Continuity equation

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Continuity Equation

The continuity equation is important for describing the movement of fluids as they pass from a tube of greater diameter to one of smaller diameter. It is critical to keep in mind that the fluid has to be of constant density as well as being incompressible. This can be related to the body in several ways, but we must be carefull. This concept is important when it comes to arteries, which divide into capillaries, and then join to form into veins. This equation is usefull for calculating the speed of the blood as it travels through the vessles. Although, vessels are elastic structures so the equation has to be applied with caution and several other factors have to be considered. This includes how elastic the vessles are, and the changing diameters of the vessles.

To understand the **continuity equation** it helps to consider the **flow rate** *f* first :

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f=Av
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the flow rate describes the volume of fluid that passes a particular point per unit time (like how many liters of water per minute are coming out of a pipe). A is the cross-sectional area of the pipe at any point, v is the average speed of the flow at that point. The units are usually millliters per second.

This can be important when calculating the amount of blood that the heart pumps per minute through vessels, thus determining if the person is healthy and efficient. Also this can be usefull in determining if a vessel is clogged with plaque, and might help to prevent heart diseases or myocardial infarctions.

Continuity Equation

A pipe, with an incompressible liquid in it is considered, where one part is wider than the other. Since the liquid is incompressible in the same time interval the same volume of the fluid will pass through each cross section of the pipe or in this case, vessles. The equation below means that the flow rate of both liquids are constant.

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f1 = f2
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Therefore:

The form of the continuity equation is given below. It means that the cross section area times the speed of fluid going through it is equal to the cross section area of another vessel of different diameter times the speed of the fluid passing through it.

This means that if blood is passing through a large artery with a certain volume, it will have to speed up alot if it then goes through a capillary with a smaller diameter.

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A1*v1 = A2*v2
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In review,

A1 is the area of the cross section of the pipe's wider part, A2 the cross-section area of the pipe's narrow part ; v1 and v2 show the velocity of the fluid passing through A1 and A2.

According to the **continuity equation**, a fluid willl pass more rapid through the narrow part of the pipe.

So if we know the flow speed v1 in the area A1 we can easily find out the flow speed v2 in the narrow part A2.

The flow speed is higher in the constricted part of the pipe. The wider the pipe is, the slower is the flow speed, if the pipe narrows, the flow speed will increase.

This equation is the basis of what determines the blood pressure in our bodies.

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The conclusion of it is, that the flow speed is inversely proportional to the cross-sectional area of the pipe.

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