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There's no doubt, if there was one place that could give you confidence in the possibility of creating amazing things it would be the Center for Biotechnology and Interdisciplinary Sciences. The center, nicknamed Biotech, looked like high tech version of Noah's Ark, grandeur and all, but the real wonder was on the inside. On our way up to Dr. Gross' lab the first day of our internship, we gazed from wall to wall at the various posters depicting the work conducted by the RPI scientists. Looking at 3d organ printing, limb regeneration, buildings mirroring biologic structures, I half expected to see a time machine stowed away somewhere. Dr. Gross, our mentor for the program, and his green chemistry projects would not seem out of place, as I soon came to learn.

As soon as we made our acquaintance with the Doctor, we were able to take a look at the various projects his post-doctoral candidates and students were planning to do. Shaheer, my partner for the internship, and I had decided instantly that we wanted to conduct our research on the Sophorolipids, a type of compound that had a special reverence in Dr. Gross' lab thanks to its near limitless possibilities as substitutes for many petroleum based chemicals and tools. The reason why they are so useful is because they have amphiphilic properties, which means one side of the compound is hydrophilic, which means a tendency to mix with water, and the other side is hydrophobic. When you place this compound in a mixture that has water and a hydrophobic substance, think oil and water in your favorite Italian vinaigrette, it will align itself along the interface of those two substances and increase the miscibility, or the ability for the contents to become homogenous, of the system. Instead of getting those lava lamp-esque droplets suspended in the water, you would instead see a one-state substance in that bottle called an emulsion.While this wouldn't seem terribly helpful for you or your salad, emulsions are a vital part of everyday life. Paints, shampoo, soaps, makeup, condiments, lotion, etc. all have emulsifiers, natural and otherwise, that allow them to function and in turn keep us all entertained, clean, full, etc. Knowing all this, and also knowing that there is a large possibility that many companies take shortcuts in terms of their products and employ such compounds, called surfactants, that are either bio-accumulative, unsustainable, or toxic to people and the environment. Sophorolipids are important because they are biodegradable and biobased which means the would have a limited impact on us and the earth.

Shaheer and I specifically decided to work on Sophorolipids and their ability to remediate crude oil in soil washing. We were previously aware of the numerous oil spills that threaten aquatic ecosystems constantly around the world, namely the BP Deepwater Horizon oil spill that occurred in 2010, but we came to learn that oil spills on land was just as pressing of an issue. In America alone, the amount of crude oil we produce and transport over the land has skyrocketed in recent years, and with that incidents of explosions or accidents that expose environments to this oil. The oil alone is toxic because of certain volatile substances such as methane and

carcinogenic compounds such as benzene. Benzene is recognized as one of the largest volume petrochemical compounds that humans interact with on a day to day basis. Studies by the National Toxicology Program and International Agency for Research on Cancer have verified Benzene as a "significant carcinogen for humans" and studies indicate that Benzene exposure in mice can induce mammary tumor growth (Huff 1989) and cause considerable mutation of the genes responsible for suppressing tumor growth. (Houle, 2006), Oil companies often times use surfactants, such as Tween 80 to clean up these spills. While Tween 80 in its food grade is a harmless surfactant, the Industrial grade used in these spills produces an extremely harmful chemical named 1,4-dioxane, that has been proven to be a carcinogen amongst other things. Several studies have linked 1,4 dioxane to breast cancer growth, such as a study published in a September 2009 edition of *Inhalation Toxicology*, that found 1,4-dioxane to be a definitive cause of breast cancer in males. Shaheer and I chose to see if Sophorolipids were able to perform well enough to replace this and other harmful surfactants.

Our experiment was focused around a handful of chemicals, one of the being Tween 80, while we tested different sophorolipids such as Lactonic Sophorolipid, Acidic Sophorolipid, Ethyl Ester Sophorolipid and Decyl Ester Sophorolipid. The difference between these are that Lactonic and Acidic Sophorolipids are compounds that exist readily in nature, produced by organisms such as the bacteria *Candida Bombicola*, while Ethyl Ester Sophorolipid and Decyl Ester Sophorolipid are modified sophorolipids produced through a process known as Base Catalyzed Transesterification. We added solutions of these surfactants along with a control of deionized water into samples of soil and sand contaminated with crude oil and used a shaker incubator to manipulate factors such as speed of shaking and temperature to see how they affect the sophorolipids performance. To analyze the results of the performance, we decanted the surfactant solution from the samples and added hexane, a compound that would dissolve the leftover oil, and test the optical clarity of the solution in a Spectrophotometer.

The procedure seemed straight forward enough, but the sheer amount of permutations that we could produce based on the different factors we had had our hands full to say the least. I am considered a (slight) workaholic, so we would often be in the lab from the morning until well into the evening, with lunch breaks of course, working to make using sophorolipids in oil spills a reality. In the end, we were able to produce a multitude of data that supported our hypothesis that sophorolipids could remediate oil from soil better than commercial surfactants, with the modified sophorolipids working especially well.

I can wholeheartedly say that I am sincerely thankful to Mrs. Laura Weinberg, Mrs. Lisa Levine and the rest Great Neck Breast Cancer Coalition as well as Dr. Gross and Amanda, our post doctoral mentor, for granting me this life affirming opportunity. Not only was I able to solidify my interest in a career in the sciences and have my first experience in a lab setting as a peer among researchers, but I was able to contribute to a wider population. Knowing that I helped make a step, however small, in the journey to keep people safe and free of dangerous threats to their health, is more than enough momentum to keep me down the path of making the world a better place for all of us.