CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Adithi R. Iyer

Project Number

S1214

Project Title

The Role Model Effect: Optimizing Blood Macrophage Signal Transduction in a Novel Treatment Method for Leukemia

Abstract

Objectives/Goals

Leukemia is notoriously difficult to detect and to treat. The current leading treatments, radiation and chemotherapy, are either indiscriminate in inducing general cell death or only effective over short periods of time. The Role Model Effect seeks to explore a venue for treatment that primes the macrophage-mediated immune response to act against leukemic cells while selecting for healthy cells by increasing macrophage density to facilitate apoptotic signal amplification.

Methods/Materials

Pro-B leukocytes of five different genetic markers, (WT, MIG IRES, P210, JAK2VF, JAK2VI) were cocultured with macrophage "role models" plated at high densities over 72 hours. Every 24 hours, the B cells were counted using flow cytometry. After the assay was completed, the macrophages were stained for Annexin V-PE to indicate apoptosis. In a secondary assay, the apoptotic rates of cocultured MIG cells were compared with those in MIG treated with UV-A radiation, chemotherapeutic drug thapsigargin, and untreated cells 24 hours following treatment.

Results

In all cell groups, growth slopes either reversed or plateaued after treatment by factors of 60X or higher while wild type cells thrived in treated environments. Treated VF cells had a 95.86% apoptosis upwards of 46.38% from the untreated strain; P210 increased 46.28% to 95.38%, and WT cells increased 9% to 89.89%. P210 and VF had the highest percent differences of around 46.28%.The MIG cells increased by 33.16% to 94.56% and VI increased by 27.49% to 95.47%. In the Case Study, thapsigargin showed 26.25% apoptosis and UV-A had 69.09%. The macrophage-treated MIG cells had 94.56% apoptosis.

Conclusions/Discussion

The results of this assay support the individual hypotheses of the Role Model Effect. The first hypothesis was that cellular #role models# would be able to have an impact in reversing proliferation characteristic of cancers. This was supported by the growth curves, in which the growth rates in untreated cells were considerably reversed in treated cells. The second was that these role models would push cancerous cells towards apoptosis through cell signaling. This was supported by increased apoptotic percentages across all groups which surpassed those of cells treated with simulated radiation and chemotherapy and was especially prominent in tyrosine-kinase stimulant mutations. This research paves the way for noninvasive macrophage transfusion in treating leukemia.

Summary Statement

The Role Model Effect presents a novel approach to leukemia treatment by amplifying cell signals in the macrophage-governed immune response to prime the immune system against leukemia and simultaneously select for healthy cells.

Help Received

Lab facilities and materials/procedures completed at UCI under supervision of Dr. Fleischman; Sarah Morse approved project parameters as they were drafted.