterior aspect of the chest wall and has two 'heads' – the ***clavicular head*** which originates from the clavicle and the ***sternocostal head*** which originates from the ***sternum*** and the ***costal cartilages***.

Question 4.

Trace the pectoralis major muscle to its point of insertion. Where does this muscle insert?

Task 5.

An annotated illustration has been provided in this handout to give you some guidance in locating the pectoralis major muscle. Make sure you can then identify these features on your cadaver.



Remember that the ***origin*** of the muscle is the 'fixed point' and it is the ***insertion*** that moves to allow the muscle to carry out its specific action.

Question 5.

Work out the *action* of pectoralis major and demonstrate them within your team.

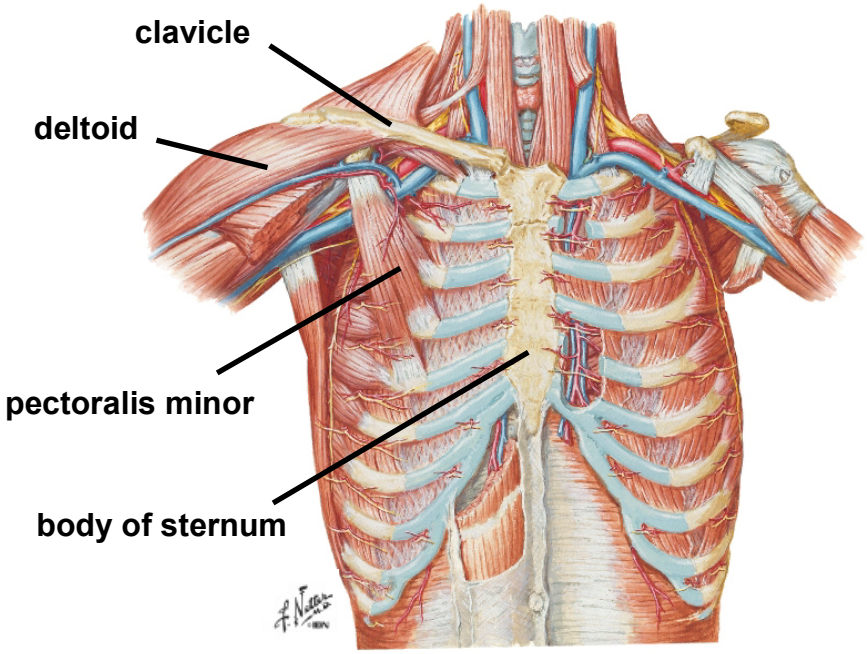
Task 6.

Reflect the muscle laterally by cutting through the muscle fibres close to the origin of the muscle. This is made easier by first using the handle of the forceps or your fingers to separate the muscle from the underlying thoracic wall. Do this slowly and carefully to ensure you do not damage deeper structures. On the deeper surface of the muscle closer to the insertion, can you identify the nerves and blood vessels supplying the pectoralis major muscle? They may be embedded in connective tissue. If they are try and carefully expose them using the open scissor technique.
Beneath the pectoralis major, identify the much smaller ***pectoralis minor*** muscle. Trace its points of attachments (origin and insertion). Once again the illustration on the next page should assist you in its identification.

Question 6.
What might the blood vessels and nerves be called?

Task 7.

Reflect the pectoralis minor muscle superiorly by cutting its attachments to the ribs. Finally identify the deltoid muscle. Trace the origin and insertion of the deltoid.



Question 6.
Using the knowledge you have just gained that the insertion is the moveable attachment of the muscle, can you determine the action of the deltoid muscle?

This completes the first dissection session for this module.

