p50 and Rel A form a heterodimer protein in the NF-κB transcription factor family responsible for the regulation of gene expression involved in immune system response, inflammation, and cell development. Our research focused on comparing p50 and Rel A between *H. sapiens* and *M. Musculus* to assess similarities and evaluate the reliability of mouse models as predictors for biological responses in humans. In stage one of our research, we expressed and purified our target protein from E. coli cells then determined the efficacy of our protocol via SDS-PAGE. Our gel depicted vivid bands, indicating the presence of p50 and Rel A. Prominent streaking along the gel columns, however, display unwanted proteins. In stage two of our research, we optimized the wash step in our protein purification protocol by increasing the concentration of imidazole. Imidazole is often used to disrupt and elute any weak binding proteins; by increasing the imidazole concentration, more undesired proteins should detach from the Ni2+ column leaving only our target protein in the SDS-PAGE. The results of the SDS-PAGE performed in stage two suggest that the alteration of our imidazole concentration did not lead to an increased purification of our p50 and Rel A protein; moreover, unwanted proteins were still present in our gel, indicating further optimizations are still necessary for better purification of the p50 and Rel A protein. These refinements are instrumental in enabling future experiments investigating the reliability and validity of mouse models in the overall study of human health.