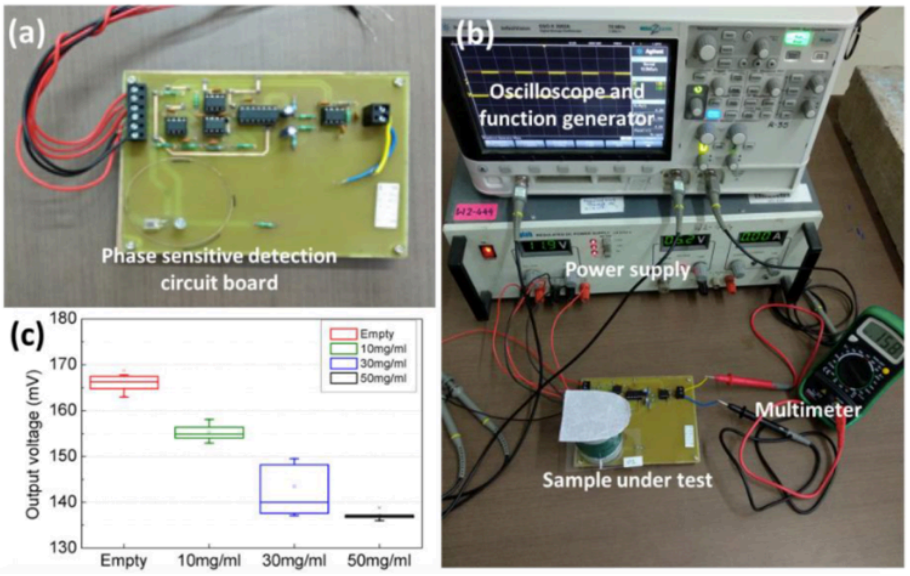
Nanocarbon-based sensor for early cardiac risk assessment

Project Lead: Prof. Siddharth Tallur

Specific problem being addressed: Cardio-vascular diseases (CVD) are a group of health disorders related to the heart and blood vessels that ultimately lead to heart attacks and strokes. CVDs are the number one cause of death globally. According to NCRB, from 2012 to 2021, there was a 54% increase in heart attack deaths. Often there are no symptoms of the diseases of blood vessels. So, it is crucial to diagnose the disorder at an early stage where proper medical intervention and lifestyle changes can minimize the chances of coronary heart disease and heart attacks. Myeloperoxidase (MPO) is an enzyme that can predict the health of cardiac muscles and, in turn, predict any cardiac risks well before the individual experiences them. The currently available tests are expensive, leaving a void for affordable diagnostic tools to detect cardiac risks at the initial stages.



Project Summary: The MPO enzyme can react with carbon. So we plan to make use of carbon nanomaterials for developing a sensor for detecting MPO. We plan to design a low-cost hand-held sensor, for monitoring the cardiac health of a person. Here we use carbon nanotubes (CNTs) and graphene oxide for sensing MPO in the human serum sample. *It predicts the risk of developing heart attack and other coronary disorders as early as six months to 30 days.* Our study will be optical absorption based and a novel method for the early detection of cardiac risk. The components used are not expensive, thereby decreasing the overall cost of the sensor. The figure shows a photograph of the experimental set-up, and experimental data collected from test samples. The packaging of the sensor will be simplified, and the system will be optimized for longer shelf life. Unlike the current methods, which demand sophisticated storage requirements, our sensor can be easily stored and made available at the remotest health centers in India.

Impact of this innovation: A study published in the scientific journal *Lancet* projected the annual number of deaths due to heart-related diseases to be around 47.7 million in India by 2020. The prevalence rates of CVD risk factors are only increasing, especially among the urban population. Early detection of these risk factors is one of the efficient ways to reduce the fatalities arising from CVDs. Our diagnostic test is affordable, less complex, small and easily portable. These factors make it ideal for its easy availability at health centers in remote villages and rural areas. Timely diagnosis and preventive approach based on the assessment can reduce hospitalization and related treatment costs and improve the quality of life, especially among the adult and elderly population. The affordability will make a significant impact on the rural population also.

IIT BOMBAY
VRCB
Wadhwani Research Centre for Bioengineering

WADHWANI
FOUNDATION