Understanding the Relationship Between the Gut Microbes and Leukemia Growth

Iyer, Keshav (School: Nikola Tesla STEM High School)

Leukemia is a blood cell cancer ranking 15th in worldwide cancer incidence and 10th in death. The gut microbiome and its metabolites, e.g., short-chain fatty acids like propionate, are thought to modulate immune function against cancer cells. The direct impact of propionate on leukemia cell growth or apoptosis remains uncertain. Leukemia cells from mice were cultured and treated with varying concentrations of propionate (1.8 to 14.4mg/mL), DMSO (positive control in which cells undergo apoptosis), or saline (negative control). Each condition was plated in triplicate in a 96-well plate. Cell viability and death were assessed using trypan blue staining by a hemocytometer and two automated cell counters (ABX-Micros-60/Countess 3). One-way analysis of variance (ANOVA) was used to compare groups (GraphPad Prism software). On d+1, there was no difference in cell counts (using the ABX-Micros 60), but we observed a dose-dependent effect of propionate on cell death (using the Countess 3 instrument). There was more cell death in wells exposed to the highest propionate concentrations, equivalent to that seen in the DMSO-treated control wells. On d+2, we observed the same dose-dependent effect of propionate: the higher the concentration, the more dead cells were observed. With 14.4mg/mL propionate treatment, we observed the highest proportion of dead cells (21.6% vs 70.6%; a 3.27 fold increase; p=0.0412 compared with saline). This study shows that propionate may directly inhibit leukemia cell growth or induce signals that result in cell death. The next steps will be to repeat these experiments and include a greater range of time points and propionate concentrations. We will also explore the role of propionate in altering T-cell responses to leukemia cells in vitro.

Awards Won: