For my steam project, I will be explaining the structure and function of the heart, explaining how the heart is regulated, and explaining the path of blood through the heart and circulatory system. Also, I will talk about the left ventricular assist device (LVAD) system and why someone may need this system.

The heart is located in the thoracic cavity between the lungs in a space known as the mediastinum (Betts et al. 2013). The heart is about the size of a closed fist and weighs about 250 to 350 g (Shaffer et al. 2014). The heart beats approximately 100,000 times a day and 2.5 billion times in an average lifespan (Shaffer et al. 2014). The heart consists of four chambers; two sides (left and right) and each having one atrium (atria for plural) and one ventricle (Betts et al. 2013). The atrium acts as a receiving chamber and contracts to push blood into the lower chambers (left and right ventricles) (Betts et al. 2013). The ventricles are the primary pumping chambers of the heart, delivering blood to the lungs and the rest of the body (Betts et al. 2013). The blood enters the heart in the right atrium as deoxygenated, it then enters the right ventricle where it is pumped to the lungs with pulmonary arteries to remove waste and oxygenate the blood (Shaffer et al. 2014). The oxygenated blood is brought back to the heart into the left atrium via pulmonary veins (Shaffer et al. 2014). The left atrium travels the blood into the left ventricle where oxygenated blood will be pumped through the aorta and about the body with the arterial system (Shaffer et al. 2014).

Heart failure is an intricate syndrome that impairs the ability of the heart to maintain stable heart circulation, causing that person's organs to be unfunctional and eventually death (Medical Advisory Secretariat, 2004). For people that have end-stage heart failure, and do not intend medical therapy, surgical treatment, or traditional circulatory assist devices, heart transplantation is the only other treatment that can be done (Medical Advisory Secretariat, 2004). Worldwide heart transplantation has increased and doubled in the last 15 years, while organ donors have dropped by a third (Prinzing et al. 2016). Therefore, the need for permanent mechanical circulatory support assist devices has increased (Prinzing et al. 2016).

A left ventricular assist device (LVAD) is a mechanical pump that helps people with chronic heart failure pump blood out of the left ventricle through the aorta and throughout the body (Cleveland Clinic Medical Professionals, 2023). The LVAD consists of a pump, a driveline, a controller, and a power supply (Cleveland Clinic Medical Professionals, 2023). The first LVAD was implanted in 1966 and since then multiple generations of LVAD have been produced and utilized (Prinzing et al. 2016). The overall chance of survival with the newer generation of LVAD systems has been critical for patients with heart failure who can’t get a heart transplant right away or is not capable of a heart transplant (Prinzing et al. 2016).

Betts JG, Desaix P, Johnson E, Johnson JE, Korol O, Kruse D, Poe B, Wise JA, Womble M, and Young KA. 2013. *Anatomy and Physiology*. Open Stax.

Cleveland Clinic Medical Professionals. 2023. *Left Ventricular Assist Devices (LVADs)*. Cleveland Clinic. https://my.clevelandclinic.org/health/treatments/17192-left-ventricular-assist-devices-mechanical-circulatory-support-mcs

Medical Advisory Secretariat. 2004. Left ventricular assist devices: an evidence-based analysis. *Ontario health technology assessment series*, *4*(3), 1–69. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3387736/

Prinzing A, Herold U, Berkefeld A, Krane M, Lange R, and Voss B. 2016. Left ventricular assist devices-current state and perspectives. *Journal of thoracic disease, 8(8), E660–E666. https://doi.org/10.21037/jtd.2016.07.13*

Shaffer F, McCraty R, and Zerr CL. 2014. A healthy heart is not a metronome: an integrative review of the heart's anatomy and heart rate variability. *Frontiers in Psychology, 5*(1040): 1-16. https://doi.org/10.3389/fpsyg.2014.01040