Chemical and enzymatic triggering strategies for hierarchical self-assembly from the nano- to the microscale

Luis A. Prieto Costas & José M. Rivera
Department of Chemistry, Natural Science College, Molecular Sciences Research Center, University of Puerto Rico, Rio Piedras Campus, San Juan, P.R. 00931.
prietoluis87@gmail.com
riveralab.upr@gmail.com

Our group has developed supramolecular G-quadruplexes (SGQs) based on the self-assembly of 8-aryl-2'-deoxyguanosine (8ArG). These SGQs exhibit a change in solubility at a specific pH and temperature, achieving thermo- and pH-responsive SGQs. These responsive SGQs further self-assemble into Supramolecular Hacky Sacks (SHS), colloidal particles that have multiple functions (e.g., drug delivery). This work builds upon previous studies of responsive SGQs to develop hydrogen peroxide (H_2O_2) and enzyme-responsive systems.

Our H_2O_2-responsive system is made from the encapsulation of boronic ester probes in previously developed SHS. These BEPs are fluorescent upon oxidation with H_2O_2. We intent to detect oxidative microenvironments in RAW 264.7 cells. Furthermore, the addition of a phosphate group to a guanosine derivative will promote the formation of enzyme-responsive SGQs upon self- assembly. These responsive entities, upon hydrolysis of an enzyme will further self-assembly into SHS isothermally.

Some of the techniques used in this project are 1D/2D NMR, water suppression NMR, IR, MS, dynamic light scattering, differential scanning calorimetry, microscopy (e.g., SEM, TEM, CLSM) and UV/Vis spectroscopy. The long-term goal of the project is to develop responsive SGQs for biomedical applications. The short-term goal is to gather fundamental information of the responsive SGQs by exploiting the inherent features of the system (e.g., synthetic modification of guanosine derivatives, encapsulation properties of the SHS).