

# **The Excitable Heart**

*is a five part series*

***Part I: Introduction to Cardiac Arrhythmias***

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Seventy times a minute, 100,000 times each day, it beats effortlessly, indefatigably. Your heart is an organ like none other, charged with moving 4,300 gallons of blood each day through the intricate vascular network of our body. Although displacement of blood is its primary function, each and every beat of this unique muscular pump is initiated and finely regulated by electrical impulses that originate in the heart itself. Electrical currents, not in the form of electrons like those that course through the wires of our house, but in the form of ions, flow across the membrane of each cell causing voltage surges that set the heart in motion. Sodium ions rush into the cells, to be followed by potassium and chloride ions making a quick exit. The resulting voltage spike or action potential regulates the influx of calcium ions that mediate the sliding motion of filaments within each cell causing their shortening or contraction.

This process, repeated in each adjoining cell of the heart, causes the orderly spread of electrical activity and the synchronous contraction of the myocardium (heart muscle). Like other “excitable” tissues, the cells of the heart are electrically connected through low resistance pathways. These pathways facilitate the spread of the electrical impulse, ensuring efficient activation and pumping motion. Without electrical activity, the heart lies motionless and serves no useful purpose. Disorderly electrical activity also known as arrhythmias may also render the heart inefficient or totally useless as a pump. Extreme disorganization of the electrical activity within the heart can lead to sudden death, the single most prevalent mechanism of death in the United States, taking the lives of over 350,000 Americans each year. Nearly every minute of every day someone in this country dies of sudden cardiac death, very often the result of an arrhythmia known as ventricular fibrillation.

Arrhythmias are not always life-threatening. Some, including extrasystoles or “extra beats” may be quite innocuous. Others like AV nodal tachycardia, although not lethal, may be incapacitating. Still others like atrial fibrillation may be less crippling, but could lead to a stroke.

Through research scientists have identified a number of mechanisms by which cardiac arrhythmias arise. Prevention, diagnosis and treatment have advanced at a steady pace offering a better quality of life for some and a new lease on life for many sufferers of heart disease. Many of these advances are directly attributable to research done at the Masonic Medical Research Laboratory (MMRL), a leading center for the study of cardiac arrhythmias for over 50 years.

The tradition of excellence continues at the MMRL thanks to the generosity of concerned individuals, including Free and Accepted Masons nationwide. It is only through such generous and considerate gifts that our scientists are able to wage a vigorous fight against

the diseases that plaque humankind. Among those contributing importantly to our research are the Brethren of the Most Worshipful Grand Lodge of Florida. A better gift to humanity is hard to conceive.

The Masonic Medical Research Laboratory (MMRL) is a 501(c)3 not-for-profit corporation founded and sponsored by Freemasonry. Recognized as a one of the finest biomedical research centers in the world, the MMRL has contributed importantly to the modern day practice of cardiology. Over the past five decades MMRL investigators have been credited with either discovering or unraveling the mechanisms of a majority of known cardiac arrhythmias and is currently one of a handful of medical research institutes worldwide capable of studying the genetic causes of the lethal cardiac arrhythmias responsible for sudden death in young adults, children and infants. The MMRL is leading the way in the development of innovative safe and effective pharmacological treatment for atrial fibrillation, one of the greatest unmet medical needs facing our society.

The Masonic Medical Research Laboratory is the Flagship Charity of the Grand Lodge of Florida, Free and Accepted Masons. The institute is also supported by Grand Chapter of Florida, Royal Arch Masons and the general public as well as through corporate, foundation, National Institutes of Health and American Heart Association grants. On average, 84 cents of every dollar donated goes to cardiac research.

The Excitable Heart Series is provided as a public service through the MMRL. Please visit [www.mmrl.edu](http://www.mmrl.edu) or [www.gflamason.org](http://www.gflamason.org) to learn more or make a donation.