OVC Scientist Spotlight: Dr. Tami Martino

Hearts beat to rhythm of circadian clock

OVC researchers are unlocking the links between circadian rhythms and health that may one day help physicians to better detect and treat heart disease.

Prof. Tami Martino, an assistant professor in the Department of Biomedical Sciences, is generating new insights into how critical proteins and hormones are governed by molecular “clocks” in tissues that run on the natural 24-hour circadian cycle.

One in three deaths in Canada is due to heart disease. Coronary heart disease is the most common cause of heart failure and death. According to the Heart and Stroke Foundation, every seven minutes in Canada someone dies from cardiovascular disease, costing the economy more than $22.2 billion per year in physician services, hospital costs, and lost wages and productivity.

Martino says that although the pathogenesis of heart disease leading to heart failure has not been fully elucidated, accumulating evidence suggests that alterations in heart structure, function, and molecular expression (remodelling) are intimately involved. Available therapies have had only limited success improving the long-term survival of patients.

In recent years, the measurement of neurohormonal rhythms and the subsequent discovery of actual molecular circadian clocks that endow cells with the ability to anticipate physiologic demands opened a new opportunity – to investigate and apply the important field of circadian physiology on clinical cardiology, and indeed medicine in general.

“Recently, our laboratory has demonstrated a remarkable day/night variation in gene activity in the heart,” she says. “Moreover, we showed that disturbing day/night physiologic rhythms (e.g. shiftwork, sleep disorders, neuro/endocrine disease) worsens heart disease and damage subsides only when the disruption ceases. We’ve also showed that timing drug therapies with the physiologic rhythms (chronotherapy) can improve disease outcome.”

“However, despite the now recognized importance of circadian rhythms in heart disease, the underlying mechanisms are still unknown.”

The primary focus of Martino’s current research is to (i) identify the role of diurnal rhythms and their disruption on the severity of myocardial infarction (heart attack) and outcome; and (ii) characterize the day/night proteome in the normal heart and in heart disease, and (iii) advance the benefits of timing of treatment post-myocardial infarction and heart failure. Her research program combines classic physiologic approaches (e.g. transgenic models, echocardiography, hemodynamics, circadian biology, chronotherapy) with state-of-the art high throughput technologies such as genomics (microarrays, biomarkers), proteomics (DIGE, mass spectrometry) and bioinformatics, to dissect the mechanistic pathways involved in circadian regulation of cardiac remodeling and treatment.
“This translational research will ultimately help to better understand disease pathophysiology, and this understanding is pivotal for the development of innovative therapeutic strategies to benefit patients.”

- Martino is one of several U of G scientists involved in a multidisciplinary research group looking at various aspects of cardiovascular disease, from the molecular level to animal models including naturally occurring heart conditions in dogs.

Members of the group share equipment and students, collaborate on grant proposals and work together on projects. They are supported by such agencies as the Natural Sciences and Engineering Research Council, the Canadian Institutes of Health Research and the Heart and Stroke Foundation.