LAB SYLLABUS

I have identified four labs that I hope that we will be able to complete. These are fundamentally “discovery” labs meaning that there is no clear set of results we are supposed to find. Instead, these labs represent a few different systems in which chemical ecology operates, and we will attempt to combine the tools of chemistry and biology and learn something about organisms. My hope is we can combine a biological assay with a chemical assay with the ultimate goal of experiencing how cool science can be.

The catch in all of these labs is that some of them have waiting periods of several days (microbial ecology and walnut allelopathy labs). We have tried to setup a tentative schedule that accounts for the dovetailing necessary, and I ask that you remain flexible in dealing with the labs on a day-to-day basis as they evolve.

I do require that you keep a lab notebook – this should be a separate notebook from class notes and entries must be dated. You are also required to submit one formal lab report as part of your portfolio; however you may include others for additional evidence of learning. If you have questions about how to keep a notebook or writing a lab report, please see the links on my website as reference. Also keep in mind that writing is a process that requires feedback. I would be pleased to sit down with you and provide detailed feedback on anything before you hand it in. That way, you get a better grade AND you’ll know how to do it better the next time!

Termite trail markers – “What do termites read?”

This is an interesting lab in which you will observe termite behavior and identify what variable causes the greatest response. While this is a “standard” lab used in many schools, being the veritable chemist, I’d like to take this one step further and try to use chemical analysis to see if we might identify a potential compound responsible for the behavior. This is a pure discovery lab and is the way we approach uncovering the secrets of chemical ecology.

Beetle chemistry – “Bugs in the Pantry”

There are a lot of stories about beetle chemistry, probably because they are relatively easier to catch and keep in a lab. Fortunately, they also have some relatively interesting chemistry about them and we are going to attempt to exploit that chemistry. In this lab, you will learn some of the techniques for working with beetles with the aim of harvesting a defensive secretion. We will go one step further and connect the biology to the chemistry using an analytical technique to see if we can identify chemical specific compounds present in the secretion.

Microbial ecology – “The Great Drug Hunt”

Although it is much more exciting to watch insects attack each other and directly watch chemical ecology in action, soil ecology is probably more relevant for your everyday life. Many of the prescribed drugs exist because of the chemical interactions that occur among soil microorganisms. In this lab, you will brave the cold, frozen fields of Iowa and gather soil samples. These samples will be thawed out, suspended in solution, and spread on agar plates to see what sorts of slimy things we can grow. Then using a couple of test organisms, we will challenge the microbes to a duel and see if there are any chemical interactions that might be worth studying. This essentially models the first stages of the drug discovery process that Big Pharma hopes will net them billions of dollars in sales.

Walnut allelopathy – “Gardening with a Brown Thumb”

Allelopathy involves the release of a metabolite by one plant that inhibits the growth of surrounding plants. There are many presumed examples of this in nature, although it is not always simple to experimentally demonstrate that allelopathy occurs in specific systems. One way to gather evidence that suggests allelopathy occurs is to find chemical compounds in plant material that inhibits seed germination. This is process we will be undertaking. The first phase is to see if black walnut (a common example allelopathy) extracts will inhibit seed germination. Then we will examine those extracts for the presence of juglone, a chemical compound believed to be an allelopathic agent in the walnut. Again, this is one attempt to link biological activity to the presence of a chemical and while it is unlikely we can unequivocally demonstrate that juglone is responsible for allelopathy, we can at least acquire supportive evidence.