Checklist

Review all the structures you have examined today and ensure that your demonstrator is satisfied that you have completed the check list below before you leave the dissecting room:

Identify and demonstrate the named landmarks of the chest wall on a skeleton and your cadaver

Understand the concept of investing fascia

Identify pectoralis major, its parameters and indicate its function

Identify pectoralis minor, its parameters and indicate its function

BSMS MODULE: 102, FOUNDATIONS OF HEALTH AND DISEASE

DR SESSION:

2. THE INTERCOSTAL MUSCLES AND SPACES AND REMOVAL OF THE ANTERIOR CHEST WALL

brighton and sussex medical school

BSMS MODULE: **102, FOUNDATIONS OF HEALTH AND DISEASE**

THEME: **THE HUMAN BODY**

DR SESSION: **2. THE INTERCOSTAL MUSCLES AND SPACES AND REMOVAL OF THE ANTERIOR CHEST WALL**

Welcome back to your second dissection session

In the first dissection session you examined the pectoral muscles and discussed their structure, position and function. In this session, the structures underlying the pectoral muscles – the thoracic cage – will be examined. We will also examine the contents of an intercostal space.

As with all practical sessions in the dissecting room make sure you work through this hand out, answer the questions and complete the checklist. In addition explore the anatomical models, prosections and other demonstration material.
Your first job is to designate a new team leader for this session.

LEARNING OUTCOMES

By the end of the practical session students should be able to:

1. Explain the difference between; true, false and floating ribs
2. Describe the relationships, functions and neurovascular supply of the layers of intercostal muscles
3. Describe the arrangement of structures within the subcostal groove
4. Explain the stem arteries from which the posterior and anterior intercostals arteries are derived

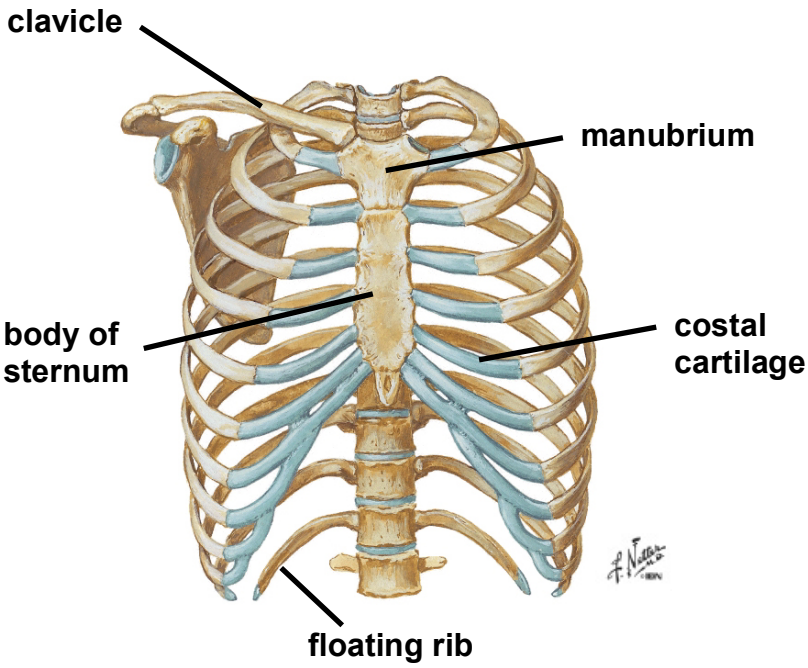
Let's start the session

Task 1

You should start by inspecting one of the laboratory skeletons. The thoracic cage is formed by the ribs, the thoracic part of the vertebral column and the sternum is a bony cage which protects the vital organs lying within the thorax and aids in respiration. There are usually 12 pairs of ribs which all articulate posteriorly with the vertebral column. Anteriorly some of the ribs ***articulate***, via their costal cartilages, with the sternum while others articulate with the costal cartilage of the rib above. The lowest two pairs of ribs, described as ***floating ribs*** do not extend forward to the anterior aspect of the thorax. Make sure you can identify all these elements on the skeleton.

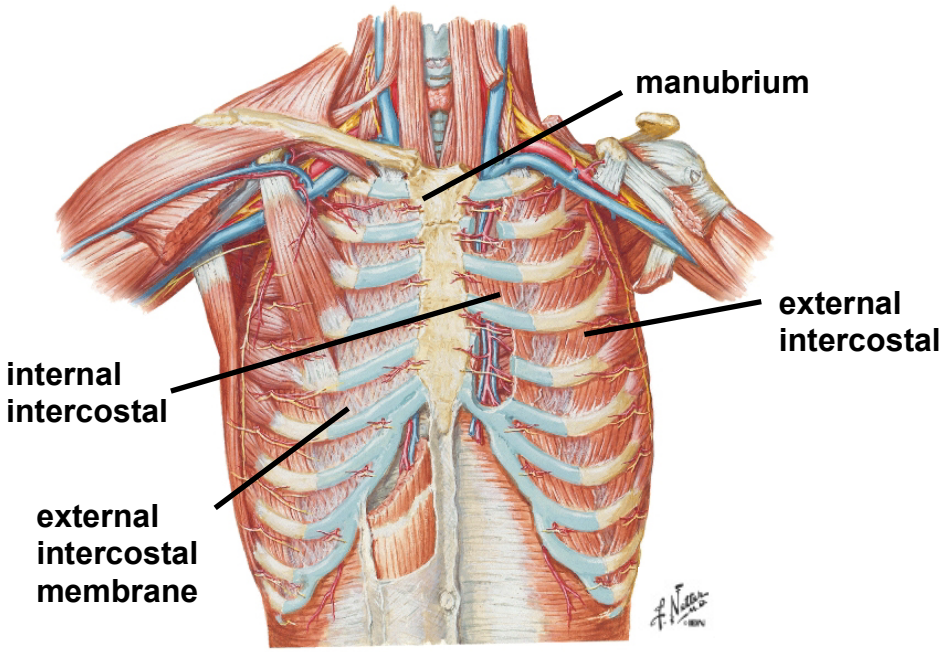
Question 1

What name is given to ribs whose costal cartilages articulate (a) with the sternum (b) with the costal cartilage of the rib above?



Task 2

Palpate the ribs and feel the intercostal space between adjacent ribs. The intercostal space contains the external intercostal muscle, the internal intercostal muscle and the innermost intercostal muscle arranged in three layers. The deepest layer, the ***innermost intercostals*** are attached to the inner surfaces of the ribs on the lateral part of the thoracic wall and therefore not usually visible in this particular dissection.



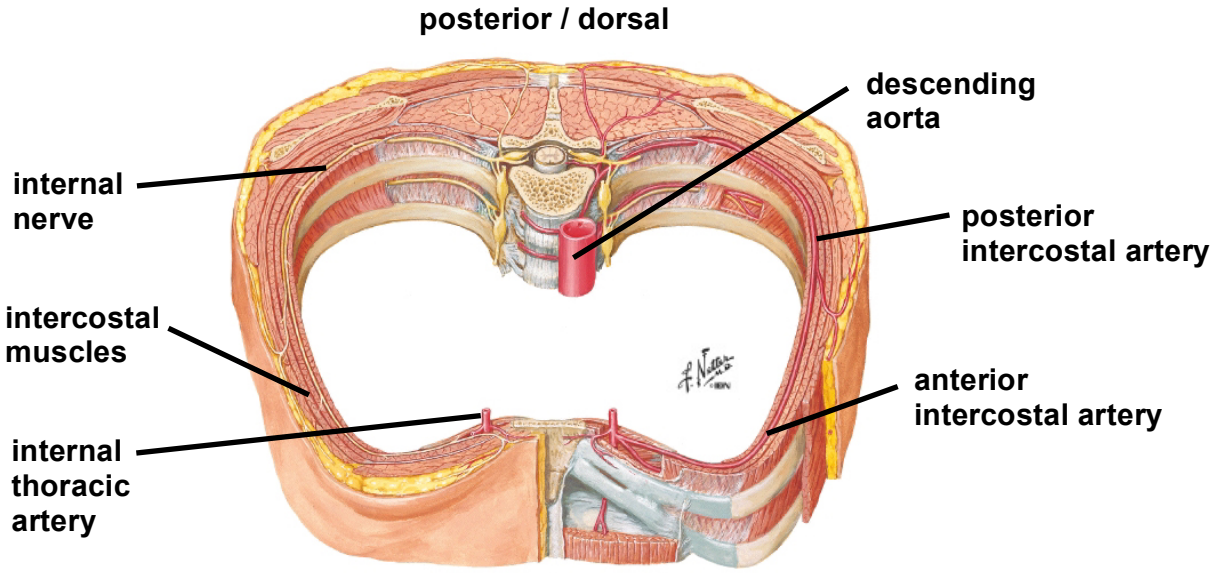
Carefully clean the fascia from the external intercostal muscle of one or two intercostal spaces. Anteriorly, the muscle is replaced by a membrane – identify this membrane in two separate intercostal spaces and on both left and right sides of the cage.

Question 2
What is the direction of the external intercostal muscle fibres? Can you describe this using anatomical nomenclature?

Task 3

Remove the external intercostal muscle by carefully cutting along its superior attachment to the inferior surface of a rib and reflect it inferiorly. Identify the internal intercostal muscle lying deep to the external intercostal muscle. Remember each muscle is very thin and so be careful not to make deep cuts.

Remove the internal intercostal muscle and dissect beneath the rib margin to expose the ***intercostal nerve and vessels*** – these may be difficult to identify and if you are having difficulty, wait until we examine the inner surface of the thoracic wall. The following illustration demonstrates the location of intercostal nerves and arteries (the veins are not shown in this illustration.



If you are able, note the relation of the intercostal vein, artery and nerve. All three are protected by the downward projection of the lower border of the rib forming the ***costal groove***. Identify a costal groove on a rib of one of the skeletons around the anatomy lab or from your box of disarticulated bones.

Question 3
In cases where it is necessary to insert a chest drain or needle into an intercostal space it is always placed in the lower part of the space – explain why.

Task 4

The next stage of the dissection is to remove the anterior chest wall, study the deep surface of the chest wall and reveal the underlying thoracic viscera, in preparation for the dissection of the heart and lungs in the next module (103).

If the serratus anterior muscle is clearly identifiable on the lateral surface of the thoracic cage and its main bellies extend onto the anterior surface of the

ribs, you should try to carefully reflect them. If the muscles are not well developed, note them, but leave them in place.

Next, under the supervision of your demonstrator, make two transverse cuts through the sternum - one just above the sternal angle, and the second at the level of the 5th costal cartilage. A bone saw is provided for this purpose (please take care when using this dissection tool). Cut through ribs 2-6, either using the saw or the bone cutters provided. Ensure that you cut through the postero-lateral aspects of the ribs – this will ensure you remove a substantial portion of the thoracic cage and will be beneficial when you begin dissection of the heart and lungs next term. Also, using a scalpel, cut through all layers of the intercostals muscles between the ribs at the same point where you have sawn/cut through the ribs themselves.

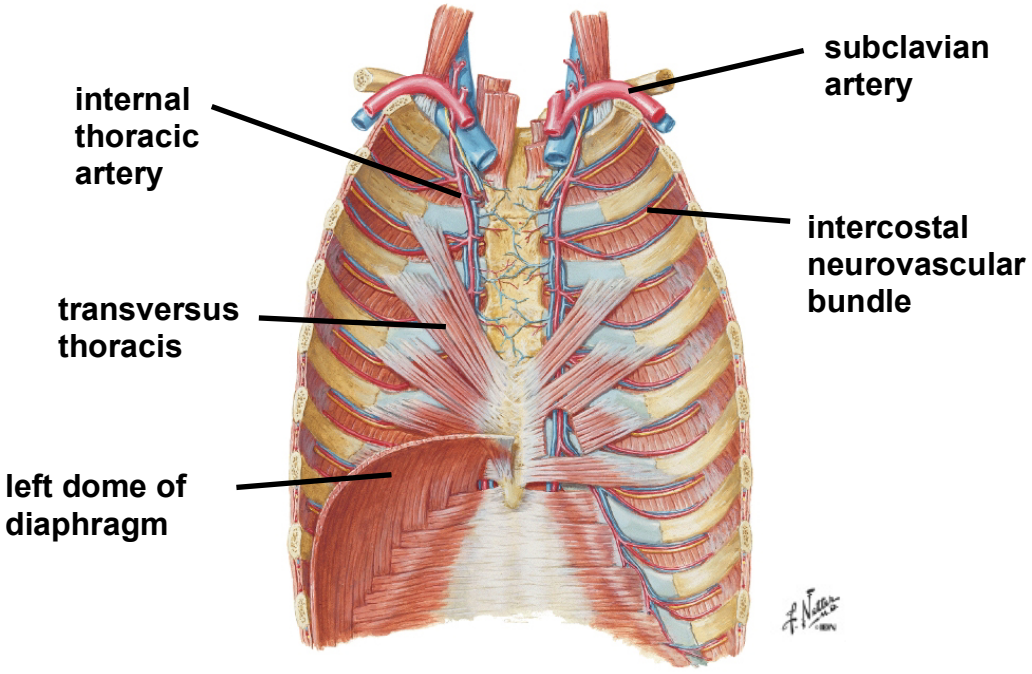
Detach the deep surface of the sternum and ribs from the underlying fascia and pleura and remove the anterior part of the thoracic cage in one piece. You may have to incise the muscles in the first intercostal spaces to do this. You should note that sometimes the pleura adhere strongly to the chest wall and you may need to place a hand behind the cage and ease it away from underlying structures using your fingers. Take great care when removing these bony elements and be aware that the cut surfaces of the ribs will be sharp – hence the reason for cutting the ribs so far laterally.

Question 4

What might the name serratus anterior tell you about this muscle?

Task 5

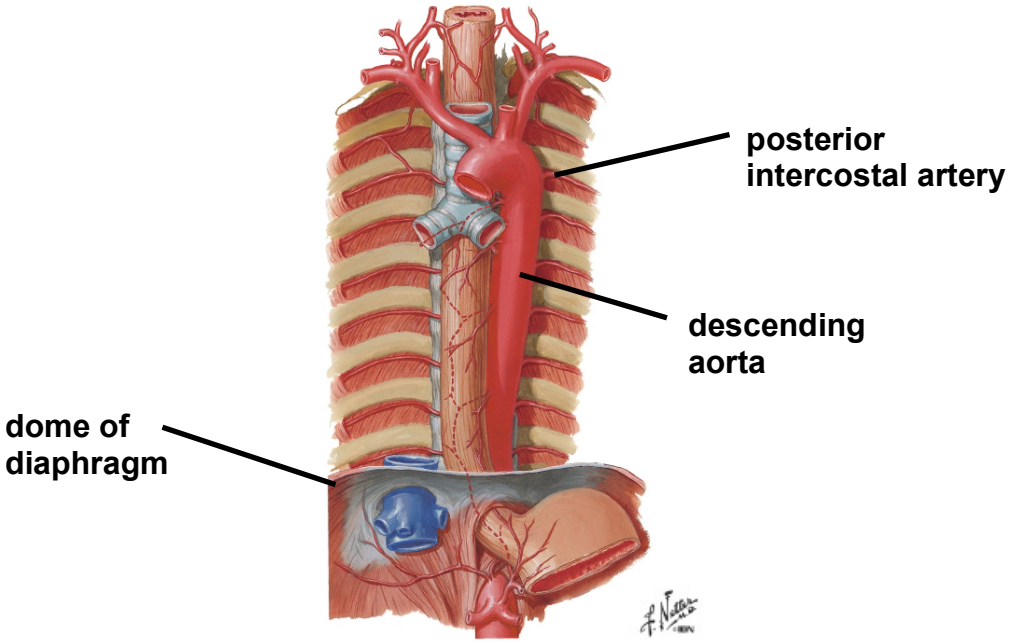
Locate the right and left ***internal thoracic arteries*** on the inner surface. These arteries normally arise from the right and left subclavian arteries, the latter which are the stem arteries supplying blood to the upper limbs. You will have had to cut these arteries to remove the thoracic wall. The following illustration shows the deep surface of the anterior chest wall.



If you can, now locate an ***intercostal neurovascular bundle*** consisting of intercostal vein, artery and nerve. Note that this should be much easier on the inner aspect.

Intercostal nerves – these nerves arise from each thoracic segment and emerge between adjacent thoracic vertebrae.

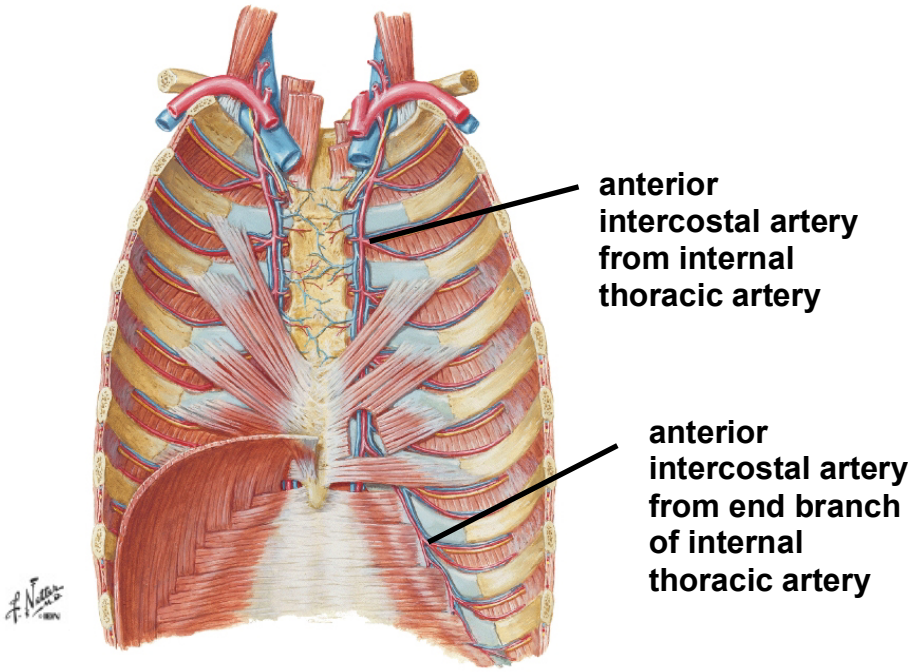
Intercostal arteries - Arteries enter intercostal spaces both anteriorly and posteriorly and run in the eleven intercostal spaces. Arteries supplying the posterior part of each space are known as ***posterior intercostal arteries***, the majority of which are direct branches from the ***descending thoracic aorta***.



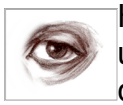
The anterior part of each space is supplied by ***anterior intercostal arteries*** which are branches of the internal thoracic artery in the upper six intercostal spaces. In the seventh to ninth intercostal spaces anteriorly, the internal thoracic arteries have divided into their end branches and it is one of these end branches that gives rise to the anterior intercostal arteries in these spaces (see diagram below). There are no anterior intercostal arteries in the last two intercostal spaces.

Question 4

Where are the internal thoracic veins located in relation to surrounding structures?

