DAGSI Research Topic-2024

1. **Research Title:** Investigation of Biophotonic Cellular Communication to Understand Mechanisms of Performance

2. **Individual Sponsor:**
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3. **Academic Area/Field and Education Level**
Molecular Biology/Pharmacology/Bioengineering/Computer Science (MS or PhD level)

4. **Objectives:** 1) Characterize and quantify the intracellular biophoton emission and determine how this intracellular emission can control and modulate cellular communication. 2) Identify cellular biomolecules (proteins, receptors, etc.) involved in wave-mediated signaling, and characterize changes caused by biophoton signaling. 3) Measure the ability of cells and cellular biomolecules to absorb entangled photons and quantify how cells produce reactive oxygen species (ROS) and biophotons after entangled photon stimulation.

5. **Description:**
Cell-to-cell communication is important for the proper function of biological systems. Different molecules are traditionally seen as information carriers activating pathways and eliciting cellular responses but there is emerging evidence of cellular communication by light as a form of non-molecular information transfer in many organisms. Almost all life spontaneously emits weak photon emissions as part of chemical reactions taking place inside each cell during normal or stressed conditions, known as ultra-weak photon emission (UPE) or biophoton emission. Despite a century of research, little is known about the specific mechanisms of biophoton generation and reception as well as the information encoded in biophoton signaling. Therefore, the goal of this research is to understand the relationship between cellular signaling and intracellular photonic emission. Compared to chemical and electrical forms of cell communication, our knowledge of cellular signaling through cell-based photons is primitive. The significance, mechanisms for photon generation and detection, and quantification of spectra, intensity, and spatial and temporal distribution are important features of this phenomenon that require further investigation. The functional significance of this research involves understanding cellular response

to photons, and how cells are able to generate and receive information via waveforms in a noisy spectral environment.

6. **Research Classification/Restrictions:** NA

7. **Eligible Research Institutions:**

☒ **DAGSI** (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati, and all other Ohio Universities)

☒ **Topic can be submitted for public release**

☐ **AFIT** (only)

☐ **USAFA** (only)

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