Research Interests

Chemical Education

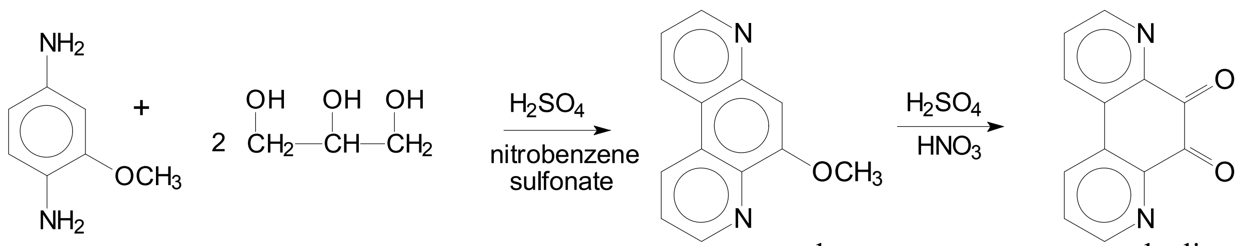
Since the beginning of my teaching career, I have been interested in what works (and what doesn't) in terms of chemical education and classroom effectiveness. Therefore, I have spent much time and effort in the arena of chemical education. Work on rearranging the sequence that general chemistry material is taught in the classroom from a logical sequence standpoint from the prospective of the student led to a peer reviewed publication (Sequencing General Chemistry, A New, More Logical Approach. B.J. Yoblinski, *Journal of College Science Teaching*. **2003**, *32*, 382). My aspiration is to continue to pursue and investigate methods that make learning general chemistry relevant and meaningful to the student.

As the Introductory Chemistry Coordinator at Appalachian, I developed and instituted a peer teaching assistants (TA) course which carries a one-semester hour credit. Those placed in the course must first be recommended by a faculty member in the department of chemistry and interviewed by myself. The potential TA's are provided training in preparation for assisting in the laboratory. The performance of the TA is graded on a satisfactory or unsatisfactory (S/U) basis. I know of no other universities that regularly place about 20 students into general chemistry labs for course credit rather than monetary pay. I've sold this program to the students on the basis that future employers want more than just technically competent personnel. They actively seek scientists who have developed the ability to interact and communicate with co-workers in a productive and positive manner. Routine academic classroom work simply cannot provide the invaluable experience of interacting with fellow classroom peers from a position of responsibility. Our students continue to be amazed at how much more marketable they become to graduate schools with this experience on their academic transcript and resume. Further, letters of recommendation from the lab instructor(s) of record frequently hold more weight that those from academic performance only. This program has been so successful and unique that it led to another peer reviewed publication (Peer Teaching Assistants in General Chemistry Labs. Yoblinski, B.J.; Rhyne, T.C. *Chemical Educator*. **2004**, 9, 303).

In terms of student projects, I was the faculty advisor for the departmental chemistry club for numerous years. During my first year, I became frustrated by the lack of involvement our members seemed to have with club activities. It was the same old story played out in clubs across academia. A select few students seem to carry the workload for the whole group and many members seem reluctant to take any initiative in club affairs. This motivated me to find a large project that would instill a sense of mission (and excitement) into the club. I envisioned a project that would have much visibility and require enough involvement to preclude short term completion in a week (or even a month). More specifically, I wanted a project that would require extensive planning and a great deal of coordination as well as member teamwork and cooperation (not so different than basic, fundamental chemical research). Yet, I wanted the project to be an endeavor that the Chem Club members would embrace and follow through to conclusion. The chemistry department had recently moved into a newly constructed building that contained numerous large, barren walls. We decided to construct an "atomically correct" long version of the periodic table from which all students and faculty can benefit and appreciate. Although the project took over 2 years to complete, it now stands as a monument that is admired and regularly used as a teaching tool in the department. This project led to a peer reviewed publication (Stretching the Periodic Table. B.J. Yoblinski, *Chemical Educator*. **2003**, *8*, (6), 389).

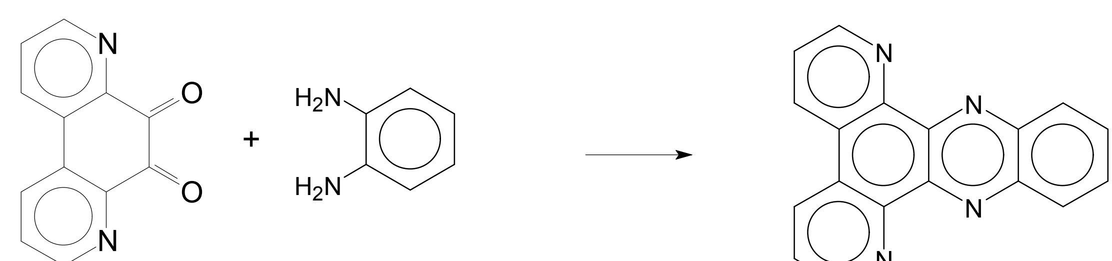
Chemical Research

As a trained inorganic photochemist, my chemical research focuses on the synthesis and characterization of potential light harvesting metal based chromophores. I am interested in preparing completely planar, doubly-bidentate polypyridyl chelating ligands to serve as the basis for multi-metal attachment. A variety of such ligands can be envisioned for attempted synthesis. However, a critical starting material for these ligands is 4,7-phenanthroline-5,6-dione (phndione). The compound is not commercially available but could occasionally be obtained as a gift in small quantities by Ciba Geigy Corporation. After the leverage buyout and reorganization of Ciba Geigy into Novartis, the compound was no longer manufactured or available as a gift. However, a literature article appeared in 1996 for the synthesis of phndione. (Imor, S.; Morgan, R.J.; Wang, S.; Morgan, O.; Baker, A.D. *Synthetic Comm*. **1996**, 26, 2197-2203). I've directed 2 research students in the attempt to synthesize this desirable compound and have finally concluded that the publication does not work as described. Using the collaboration of one of our organic chemists, I've directed a particular undergraduate research student toward tweeking the reaction conditions and manipulating the recovery process to the point that I believe I can now generate useful quantities of phndione.



mephen phndione

Assuming a reliable supply of phndione, I propose to synthesize a series of doubly-bidentate polypyridyl chelating ligands from various 1,2-phenylenediamine species as follows.



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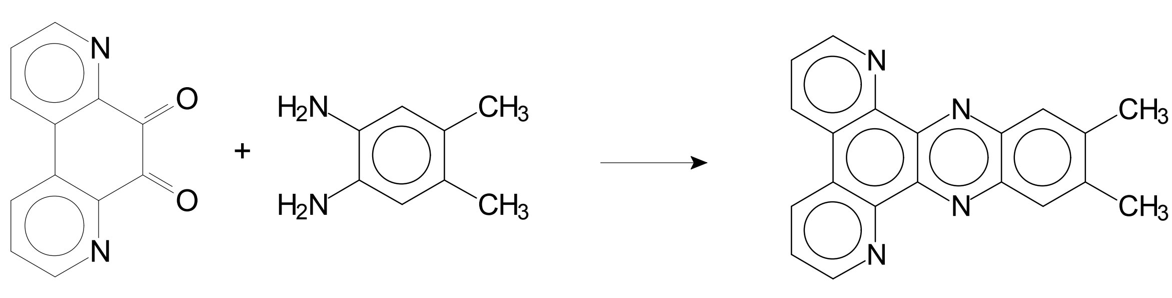
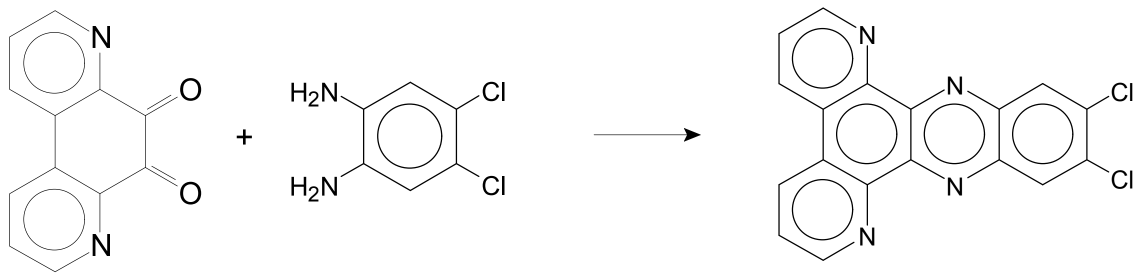
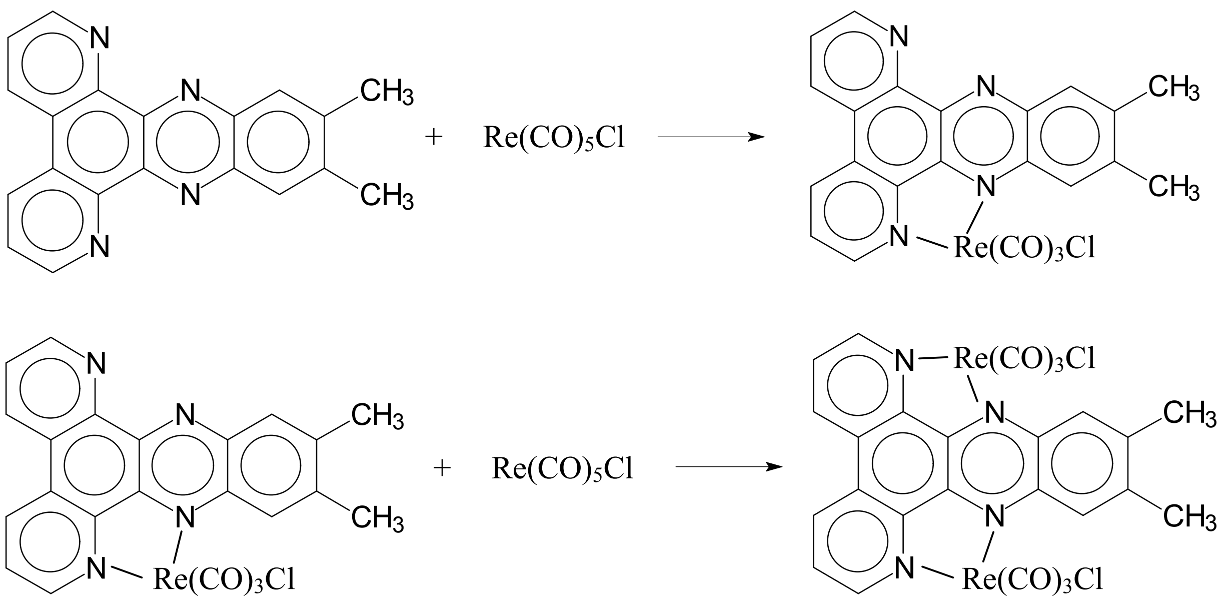
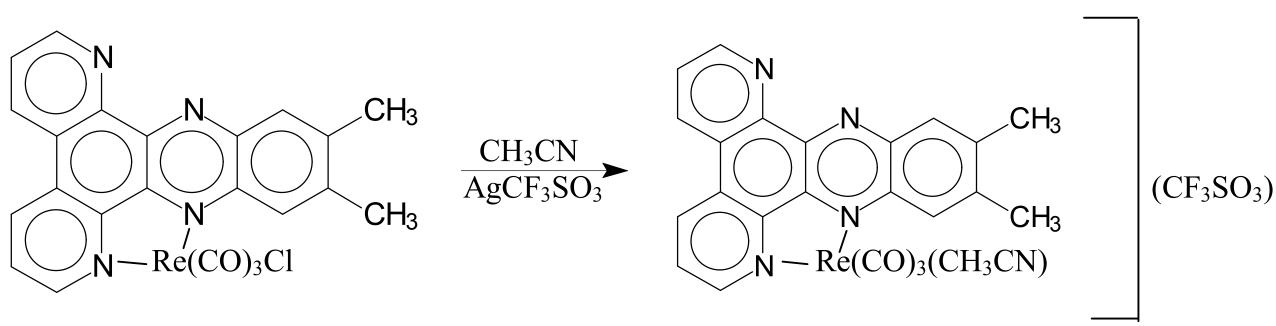




Of course many other ligands can be envisioned by manipulation of the attached chloro and methyl groups. These doubly-bidentate polypyridyl chelating ligands will serve as the starting point for metal attachment such as a -Re(CO)$_3$Cl moiety. The synthesis of both mononuclear and dinuclear species can be envisioned.



The supporting chloride on the –Re(CO)$_3$Cl moiety can also be removed and replaced with an acetonitrile molecule (resulting in a cationic complex species) in an effort to tune excited state energies.



A research project such as this is ideal for the undergraduate student because the project is actually feasible. A multitude of benchtop techniques are required for the preparation and purification of compounds such as reflux, sonication, roto-vaporization, extraction, and column chromatography. Numerous techniques that are already familiar to a junior/senior chemistry undergraduate are incorporated into the characterization of the compounds such as ^{1}H NMR, IR and UV-Vis spectroscopies. If time and equipment are available, the undergraduate student could be exposed to more advanced measurements such as the photophysics of the chromophoric compounds including luminescent properties and excited state lifetimes. Such compounds also lend themselves to electrochemical investigations such as cyclic voltametry.

My research has always focused primarily on mentoring the student in order to develop their technical laboratory skills as well as application skills. This project is quite "doable" for undergraduate students. It's a project that is not so complex that an undergraduate would "burn out" after months of failure (a situation I have seen all too often occur). I have used my research lab as a platform for the student to learn to independently solve problems that invariably arise. They are certainly given direction, but also are required to attack problems and search for solutions without constant input from me. While at times frustrating to the student, the research process in my lab is designed to sharpen their creativity and independent reasoning ability. In this way, I believe I am preparing them for the next step of graduate school or industrial work.