Many commercially viable crystalline materials emerge from the synergistic research efforts of compound discovery and process development, which encompass complex, multi-faceted challenges in many academic disciplines. Solid state chemistry plays an intricate role in the discovery and development of functional materials. This presentation highlights the chemical aspects in the research of novel thermoelectric materials and in the development of emerging hard radiation detection materials. In the study of novel thermoelectric materials, electrical properties of the layered rare-earth pnictide sub-oxides were optimized by chemically altering their charge transport mechanisms. In the search for low cost X/γ-ray detectors, chemical guidelines and intuitions were employed during the selection, screening and crystal growth development of the lead selenophosphate, Pb$_2$P$_2$Se$_6$.

References: