Researchers at the University of South Florida have developed novel systems and methods for immobilizing target proteins on an underlying electrode for applications in bio-photovoltaic (bio-PV) and bio-sensor devices.

The advantages of renewable energy sources over fossil fuels have led to governmental investment in renewable energies such as solar energy harvesting. For inexpensive harvesting, truly green technologies have photosynthetic proteins as active components within solar cells. In a photosynthetic organism, the primary energy conversion reactions take place in a reaction center (RC) protein. The bacterial photosynthetic RC shows great promise for solar energy harvesting due to its nearly 100% quantum yield of primary charge separation. Although the internal quantum efficiency in RCs is very high, efficient transfer of charges from RCs to underlying electrodes is still challenging. Previous applications of RCs in protein-based solar cells exhibited low power conversion efficiency, mainly due to an inefficient electron transfer (ET) to or from an electrode. It is therefore desirable to increase the charge transfer rate between RCs and electrodes of an electrochemical bio-photovoltaic (bio-PV) device.

Inventors at USF have devised systems for immobilizing target proteins, such as RCs, on the working electrode of an electrochemical device. The target protein can be immobilized using a linking protein that attaches the target protein to the electrode, either directly (physisorption or using functionalized proteins) or indirectly through another linker molecule (e.g., an oligomer molecule, conducting polymers, nanoparticles, or a DNA). This form of attachment facilitates charge transfer between the target protein and the electrode via the linker protein and can find numerous applications in both bio-PV and bio-sensing devices.

**ADVANTAGES:**

- Greater electron transfer resulting in improved performance

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**Schematic drawing illustrating an example of immobilization of a target protein using a molecular wire including a linker protein**