

# Circulatory System

Critical teaching ideas - Science Continuum F to 10

**Level:** Moving to level 6

## Student everyday experiences

Students will have a variety of ideas about the circulatory system and its relationship to the body as a whole system. They tend to focus on parts of different systems, e.g., the heart being a pump rather than it being an organ with its own requirements (i.e. its structure as a muscle and its need for nutrients in order to act as a muscle). Students often know that the heart pumps blood, however are unaware of the components of the blood, other than red blood cells (See Reiss, 1999; Loughran Berry & Mulhall, 2004).

Students may be confused about how the blood moves around the body. Rather than it being contained in blood vessels, they may think of it more as somehow just washing around inside the body, which also raises confusion about how blood and the circulatory system relate to the whole body as a system. This is reasonable given their experiences when they cut themselves and blood 'comes out'. Students who do not have a sense of blood travelling in vessels may not recognise that there is continual one way flow of blood in these vessels (See Reiss, 1999; Loughran Berry & Mulhall, 2004).

Some students have an understanding of blood vessels but there is often some confusion about them, for example students often see arteries and veins as similar structures that contain different things. This is also reasonable given the images they have seen in books, such as blood in veins is always blue, and that in arteries is always red, and otherwise looking to (this phrase is confusing to me) have the same structure (See Reiss, 1999).

The idea of 'waste' may only be connected with the digestive system so that waste may not be considered to be in the form of gases, ions etc. carried in the blood (See Loughran, Berry & Mulhall, 2004). Again the connection to other body systems and the body as a whole system may be confusing for students.

Students are likely to know that blood has some role in the transportation of oxygen, but there is confusion about the details of this idea. (See Reiss, 1999)

Students are also likely to be aware of some of the effects of different lifestyles on the health of the heart but unclear how this is linked to the body as a whole system (e.g. coronary heart disease), (See Reiss, 1999)

## The scientific view

The circulatory system is the transport system of the body and provides the means by which materials are transported around the body. Within the system, the blood is the transport medium and is confined to tubes (therefore it is a closed system). The heart is the pump that moves the blood. This system transports many things including oxygen, hormones and nutrients to all cells in the body and carries away waste products (See Loughran, Berry & Mulhall, 2004).

This closed system consists of a network of blood vessels extending to all parts of the body, as well as the heart as the pump for the system. There are three types of blood vessels (or tubes) that carry the blood throughout the body; arteries, veins and capillaries, all are different in structure and function.

Blood is complex in nature consisting of cells, cell fragments, liquid plasma and dissolved substances and water as a major component (See Loughran, Berry & Mulhall, 2004).

Exchange occurs between the circulatory system and other systems e.g. the digestive system (products of digestion); the respiratory system (oxygen/carbon dioxide); the renal system (metabolic waste) and the endocrine system (hormones). All these body systems work together to create one big system – the human body (See Loughran Berry & Mulhall, 2004).

### **Critical teaching ideas**

- Creating models and simulations increases the students' understanding of complex systems such as the circulatory system
- The circulatory system transports food, oxygen and other materials used by the body for maintenance, growth, repair and wastes to serve the needs of individual cells
- The circulatory system is a closed system consisting of the heart (organ), blood vessels (that include the arteries, veins and capillaries), and the blood
- The heart acts as the pump for the circulatory system that maintains the flow of blood due to the changing pressures around the body
- The circulatory system is in contact with the entire body in order to serve the needs of individual cells
- Drugs, diseases and conditions can influence the efficiency of the circulatory system

(See Loughran Berry & Mulhall, 2004; Howe et al., 2005; AAAS Maps)

The circulatory system is a complex transport system. A useful starting point is to unpack students' ideas about how it functions and the elements that are involved through the use of models and simulations. Again with this system it is useful to discuss the students' everyday experiences including cuts, bruises, visits to the doctor and the information and diagrams they have observed in the past. As with the study of other human systems it is useful to study what the elements of the circulatory system look like, their function and how they contribute to maintaining the successful functioning of the body.

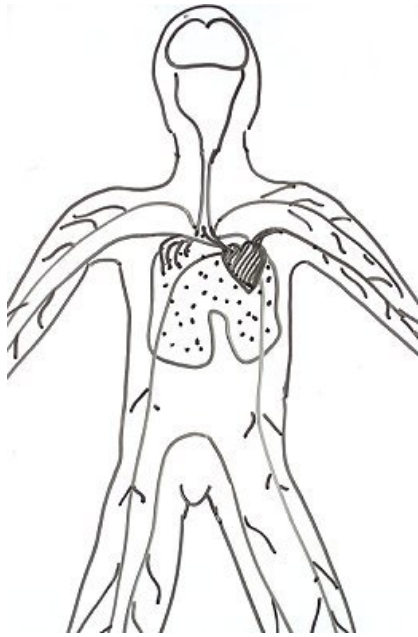
### **Teaching activities**

#### **Bring out the students' existing ideas.**

Students could develop several role plays of the whole circulatory system, or parts of the system (e.g. the functioning heart - as blood moves from each chamber). This activity offers the possibility of kinaesthetic learning experiences for the students.

#### **Reflection on and clarification of existing ideas & opening up discussion via a shared experience.**

These activities will also help to build students' understanding and knowledge of the circulatory system through modelling.



Students could design their own model of the human transport system that transports food, oxygen, waste, and communication systems to and from the cells. By doing this activity they would consider the most efficient methods for transport within the human body and the structural features that would be necessary. This activity encourages students to reflect on the usefulness of a scientific model.

Students could take part in a decision making activity to discuss 'how can you maximise the transport system in the human body'. This activity would enable the students to consider the positive and negative impacts various factors have on the circulatory system and other aspects of the human body as a whole.

**Clarify and consolidate ideas for/by communication to and with others.**

This activity will encourage students to look at the impacts of drugs on maximising the functioning of the circulatory system. Students could investigate the measures that elite athletes use to improve the functioning of their circulatory system. Through discussion, the impacts of these measures on the circulatory system, both positive and negative, and the consideration of the use of drugs such as EPO could be explored. This could be presented in a poster format, which student could then present at a summit held to discuss the ethics of the athletes' choices.