Problem Statement: Twin Screw Wet Granulation (TSG) is a novel, continuous method for wet granulation. Numerous studies have investigated the influence of screw element configurations, liquid-to-solid ratios, screw rotational speeds, and powder feed rates on the resulting granule properties, i.e., size distribution, porosity, and liquid content. The movement of material axially along the screw also offers the possibility of producing layered granules, which has not been previously explored with TSG. This new approach to manufacturing has the potential to provide an alternate pathway for producing structured granules for use in drug products.

Objectives:

1. Perform parametric studies with varied processing and formulation conditions to produce layered granules. These studies will include variations in screw configuration, powder and liquid addition locations, liquid-to-solid ratio, powder feed rate, and screw rotation speed. Prior experience using the TSG will be used to efficiently design these parametric studies.
2. Characterize the resulting granules in terms of granule size distribution, granule shape, granule porosity, binder distribution, internal microstructure, and granule strength. Also report the yield (by mass) of the granulation process.
3. Offer recommendations for how to efficiently manufacture layered granules with target properties.

Methods and Materials:

1. Thermo Fisher Scientific Eurolab 16 mm twin screw granulator
2. Powder formulation to be determined by project partners
3. Measurement methods: granule size distribution - sieving, granule shape - microscopy, granule porosity - gas and powder pycnometry, binder distribution – UV-Vis absorption spectrometry, internal microstructure - XRCT and Raman spectroscopy, granule strength - micro-compression tester

Anticipated Impact: Having a new method for producing structured granules will provide engineers and formulators additional flexibility when designing drug products and processes. Using the TSG to produce layered granules could result in granule structures with modified release profiles, buffer layers, surface lubricant, or attrition resistance. Although layering could be performed via Wurster column coating on excipient beads, for example, the method proposed here would apply the coating in a powder form rather than as a sprayed solution.