CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
S1823

Project Title
Dynamic Monitoring of the Effects of Lovastatin and Acetaminophen on Human Liver and Muscle Cells

Abstract

Objectives/Goals
The purpose of this project is to study the dynamics and drug-drug interaction of lovastatin and acetaminophen (APAP) in affecting the health of human muscle and liver cells. Both of these drugs have been reported in previous studies to induce mitochondrial toxicity. Since mitochondria are the "power plants" of cells, my hypotheses are that these drugs will cause dose dependent cell damage after prolonged treatments in both human muscle and liver cells, and that cells pretreated with lovastatin will be more sensitive to APAP-induced damage than cells that were not pretreated.

Methods/Materials
Instead of using conventional end-point cell assays, I monitored cell dynamics using real-time cell electronic sensing (RT-CES) technology, which automatically measures the microelectrode impedance at the bottom of each well in a special cell culture plate (E- plate). The changes of impedance in each well are used to derive cell index (CI), reflecting cell proliferation and viability. In this study, human liver cell line (HepG2) and muscle cell line (A204) were seeded in the wells of E-plates and cultured with the drugs for 72 hours at 37C. The CI was collected every minute in the first hour after treatment and every 15 minutes thereafter. The independent variables were the concentrations of the drugs and length of time of treatment. The dependent variable was the CI.

Results
APAP induced dose-dependent decrease in CI in both HepG2 and A204 cells in the 1st hour of treatment. A204 cells were not able to recover from the damage, and the CI remained at low levels, but the HepG2 cells recovered from the damage after 48-hours, and the CI grew to the same level as the control cells. By itself, lovastatin did not show significant damage to either cell type even at the highest dose (50uM). However, the 48 hour incubation with lovastatin made the liver cells more sensitive to APAP-induced cell damage when compared to the cells without lovastatin treatment.

Conclusions/Discussion
Dose-dependent decreases in the CI were observed when HepG2 cells were treated with up to 20 mM APAP, consistent with previous studies of APAP hepatotoxicity. In addition, pretreatment with lovastatin made HepG2 cells more sensitive to APAP-induced damage. This finding may warrant a caution for patients who take lovastatin and large doses of APAP together.

Summary Statement
A comparison of the effects of lovastatin and acetaminophen on human liver and muscle cells using microelectrode impedance-based real-time cell electronic sensing (RT-CES) technology.

Help Received
Used lab equipment at ACEA Biosciences under supervision of Dr. Xu and Ms. Zhu