Ovarian cancer has been identified as the most deadly gynecological cancer, usually diagnosed in stage III or later, leading to a grim prognosis for those affected. With a five-year survival rate of roughly 44% for patients diagnosed in stage II, traditional chemotherapy leaves something to be desired in terms of affectivity. Targeted therapies, among which include aptamer therapies, are designed to kill only malignant cells. The Richardson lab identified seven single-stranded DNA aptamers, 60 bases in length (RLA01-RLA07), suitable for binding to cancerous ovarian cells from a panel of 40 potential aptamers. The binding affinity of RLA01 through RLA03 had been previously tested and all three were capable of both interacting with the membrane of cancerous ovarian cell lines and internalizing into the cytosol while they did not interact with normal cell lines. Of the four remaining aptamers, RLA04 and RLA06 were used for this investigation of binding affinity with the human ovarian adenocarcinoma cell line CAOV-3 and the normal Human Ovarian Surface Epithelial cell line (HOSE). Through flow cytometry and confocal imaging, it was found that aptamers RLA04 and RLA06 not only associate with the cell membrane of cancerous CAOV-3 cells, but they also internalize into the cytosol while the aptamers do not associate at all with the normal HOSE cells. The binding affinity of the aptamers with the CAOV-3 cells varies, and following a one-way ANOVA, it was further determined that the differences between aptamer binding affinities were significant and of interest for further evaluation of their differences. RLA01 has the highest binding affinity as it has the highest average number of fluorescence events determined by fluorescence activated cell sorting. RLA06 had the lowest average number of fluorescence events determined by FACS and therefore, the lowest binding affinity. RLA04’s binding affinity fell between RLA01 and RLA06.

The Richardson lab will finish out aptamer binding affinity evaluations with the aptamers RLA05 and RLA07. Following the conclusion of aptamer binding affinity testing, aptamers will likely be evaluated for their bind affinity for cancerous cells of the cervix and uterus, which are common metastasis sites for ovarian cancer. The affinity of aptamers for only the cancerous cell lines has potential as a diagnostic test for ovarian cancer which is usually asymptomatic in stages I and II. Additionally, the aptamers that have exhibited the ability to interact with the ovarian cancerous cells will be conjugated with nanoparticles developed by the Ogle lab in the chemistry department. The nanoparticles are specially engineered to have a higher specificity for cancerous cells that is enhanced when they are conjugated with aptamers. The nanoparticle (with aptamer attached) will be loaded with a chemotherapeutic agent and used as a targeted therapy for the ovarian tumor(s). Use of the nanoparticles conjugated with aptamers will decrease the amount of chemotherapeutic agent needed as well as cytotoxicity to normal cells since the drug will be applied to only cancerous cells.