

APPENDIX

A NORMAL CARDIAC PHYSIOLOGY

In order to better understand the opportunities discussed in this work, we provide a brief medical review of normal function of the heart.

The heart consists of four chambers: two atria and two ventricles, one of each composing the right heart and one of each composing the left heart. The two atria (singular atrium) drive blood into the two ventricles, and the ventricles drive blood forward. The right heart takes deoxygenated blood from the body and pumps it through the lungs. The left heart takes blood from the lungs and pumps it through the body. The left heart does more work than the right heart, and the pressures that it produces are higher than the pressures produced by the right heart. There are four valves in the heart. The right heart valves are the tricuspid and the pulmonic. The tricuspid valve is between the right atrium and ventricle; the pulmonic valve is between the right ventricle and the lungs. The valves of the left heart are the mitral and the aortic. The mitral valve is between the left atrium and ventricle, while the aortic valve is between the left ventricle and the rest of the body.

The heart cycles through two phases as it beats: systole and diastole. In systole, the heart contracts and drives blood forward. In diastole, the heart relaxes and refills with blood. One common metric of cardiac function is blood pressure, represented by two numbers: a systolic and a diastolic pressure. The systolic pressure is the pressure in the arteries as blood is actively pumped out of the heart. The diastolic pressure is the pressure in the arteries as the heart relaxes. The heart typically spends about one-third of the time in systole and two-thirds of the time in diastole. The normal heart produces two sounds, called S1 and S2. S1 is caused by the closing of the mitral and tricuspid valves at the beginning of systole. Their closure prevents the backwards flow of blood from the ventricles into the atria. S2 is caused by the closing of the aortic and pulmonic valves. Their closure prevents the backwards flow of blood from the body or lungs backwards into the heart.