D.7. Plasma

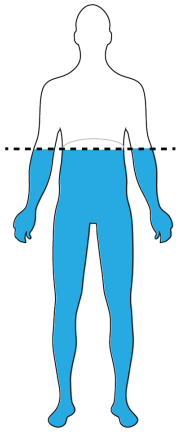
Introduction

I have decided to add a page on the physiology of plasma. Mainly because plasma is relatively unrecognized but does play an important role in human physiology and medicine.

A. Plasma:

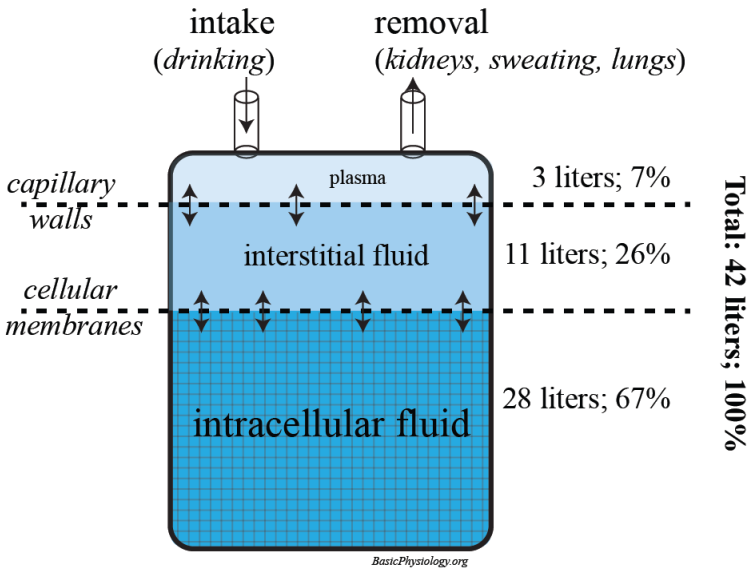
1. Plasma is the **largest** component in blood, about 55-60% of the blood is plasma.	2. Plasma consists of water (of course!) and contains salts, many enzymes, nutrients, hormones and waste products.
3. Plasma also contains important components such as antibodies, clotting factors, and the most important transport protein: **albumin**. With this and other similar proteins, plasma can transport all kinds of nutrients etc. to all parts of the body.	4. And … plasma also transports all kind of waste products, from the cells, to those organs where this waste will be removed (lungs, kidneys, spleen, liver).
5. So, plasma is used primarily for one thing: TRANSPORT!	

B. Body Fluids:

1. In fact, this maybe the perfect opportunity to discuss all the water in the body: **body fluids**.	 60% of 70 Kg = 42 liters water BasicPhysiology.org
2. But first, how much water do we have in our body?	
3. In general, about 60% of our body consists of water. So, if you weight 70 kg, then 42 kg of your weight will be water. As 1 kg of water is 1 liter, this is equivalent to 42 liters of water.	

4. Btw, there is a small difference between **man and women**; women have slightly more fat and therefore less water than man. About 5% less water than man.	5. Interestingly, children have much more water than adults! An infant has about 75% water, which drops as a child develops to about 65%. Older people have less and less water ;-(😞

C. Water distribution in the body:

1. Now, where is all this water located? As you can see in the diagram, most of the water (28 L) in the body is located in all the cells in the body.	2. As you saw in a previous chapter (*A.2. The Cell*), this cellular fluid (=cytoplasm) is continuously exchanged, through the cellular membranes, with the interstitial fluid.
3. This interstitial fluid (about 11 liters) is the 'bridge' for the transport of nutrients and waste between the cytoplasm and the plasma, through the cell membranes and the capillary walls.	
	
4. The water in the plasma, in turn, is continuously being replenished (intake) and removed. The intake is performed by drinking water (and a little bit by eating food).	5. The removal of (excess) water is performed by: a. kidneys (formation of urine) b. sweating (when it gets too hot) c. expiration (by the lungs)

D. Cytoplasm:

1. The water inside the cells is called cytoplasm. We discussed this briefly in *A.2.1. Structure of the Cell, panel D*.	2. Inside this cytoplasm, all the cellular organelles 'float' around inside the cytoplasm, such as mitochondria, lysosomes, ribosomes, and, of course, the nucleus.
3. Although there is not a specific circulation system inside the cell, as there is in the whole body, there are some cellular structures that are involved in a 'cellular circulation'.	4. The most important ones are the reticular system (= endoplasmic reticulum) and the Golgi apparatus. Both these systems are involved in processing specific molecular pathways. More: *A.2.1. panels E and F*.

E. The Plasma Membrane:

1. The boundary between the cytoplasm (inside the cells) and the water located outside the cells (=interstitial fluid) is formed by the plasma membrane (=cellular membrane).	2. This plasma membrane is a very specific and crucial structure that effectively divides these two compartments.
3. In physiology, the plasma membrane is so important that I dedicated a special page to this structure: *A.2.2. The Plasma Membrane*.	4. If you want to check out how water moves, through the plasma membrane, in and out of the cell, go to: *A.2.3. Passive Transport Systems*.

F. The Interstitial Fluid:

1. The interstitial fluid, also called **extracellular** fluid, is the fluid that is located outside the cells.	2. It literally forms a 'bridge' or connection between the cytoplasm in the cells and the plasma in the blood.
3. This bridge is necessary as a passageway for the oxygen and other nutrients to reach the cells and for all the waste to be removed from the cells.	4. You can compare it with the streets outside of your house, which allows you to go in and out of your house, together with your family, your shopping's, etc.!

5. The composition of the interstitial fluid is however different from that of the cytoplasm and that of the plasma.	6. The difference in composition of the interstitial fluid with that of the cytoplasm is determined by the various passive and active transport mechanisms across the plasma membrane.
7. We discussed these extensively in A.2.3 (*Passive transport systems*) and in A.2.4. (*Active transport systems*).	

G. The Capillary (and Lymphatic) walls:

1. Of course, the interstitial fluid must also make contact with the plasma in the blood.	2. Again, we discussed that in greater details in the physiology of the capillaries (*B.5.3. The Capillaries*).
3. Remember that the flow of water between the plasma and the interstitial fluid was determined by a) the **hydrostatic** pressures and b) the **oncotic** pressures in both systems.	4. And, when something goes wrong, water can accumulate in the interstitial space; this is called **oedema**!
5. Also, don't forget that some of the water does not flow to the blood vessels but flows to the lymph system (*B.5.5. The Lymph Circulation*)	6. Although the quantities are very small, they play a crucial role in the immunology of the body as the lymph nodes detect the presence of bacteria and viruses.