

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 get them as part of a pluck (heart and lungs) or ask for as great a length of blood vessels as possible to be left attached. 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.
- Students must be closely supervised when performing heart dissections.

3. Safety notes

- 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:
 - Ensure students demonstrate responsible behaviour while using scalpels.
 - Only staff should carefully attach and remove scalpel blades with pliers or disposable scalpel 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.
 - Blades should be removed carefully using pliers, forceps or a commercial blade remover.
 - 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, gloves and safety glasses)
 - Scalpels
 - Scissors
 - Forceps
 - Probe
 - Dissecting boards covered with newspaper. Glazed ceramic tiles, nylon plastic boards or disposable foam trays are suitable.
 - 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).

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.
5. The main chambers of the heart can be cut open with dissecting scissors or a scalpel. 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.

(Operating procedure cont....)

Figure 1. Shows photo of sheep heart before dissection.

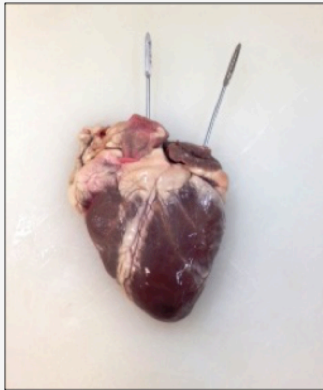


Figure 1. External view of the sheep heart with probes showing the opening to the vena cava and pulmonary vein. (Image by K. Szalai, 2015)

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.

Figure 2. Shows the completed dissection of the sheep heart.

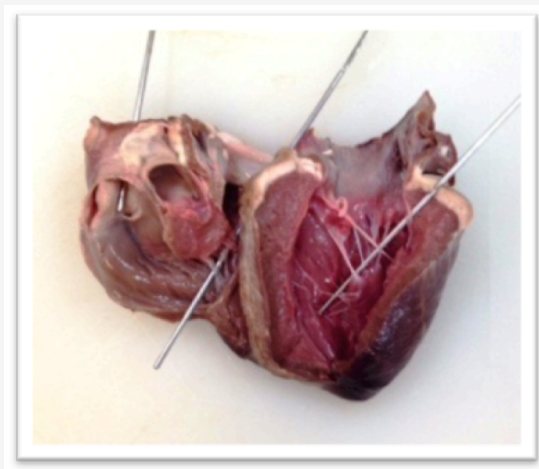


Figure 2. Dissected heart with probes showing the heart valves: The bicuspid in the left ventricle and tricuspid in the right ventricle. The semi-lunar valves can be seen high in the right ventricle in the opening of the pulmonary artery. (Image by K. Szalai, 2015)

11. Identify the valves at these openings. These are called semi-lunar valves and prevent blood from flowing backwards from the arteries.

(Operating procedure cont....)

Figure 3. Shows the labeled structure of the heart.

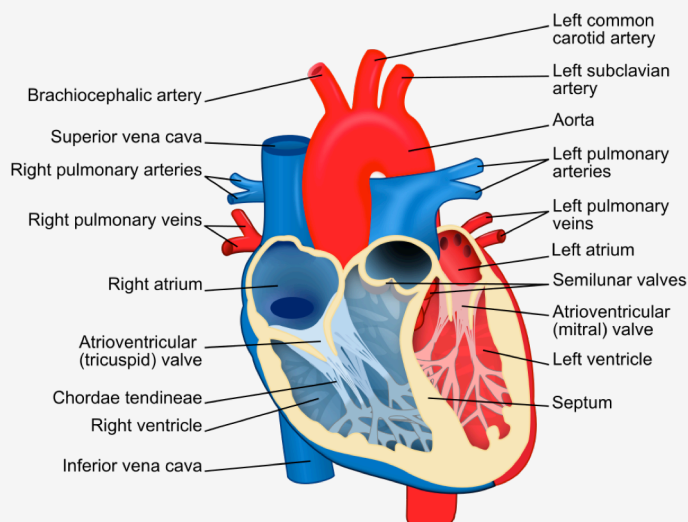


Figure 3. Labelled heart.

Image by Zoofari, Heart diagram, CC BY SA 3.0
http://commons.wikimedia.org/wiki/File:Heart_diagram-en.svg

Clean up:

- Make sure all instruments are returned.
- All parts of the heart must be wrapped in newspaper, as well as the disposable foam tray (if used) and placed in a dedicated plastic garbage bag. When all waste material is collected, double bag for disposal.
- If blood is present dissecting boards, scissors, forceps, probes and scalpels must be immediately soaked in disinfectant, otherwise wash in hot soapy water, then rinse or place in dishwasher to minimize handling.
- After washing dissecting instruments can be soaked in 70% 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

- First aid: See latest disinfectant SDS 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.
- Care should be taken with sharps such as scalpel blades and scissors.
- See safety notes if it is necessary to remove broken or used scalpel blades.
- Store all dissecting instruments securely.

- First aid: cuts and lacerations should be washed under running water, then patted dry and covered with a clean paper towel or tissue in the first instance and referred to the school first aid officer for assessment.

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

References:

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).