

## **Impact of low power microwave irradiation on biomolecules and biological systems at constant temperatures**

Tony Yan

Brock University, tyan@brocku.ca

While microwave has been recognized as a useful tool in chemical synthesis, which often leads to improved yields and selectivity, the impact of microwave on biomolecules and biosystems remains controversial. In our attempt to explore the possible “microwave-specific effects”, temperatures of systems exposed to microwave was controlled through simultaneous cooling. We demonstrated that while trypsin activity was significantly increased in the presence of 10 W microwave at constant temperatures, exposure to microwave had no influence on the activity of  $\alpha$ -amylase and phosphatase. At a cellular level, *Escherichia coli* growth was slowed down while exposed to non-lethal microwave at 37°C, however, the effect was transient. Proteomic analysis revealed differences in protein expression in *E. coli* cultures treated with microwave. RNA sequencing also suggested differences at the transcriptional level. In a PC-3 prostate cancer cell line model, our results suggest that while the microwave-treated cells did not undergo apoptosis or necrosis, cell membrane properties were perturbed. Furthermore, incubation of PC-3 and MCF-7 cancer cells with doxorubicin in the presence of microwave irradiation led to significant increases in the uptake of the anticancer drug. Taken together, results from our investigation suggest that exposure to microwave at constant temperatures can lead to subtle differences in the properties of biomolecules and functions of cells.