

# Model Credibility Plan

## Verification

The code underlying the proposed model has been verified repeatedly, and we continue to do so. Test problems are constructed with few enough elements that an analytical solution is attainable, and the computational results are compared to the known solution. This approach will be used on all new code developed in the proposed work.

Repeated-refinement mesh convergence tests, at both the macroscopic and microscopic scales, will also be performed. At the macro scale, we will refine the mesh until the simulation results change by less than 1% when the same microscale model is used for each element. At the micro scale, we will use the same approach, but since a finer network model is a different model, it is not reasonable to expect the same results. Rather, we will perform simulations on 20 microscale networks of each type and compare the average results. The microscale mesh will be deemed to have converged if the average over the 20 replicates has converged to within 5%.

## Validation

Model validation is, of course, much more difficult than verification. For purely mechanical simulations, the model will be compared to experimental data from our prior experimental work, the proposed experiments and/or the literature as appropriate.

The proposed model will be verified against observations of facet capsule and gel experiments – does the simulated response produce a neuron of a shape similar to that observed and does it predict strains across scales matching experimental values? If the model matches the experimental observations well, it will be deemed valid in this regard.

## Milestones

### YEAR 1

- Identify & engage experts in the field to perform model validation
- Construct test cases for verification & validation of model

### YEAR 2

- Test whole-tissue model against biomechanical experiments
- Engage experts in the field to test standard multiscale code

### YEAR 3

- Test cell-level model against experimental results
- Engage experts in the field to test viscoelastic & interstitial flow models.

### YEAR 4

- Conduct V&V review based on previous year's external tests.

### YEAR 5

- Engage experts in the field to identify key areas for code development