

STANDARD OPERATING PROCEDURE:

Performing a heart dissection

Note: To be undertaken only by trained personnel in conjunction with a current Safety Data Sheet (SDS) and site-specific risk assessment.

1. Introduction

Heart dissections are conducted to explore the function of a heart by examining the internal and external structures. Good hygiene practices should be observed at all times. Hearts suitable for dissections include fresh sheep, cow, and ox or pig hearts purchased from a butcher, abattoir or a supplier that has passed relevant health inspections. It is best to ask for as great a length of blood vessels as possible to be left attached and to consider obtaining at least one of them as part of a pluck (heart and lungs) for demonstration purposes.

The hearts can be obtained some weeks beforehand and stored in a freezer.

2. Context

- These instructions are for the use of experienced science teachers and technicians and students under close supervision.
- When planning a class dissection activity it is best to discuss beforehand, the type of dissection to be undertaken, and warn of the possibility that there may be some blood and odours present during the dissection.
- Demonstrating the dissection to students before they begin is helpful, not only for correct procedure but allows the students to adjust to the appearance of the material, and any blood that may be present after the dissection material has been washed.
- Let students know they don't have to participate in the dissection and can be excused from the class. Alternative arrangements can be made for students who don't wish to participate, by giving them worksheets to complete and relocating them to a private study area.

3. Safety notes

- A site specific risk assessment should take into consideration the maturity of students carrying out the dissection and address risks associated with students using scalpels and other dissection equipment
- Before the dissection it is recommended the teacher or laboratory technician trial the dissecting instruments (scalpels, scissors and pointed forceps) to establish that they are sufficiently sharp enough and to determine the most appropriate equipment for the task considering the student behaviour.

Fainting: signs and symptoms:

- Fainting may occur during this type of activity. Please read the first aid information in section 7 before conducting the dissection.

- Fainting is caused by a sudden drop in blood pressure. Common causes include heat, pain or distress and the sight of blood.
- The possible symptoms include the following.
 - 'Dizziness
 - Light-headedness
 - A pale face
 - Perspiration
 - Heightened anxiety and restlessness
 - Nausea
 - Collapse
 - Unconsciousness, for a few seconds
 - Full recovery after a few minutes¹

Handling specimens:

- If using frozen hearts defrost overnight in a refrigerator and use within 24 hours. Consistent with safe food handling procedures, all meat products should be stored below 5⁰ C prior to dissections.
- Good hygiene practices should be observed at all times.
- Keep hands away from mouth, nose, eyes and face during and after dissection and wash hands immediately after handling dissection material.

Safety with scalpels and dissecting instruments:

- Store all dissecting instruments securely.
- Care should be taken with sharps such as scalpel blades and scissors. Some school science departments restrict the use of scalpels unless specifically requested by a teacher, and prefer to only issue scissors, probes and forceps to students for dissections.
- Ensure students demonstrate responsible behaviour while using scalpels and other dissecting instruments.
- Scalpels should be provided in and returned to a lined container, blade end down
- Students should not walk around the lab with the dissecting instruments, in particular with a scalpel or pointed scissors, forceps or probes.
- To reduce the possibility of stab wounds or cuts from slippage always point sharp instruments such as scalpels and scissors away from yourself and others
- Hold the instruments so that any sharp points or exposed sharp edges point down onto the dissection board or tray. If there is any slippage when using the instrument, the point/exposed edge will be absorbed by the board/foam or wax tray.

Scalpel blades:

- Only staff should carefully attach and remove scalpel blades using pliers, forceps or a commercial blade remover.
- The scalpel blade size and handle must be compatible e.g. number 4 handle and number 23 blades.
- Keep the blade in the foil wrapper and attach to the handle with the sharp side of the blade pointing away from the body.
- An alternative is to use disposable scalpels.

4. Regulations, licences and permits

Offal that has passed a health inspection by a meat inspector or produced from a butchers shop, abattoir or biological supplier is suitable for dissection. In some jurisdictions, all dissections need to be reported to the school animal ethics committee.

