Report of April 2011 Meeting
Royal Society
Southern Highlands Branch

Speaker: Professor Jamie Vandenberg
Head, Mark Cowley Lidwell Research Program in Cardiac Electrophysiology
Victor Chang Cardiac Research Institute.
Topic: Genetics and Sudden Cardiac Death

Jamie Vandenberg began his lecture with the question, "What is sudden cardiac death (SCD)? He defined it in two ways. In the case of a witnessed death, SCD is an unexpected death that occurs within one hour of the start of symptoms. When the death is unwitnessed, SCD is defined as occurring within 24 hours of the person being seen alive and well. Most deaths that meet these definitions are caused by cardiac arrhythmias, the commonest mode of death in western societies.

Despite a spectacular decline in age-adjusted rates of mortality due to heart disease in the last 40 years, cardiovascular disease remains the number one cause of death in Australia today. Over half of these deaths are due to abnormal heart rhythms, resulting in SCD. Research into its prevention relies on the understanding of the mechanisms of disordered electrical signaling in the heart, better identification of high risk patients and the development of effective anti-arrhythmic drugs. Professor Vandenberg's research team has now come one step closer to understanding how the rhythm of the heartbeat is controlled, and why many common drugs, including some antibiotics, antihistamines and anti-psychotics, can cause a potentially fatal abnormal heartbeat.

In the same way that a set of metal wires carry electricity to light up our streets, our body has a series of channels that carry tiny particles called ions, into and out of cells to trigger a heartbeat. These channels must be opened and closed by a series of "gates". Recent research at the Victor Chang Institute has focused on the method of operation of these "gates", and how they can be affected adversely by certain drugs.

Depending on the position of the gates, many common drugs bind, or attach themselves to these channels, blocking the ions from passing through. This causes what is known as Long QT syndrome, where the length of the heartbeat is longer than usual, greatly increasing the risk of arrhythmia. The group of drugs most commonly associated with this side effect include anti-psychotic drugs, taken by patients with schizophrenia and other psychiatric disorders. Patients taking these drugs are three times more likely to die of sudden cardiac death due to an abnormal heart rhythm.

Professor Vandenberg's research team has studied the hERG potassium channel, an ion channel that determines how long each heartbeat lasts, and which is also most susceptible to being "blocked" by drugs. They describe the hERG channel as a particularly "sticky" channel, in that most drugs will bind to it when the outer gate is closed. They have now discovered how these outer gates operate, giving hope that future drugs can be designed to minimize unwanted side effects.

The vast majority of cardiac arrhythmias occur in the context of pre-existing heart disease. However in some patients, arrhythmias can occur in the absence of any structural abnormalities or damage to the heart. The commonest of these is the congenital Long QT syndrome (LQTS). This is a particularly devastating disorder as it typically results in the sudden death of young people who are otherwise fit and healthy. Congenital LQTS is caused by mutations in the ion channel genes that regulate electrical activity in the heart.

In the last part of his presentation, Professor Vandenberg described how genetic studies have contributed to a better understanding of SCD, and discussed how they may contribute to improved treatment options.

The 42-strong audience was most appreciative of Professor Vandenberg's excellent presentation. The vote of thanks was given by Ted Smith.

Anne Wood