Description of Proposed Honors Option

▶ <u>Project Title:</u> Introduction to Electrical Impedance Tomography

▶ <u>Course Description:</u>
Linear Algebra is a general education, mathematics course required by my major. Prof. Marvel tells me that the course introduces concepts associated with linear functions acting on high-dimensional spaces, and the way that those concepts are encoded by the algebra of matrices. Although applications will make cameo appearances throughout the course, they will occur mostly as one-shot exercises that highlight one particular concept or skill; none is covered in depth.

▶ <u>Proposal Overview:</u>
Cancer researchers have found that tumors tend to conduct electricity much better than healthy tissue, and it is hoped that this fact can be exploited to devise a new means of detection: locate tumors by locating regions of high conductivity (low resistivity). As a practical matter, since our intention is to avoid dissecting the patient, this requires us to reconstruct the conductivity of a body's interior based solely upon knowledge at its boundary, and that is the goal of electrical impedance tomography (EIT).

In this honors option, I will extend the standard course in linear algebra by investigating its application to electrical impedance tomography in the discrete setting. Under the direction of Prof. Marvel, I will familiarize myself with the physical laws that govern voltage and current in biological tissue, and the systems of linear equations that result from them in inhomogeneous (location-dependent), anisotropic (direction-dependent) situations. This will involve directed reading, and the completion of exercises in which I see how the ideas and techniques of linear algebra help us to accomplish the goal of EIT. In the end, I hope to have a thorough understanding of the problem and the associated linear algebra.

▶ <u>Deliverables:</u>
Prof. Marvel will help me learn the basics of LaTeX (a mark-up language used for mathematical writing), and I will use what I learn to write a report that summarizes the application of linear algebraic ideas to the problem of EIT. I will also deliver an oral presentation of my findings at the Honors Creativity and Research Symposium.

Prof. Marvel will coach me toward a high-quality outcome, and will assess whether I have met the terms of this option at a level that demonstrates the substance and quality expected of honors-level work.