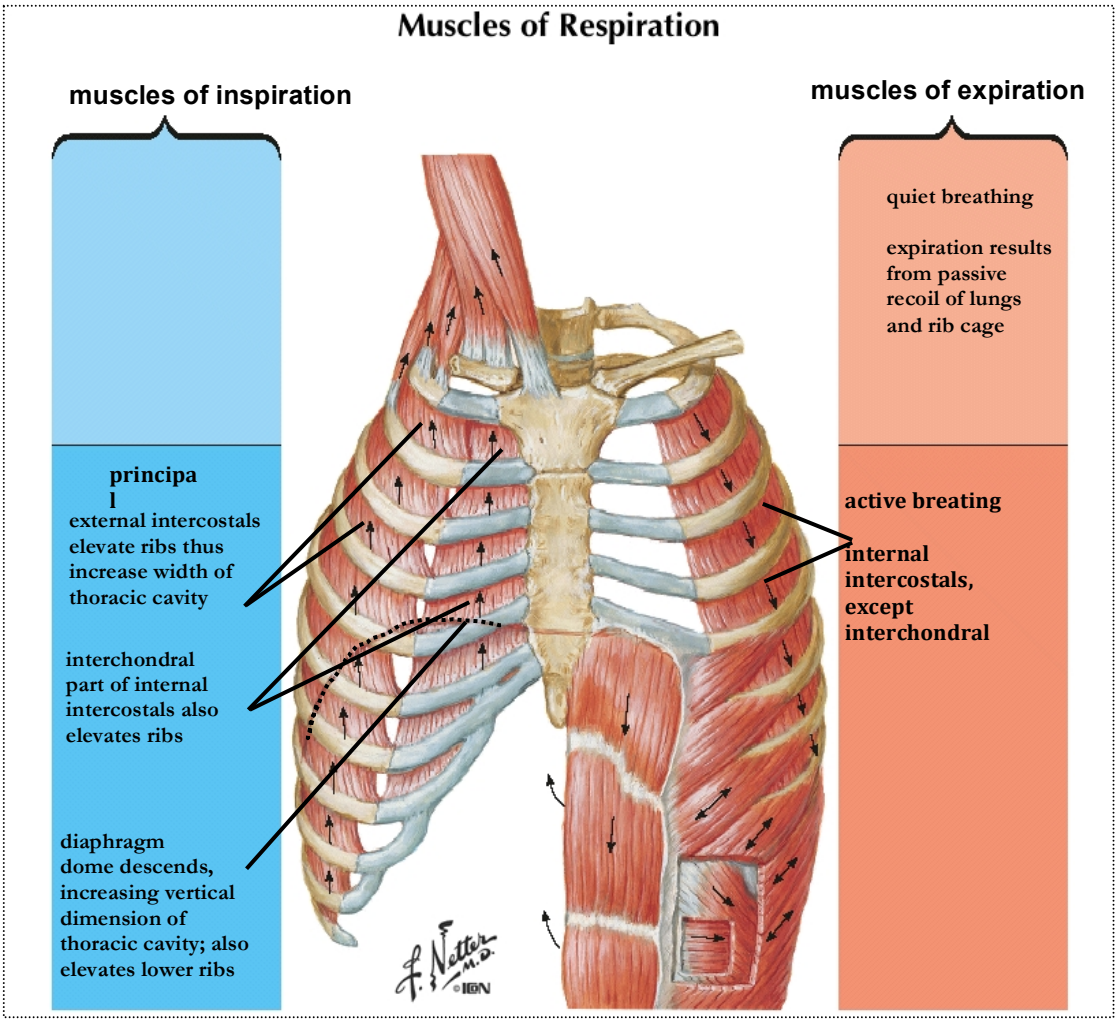


Task 6



Having removed the anterior thoracic wall, take a moment to view the underlying thoracic viscera. Locate the right and left lungs and pericardial sac containing the heart. These structures will be studied in detail in Module 103 next term. Do not attempt any dissection of these structures.

Finally, in order to begin to gain an understanding of the muscles acting during the two phases of respiration, discuss **briefly** with your demonstrator the action and function of the two main layers of intercostals muscles during this process. The following diagram should help you in discussing these actions. We will discuss these in further detail in the next module.



Question 6

What other muscles might be involved in thoracic breathing and therefore actively move the thoracic cage?

Checklist

Review all the structures you have dissected today and ensure that your demonstrator is satisfied that you have completed the checklist below before you leave the anatomy laboratory

Understand the terminology true, false and floating ribs
Determine the relationships of the layers of intercostals muscles, the direction of the fibres of these muscles and the relationship of intercostals nerves to these muscles. Indicate the muscle functions.
Be aware of the arrangement of structures within the subcostal groove
Be able to determine the stem arteries from which the posterior and anterior intercostals arteries are derived
Review and understand all the structures you have dissected in the two dissection sessions within this module