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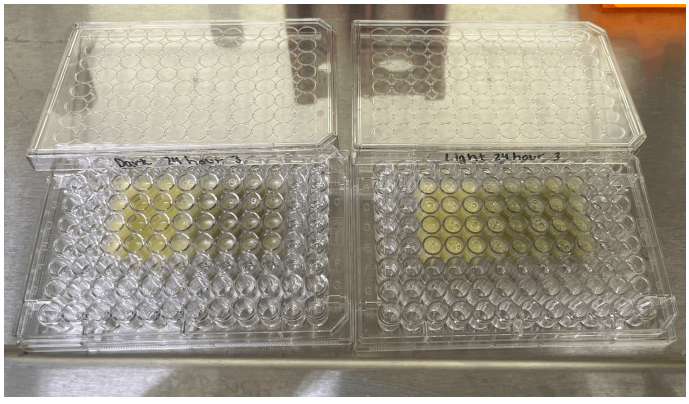
Biological Analysis of Bioactive Substances as Switchable and Targetable Photopharmaceuticals

I will admit the title of this paper is a mouth full and a bit confusing, so hopefully I'll be able to break it into pieces to explain what I did and what I found this summer. This summer I was trying to prove that these synthesized substances (or drugs) would show a different effectivity on illnesses or diseases such as cancer whether they were in an environment with light or in a dark environment. The drugs I'm working with are azologue drugs, meaning they contain a nitrogen-nitrogen double bond. This unique double bond allows the drug to adopt two different conformations. Cis, where the side groups are on the same side of the double bond. And trans, where the side groups are on different sides of the double bond. The goal of this project is to apply the drug Nilotinib and Imatinib in different concentrations to cells on a 96 well plate, and see a difference in its effectiveness under dark and light conditions. One of the plates is placed under a light that goes off for two minutes initially and then a minute every hour. The other plate is in a dark environment, both placed in an incubator at 37 degrees celsius and 5% of CO_2 present in the environment.

So far, I got one of my trials to look pretty good, but I have yet to complete another trial showing a significant difference between the light and dark plates, this was until my last trial. I'm looking to see somewhat of an ombre coloring in the plate by using a chemical called MTT. The added MTT will turn alive cells burgundy while the dead cells remain yellow once dimethyl sulfoxide is added. At the lower concentrations I expect to see a burgundy shade that turns to yellow as we look towards the left side of the plate where the drug concentration increases. This signals that there are more cells being killed at the higher concentration of drugs. In these trials we are wanting to observe more dead cells in the dark plate than the light plate, meaning the drug is more active in the dark. Finally, on the last day I pulled out my last trial for the summer and the results that I analyzed looked pretty promising.



Above is a picture from my last trial. This trial we didn't use dimethyl sulfoxide, instead SDS was added to the incubated MTT, so the alive cells don't show a burgundy color, but they show a dark green. As you can see, the dark conditioned plate shows lighter wells than the light

conditioned plate, so the drug kills more cells in a dark environment. And overall I found that the drug was four folds better in the dark than it was in the light.

This project is crazy important to Albion College and for those dealing with any type of sickness that these drugs can be applied to. Proving that these drugs can and are area selective when a light is applied is a huge step to area selective treatments, like cancer treatments. If this is made possible, the crazy uncomfortable and painful side effects can be reduced if not eliminated because when going through the treatment your healthy cells are not also being killed with the cancer cells. In the future, I plan on presenting my findings at the Elkin Isaac Symposium in the Spring of 2025, and when I find more success with this biological analysis my plan is to help Noah Rollison, who synthesized these drugs, and Craig Streu write a paper to publish in a journal. This research experience has taught me more than I thought possible. I'm a very type A personality who has very high expectations. Because of this I'm not used to failing at things, especially not academically, but summer research taught me that there will be failures, and sometimes you don't know why. I've learned how to push past these failures and continue to test trial after trial until I get a success.

Finally, I want to thank FURSCA, my advisor Dr. Craig Streu, and my lab mates. FURSCA for funding and supporting my research during this 8 week period. Dr. Craig Streu for overwatching me in the lab and mentoring me through this difficult research, and lastly my lab mates for being supportive and making this summer full of fun and memories.