5. Equipment

- PPE (Lab coat/apron [it is recommended to use plastic disposable aprons], safety glasses and gloves)
- Scalpels (optional subject to a site specific risk assessment)
- Scissors, Forceps, Probes
- Dissecting board covered in newspaper or disposable foam tray.
- Newspaper to protect bench and for wrapping biological materials after dissection
- Paper towel
- Disinfectant – hospital grade general purpose disinfectant (the label on the front of the pack must state 'hospital grade', which is a general purpose hard surface disinfectant which will kill micro-organisms).
- 70% v/v ethanol

6. Operating procedure

Preparation

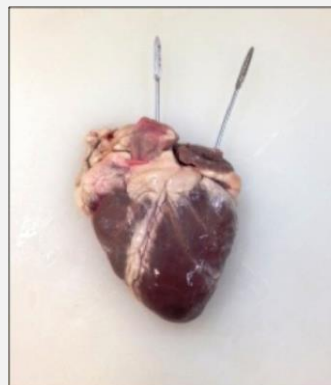
- If any blood is associated with the hearts rinse them in cold running water.
- Prepare disinfectant solution according to manufacturer's instructions. Place disinfectant in a container ready for instruments to be placed at the end of the dissection.
- Ensure students have appropriate PPE.
- Distribute the instruments to students. Scalpels, scissors, forceps and probes should be counted out, and counted in when returned.

Examining and dissecting the heart

1. Place the heart on the dissecting board or tray. Examine the outside of the heart, note the coronary arteries (vessels that supply the heart muscle with blood), and identify the left and right sides of the heart. A diagonal furrow on the surface of the heart indicates the divisions between the right and left side.
2. Use your fingers to feel the right side of the heart. Compare the thickness of the right and left sides. The muscles in the wall of the left ventricle feel firm, while those of the right ventricle feel soft and flabby. Feel the muscle wall in the centre of the heart. This is called the septum and separates the left and right side of the heart.
3. Locate the right and left atria on top of the ventricles and compare their thickness. The walls of the atria look quite different from those of the ventricles. Note the fat surrounding the atria.
4. Locate the large blood vessels attached to the atria. The right atrium is connected to the body by the large vein the vena cava and to the lungs by the pulmonary artery. The left atrium is connected to the lungs by the pulmonary vein and to the body by the aorta. Figure 1. Shows photo of sheep heart before dissection

(Operating procedure cont....)

Figure 1. External view of the sheep heart with probes showing the opening to the vena cava and pulmonary vein. (Image by K. Szalai, 2015)



5. The main chambers of the heart can be cut open using dissecting scissors. Locate either the vena cava, or if these are missing, the opening of the right atrium and carefully push a dissecting probe through the atrium into the ventricle. Using the probe as a guide insert the rounded end of the dissecting scissors and cut down through the wall of the atrium and right ventricle to the pointed end of the heart. Keeping your cut about 1cm away from the furrow marking the division between the right and left ventricle of the heart.
6. Open out the heart to expose the right atrium and the opening between the atrium and ventricle.
7. Make a similar cut from the pulmonary veins or opening of the left atrium down into the left ventricle. Again make your cut parallel to the furrow on the outside of the heart. Note the ventricles will not fall open until the strong fibrous cords linking the opposing walls are cut. Cut these and open the ventricles.
8. Compare the two sides of the heart. The right side of the heart pumps deoxygenated blood to the lungs. The left side of the heart receives oxygenated blood from the lungs and pumps it to the rest of the body. The walls on the right side are not as thick as the left side because the blood does not have to be pumped as far.
9. Between the ventricles and the atria observe the valves, made up of parachute-like flaps. Each is anchored to the ventricle walls by white tendons. The right atrioventricular valve is a tricuspid valve (it has three cusps). The left atrioventricular valve is a bicuspid valve (it has two cusps). These valves prevent blood flowing back into the atria
10. Locate the openings of the aorta and the pulmonary arteries, high in the ventricles using a probe or your fingers.
11. Identify the valves at these openings. These are called semi-lunar valves and prevent blood from flowing backwards from the arteries. Figure 2. Shows the completed dissection of the sheep heart.

Figure 2. Dissected heart with probes showing the heart valves: The bicuspid in the left ventricle and tricuspid in the right ventricle. The semi-lunar valves can be seen high in the right ventricle in the opening of the pulmonary artery. (Image by K. Szalai, 2015)

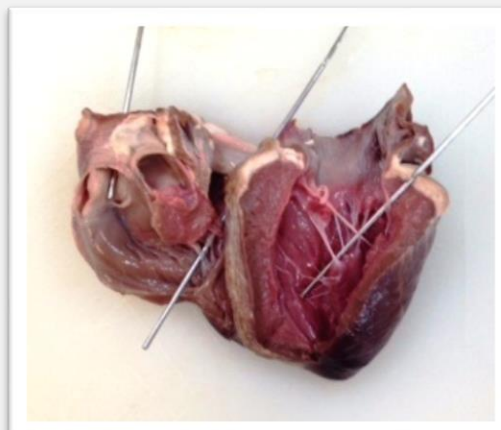
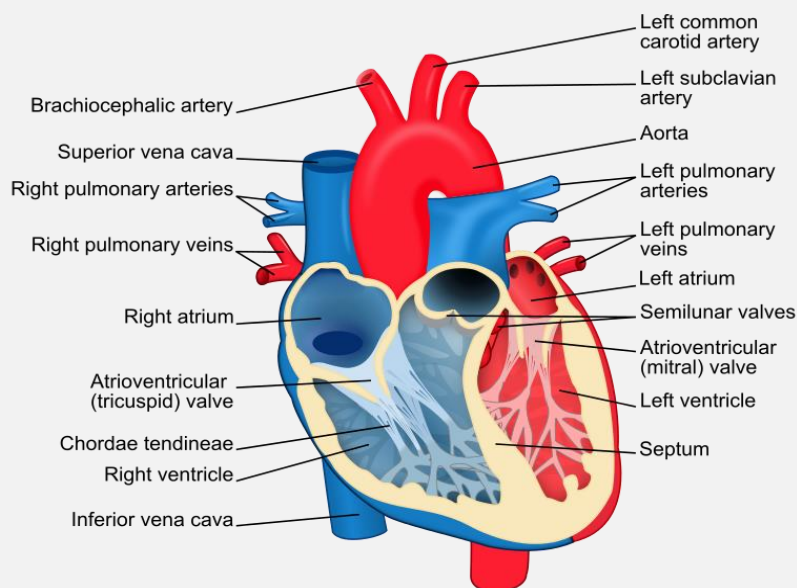


Figure 3. Labelled heart.
Image by Zoofari, Heart diagram, CC
BY SA 3.0
https://commons.wikimedia.org/wiki/File:Heart_diagram-en.svg
By ZooFari [CC BY-SA 3.0]



Clean up

- Make sure all instruments are returned.
- All parts of the heart as well as the disposable foam tray (if used) must be wrapped in newspaper and placed in a dedicated plastic garbage bag along with gloves and disposable aprons (if used). When all waste material has been collected, double bag for disposal. Freeze material if unable to dispose of immediately.
- If blood is present on dissecting boards, scissors, forceps, probes and scalpels they must be immediately soaked in disinfectant. Otherwise wash equipment in hot soapy water, and rinse or place in a dishwasher to minimise handling.
- After washing, dissecting instruments can be soaked in 70% v/v alcohol for 20 minutes as an optional additional disinfectant and to avoid rusting.
- Dry all equipment thoroughly.
- Disinfect workplace and wash hands thoroughly.

7. Trouble shooting/emergencies

- **If fainting occurs:** If students start to feel faint, dizzy or nauseous during the dissection lie them down (if possible) and elevate their feet. They can get up slowly after ten minutes. Sending them outside for some fresh air can also help. If they don't recover quickly, always seek urgent medical attention. ***'Do not sit the patient on a chair with head between knees'***ⁱⁱ
- First aid: See latest SDS of any chemicals used for more detailed information
 - **If swallowed:** Do not induce vomiting. Rinse mouth with water, and then give water to drink. Seek urgent medical attention.
 - **If in eyes:** Hold open and irrigate with copious quantity of water for at least 15 minutes. Seek medical attention.

- **If on skin/clothes:** If spilt on skin or clothes quickly wipe off with a dry cloth to absorb as much liquid as possible. Remove contaminated clothes and drench the area with excess water under a safety shower. Seek medical attention.
- **If inhaled:** Remove to fresh air and seek medical attention if symptoms persist.
- For further advice contact the Poisons Information Centre on 131 126.
- First aid: cuts and lacerations should be washed under running water, in the first instance and referred to the school first aid officer for assessment.
- Any health concerns should be referred to the school first aid officer for assessment, accompanied by the relevant latest SDS if applicable. Follow your school's accident and incident policy and reporting procedures.
- See safety notes if it is necessary to remove broken or used scalpel blades

8. Waste disposal

- Used and damaged scalpel blades must be placed in an approved sharps container after use.
- Biological material must be wrapped in newspaper, placed in a double plastic garbage bag and sealed for immediate disposal in the industrial bins.

9. Related material

- Risk Assessment
- Manufacturer's Safety Data Sheet for disinfectant
- More detailed information on a heart dissection can be found on the following website: Nuffield Foundation. 'Looking at the heart' <http://www.nuffieldfoundation.org/practical-biology/looking-heart> (December 2008)

References:

ⁱ 'Fainting', Better Health Channel website, State Government of Victoria:

[http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Fainting_\(August_2014\)](http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Fainting_(August_2014))

ⁱⁱ St John Ambulance Australia. 2011. *Australian First Aid*. Barton, ACT

Cash, S; Quinton, G; Tilley, C 2012. *Oxford Big Ideas Science 9 Australian Curriculum*. Oxford University Press Australia

Chemwatch Gold. 2013. *Safety Data Sheet: Hospital grade disinfectant*.

<http://jr.chemwatch.net/chemwatch.web> (subscription required accessed October 2014).

'Heart', Wikipedia website, <https://en.wikipedia.org/wiki/Heart> (Accessed July 2016)

CLEAPSS. 2014. *G268 Dissection: a guide to safe practice*. Uxbridge UK

<http://science.cleapss.org.uk/Resource-Info/G268-Dissection-a-guide-to-safe-practice.aspx>
(Subscription required.)

'Dissection safety tips', Flinn Scientific website,

<http://www.flinnsci.com/media/396301/dissectionsafety.pdf> (2010)

Dissection Safety Policy and Procedures' Flinn Scientific website'

<http://www.flinnsci.com/media/948812/sf10490.pdf> (2013)

Glossary

Aorta – main artery that carries blood from the left ventricle of the heart to all the branch arteries in the body except those in the lungs.

Atria – (plural of atrium) are the blood collection chambers of the heart.

Atrioventricular (tricuspid) valve – or right atrioventricular valve, is on the right dorsal side of the mammalian heart, between the right atrium and the right ventricle.

Atrioventricular (mitral) valve – or left atrioventricular valve, is a dual-flap valve in the heart that lies between the left atrium and the left ventricle.

Atrium – is one of the two blood collection chambers of the heart.

Bicuspid – is an aortic valve that only has two leaflets, instead of three.

Blood – is living tissue made up of liquid and solids (cells). The liquid part, called plasma, is made of water, salts, and protein. It performs two major functions: transport through the body of oxygen and carbon dioxide; food molecules (glucose, lipids and amino acids). The cell component includes red blood cells, white blood cells and platelets.

Brachiocephalic artery – artery that supplies oxygenated blood from the aorta to the head, neck and arm regions of the body.

Carotid artery – the large artery on each side of the neck that supplies blood to the head.

Chordae tendineae – or heart strings, are cord-like tendons that connect the papillary muscles to the tricuspid valve and the mitral valve in the heart.

Coronary arteries – vessels that supply the heart muscle with blood.

Deoxygenated blood – blood that is rich in carbon dioxide rather than oxygen.

Pulmonary artery – artery carrying deoxygenated blood from the right side of the heart to the lungs.

Pulmonary vein – one of the four veins that carry oxygen-rich blood from the lungs to the left side of the heart.

Semi-lunar valves – heart valves with cusps shaped like half-moons; preventing blood flowing from the aorta back into the heart.

Septum – the muscle wall in the centre of the heart.

Subclavian artery – the major arteries of the upper thorax (chest).

Tendons – a tough band of fibrous connective tissue.

Tricuspid – a valve having three leaflets preventing back flow of blood from the right ventricle into the right atrium.

Vena cava (superior) – the [superior](#) of the two venae cavae that return deoxygenated blood from the upper part of the body above the diaphragm to the right atrium of the heart.

Vena cava (inferior) – is a large vein that carries deoxygenated blood from the lower and middle body into the right atrium of the heart.

Ventricle – a ventricle is one of two large chambers of the heart that collect and expel blood received from an atrium pumping it into the arteries.

History of reviews

Date	Version Number	Notes
April 2015	Version 1.0	
Sept 2016	Version 2.0	<p>Additional safety information included</p> <ul style="list-style-type: none"> • Fainting information • Safe food handling procedures • the use of scalpels and dissecting instruments <p>Glossary included</p>