Cancer-inhibiting Diet-Derived Alkaloids in Secretions from Hawaii Poison Dart Frog Dendrobates auratus

Cook, Aslan (School: Kamehameha Schools Kapalama Campus)

Dendrobates auratus is a species of poison dart frog with skin secretions that contain diet-derived alkaloids. Plant alkaloids have been used in cancer research, so alkaloids in D. auratus secretions may also have anticancer properties. Previous years' research has shown that D. auratus secretions affect RPMI-8226 myeloma cells. This year focused on specifying cellular effects of alkaloids. Three pumiliotoxin and two allopumiliotoxin alkaloids were identified in D. auratus secretions via liquid chromatography mass spectrometry. Pumiliotoxins and allopumiliotoxins block voltage-gated sodium channels, which are key in cell proliferation for many cancers, breast cancer in particular. Interfering with these channels can lead to cell-cycle arrest, which was observed in cells treated with alkaloid-containing frog and ant extracts. Extracts were made from D. auratus skin secretions, as well as from two species of ant found in the D. auratus diet— Technomyrmex difficilius and Plagiolepis alluaudi. Extracts were tested against RPMI-8226 myeloma and MCF-7 breast cancer cells at various time points. Cells were quantified via hemocytometer counting and XTT viability assay. Both frog and ant extracts significantly inhibited RPMI-8226 and MCF-7 growth. Hoechst nuclear staining showed enlarged cells in extract-treated cells, which may indicate that extracts are inducing cell cycle arrest in the form of senescence. Pumiliotoxin and allopumiliotoxin alkaloids from the diet and secretions of Hawaii Dendrobates auratus inhibit the growth of RPMI-8226 myeloma and MCF-7 breast cancer cells, likely by blocking voltage-gated sodium channels in the cell.