Title: Fluorophores for Biological Applications

Program of Study: Biomedical Sciences – Department of Biology & Chemistry

Presentation Type: Physical Poster Presentation

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Category: Experimental (Basic)

We present an interdisciplinary project incorporating the fields of organic chemistry and biology. Fluorophores are compounds that absorb light at a specific wavelength and subsequently fluoresce at a greater wavelength. Fluorophores are invaluable to biological research, as fluorescent dyes are used routinely in fluorescent microscopy to probe for the presence and location of biological molecules and structures in cells, among other applications. Common fluorescent dyes include DAPI, GFP, and rhodamine 123, which allow for the visualization of DNA, proteins, and mitochondria, respectively. Liberty University has recently acquired a fluorometer, which allows for the study of the fluorescent properties of fluorophores, including excitation and emission wavelengths (color), stokes shift, molar extinction coefficient and quantum yield (brightness), and photostability. We are currently characterizing commonly used dyes with the newly acquired fluorometer in order to assess their properties and limitations. Our aim is to synthesize novel dyes in order to contribute unique fluorescent probes to the field of biological research. Already, we have synthesized and characterized few fluorophores and are in the process of synthesizing many more to be characterized and compared to commonly used dyes. The greatest challenge to fluorescent microscopy is photobleaching, or the progressive loss of fluorescence with light absorption, so the characteristic of photostability will be given special

attention when considering novel syntheses. In addition, some families of cellular and tissue structures have few fluorescent probes established for their detection, therefore our future research will focus upon the synthesis of unique dyes with novel binding properties in order to fill vacant niches in fluorescent analyses. We will present the background and understanding of fluorophores, the novel application of our research to the field, and our current data gathered thus far.

Scientific experimentation is consistent with a Christian worldview. According to Scripture, God's character is logical and He is a God of order. Thus, it would be expected that His creation would also be ordered and logical and therefore could be understood through scientific inquiry. Researchers can draw conclusions from repeated experiments because they can anticipate that natural laws will function in a regular and consistent manner. In chemistry, research is possible because one can anticipate the ways that various molecules will interact with each other and with the environment. Large molecules can be built through predictable chemical reactions and these products should have predictable chemical and physical properties (such as fluorescence) and bond formation. This consistency is a fundamental assumption of the Christian worldview. Furthermore, Scripture calls Christians to glorify God with whatever they do (Colossians 3:17). This scripture indicates that Christ-followers are to display excellence in everything they do in order to bring maximum glory to God's kingdom. Therefore, Christians should be at the forefront of scientific research, as scientific research provides a world-wide platform that Christians can use to impact the world for Christ. Scientific discovery can be used to glorify God by increasing knowledge about His universal design. Every new discovery shows how powerful God is and reveals His wisdom in the way He has created the world to function so intricately. By characterizing another component of God's creation, the scientific community

will be impacted/enriched. With the goal of glorifying God, Christian scientists should perform research with excellence so as to reveal through their research His greatness.