**MEETING NOTES**

**2014-07-24**

Discussion of future work with the mechanical-load clamp, ver.2

* Stiffness examples confirm that new clamp performs just as well, or better than, previous clamp
* Regarding stiffness, what do we want to learn?
  + Spiking versus limit-cycle oscillations -> Calculate the residence time distribution. Spikes will be Poisson
    - Detrend/center time trace
    - Initialize vector of zeros
    - Find excursions with moving windows and update those below some threshold with ones – Moving window with mean and standard deviation -> choose window size, thresholds (mean+m\*std\_up, mean-n\*std\_down)
      * Or median and median absolute deviation (mad(x,1))
    - Find spikes in vector as ones
    - Gives times for up and down states
    - Can also set up a buffer region between two thresholds that is not counted – vectors of 1, 0, and 0.5
    - **How much time do we need?**
      * Try with an artificial trace first at different lengths of time first
      * Will determine how much of the state diagram we can map with this method
      * Do this for a few operating points in DIFFERENT bundles for long periods of time (e.g. five points per bundle)
    - Goal:
      * RTDs for spiking in both directions, limit cycles (five operating points), also for bistable and multimodal(?)
        + Do this both at the head and the tail of the fish, finding difference between classes of excitability
      * Hold at different offset forces and quantify spike frequency
        + Do this both at the head and the tail of the fish, finding difference between classes of excitability
* Revisit mass and drag
* Calculate the mass of a borosilicate glass cylinder with the dimensions of a stimulus fiber.
  + Should this be added to the load clamp?

**2014-07-31**

Discussion of gentamicin controls

* The previous gentamicin controls did not have enough time (only one second) per operating point.
* As a result, the analysis was poor:
  + Significance was sometimes found for different parameters, with very small p-values, in the control data
  + One cannot tell if this behavior is real or if it is due to the short time traces
  + Additionally, it is hard to tell if a bundle is oscillating with only one second of data (with only 500 ms on average analyzed)
* PLAN: Repeat the gentamicin experiments on robustly oscillating hair bundles

**2014-08-07**

Review of new gentamicin data and use of state diagram analysis tools

* Resend file for ttrace\_plots.m -> Will calculate the RMS amplitude and keep consistency
  + Done.
* PLAN: Run programs for data that appear reasonable by eye.
  + Do for a pre and post gentamicin
  + Pick a cell in which all points were multimodal
* Running the files:
  + T\_find.m: Choose an fmin value (0,0.5,**1**,2 Hz)
  + Hist\_plots.m: Choose a value for fdrift (**0.5**,1,2 Hz; 2/3 s 1/3 s 5/3 s)
    - Multimodality test: Keep p-value the same and adjust the score to attempt to find a simply connected region
    - Asymmetry test: KS
    - Fatness: K
* Try running a second instance of MATLAB to increase productivity
  + **Open Finder -> MATLAB R20XX.x -> bin -> Make Alias of “matlab” UNIX file**
* Assess with PSD\_plots to see which threshold is needed for Tfind
* PLAN:
  + Attempt with ONE gentamicin case
  + THEN, work on the state space over time
  + Next meeting on Tuesday -> Bring one gent case

**2014-08-19**

Review of state diagram controls

* There were many significant correlations in the gentamicin controls, which is troubling.
* Rerun the analyses including the elimination of 60/120/180 Hz peaks in Tfind(), try increasing Tmin from 2000 ms (to 3000 or 4000 ms), and collect the results in a summary table.
* Goal: Have these analyses complete by the end of the week.
  + Meet within the next 1-2 days to discuss the updated analyses.

**2014-08-29**

Mutual information and excitability

* Mutual information:
  + Run the MI script on known signals – sine waves with and without noise, including noise in both amplitude and phase
  + Try to calculate MI for a 4D histogram that includes both phase and displacement
    - Question: Are the MI values from each 2D histogram (phase and displacement) additive?
* Excitability:
  + Run a moving window of different window sizes and calculate the number of events within each window
    - Fit to a Poisson distribution
  + Run stochastic simulation (from Mathematica file by Daibhid) of a SNIC bifurcation with stochastic noise
  + How do the stable fixed points move with changes in the control parameter?
    - This appears to be sqrt(µ), as given by the normal form of a saddle node bifurcation
  + Fit spike frequency versus force
    - F^a
    - 1-exp(a\*F)
  + Calculate the spike frequency from the mean waiting time
    - Does this follow the same distribution?
    - Plot the mean residence time in the up position as a function of force (or 1/(meanRT)