

Lab

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Contents

Introduction	2
Methods	2
Results	3
Discussion	16

Introduction

Methods

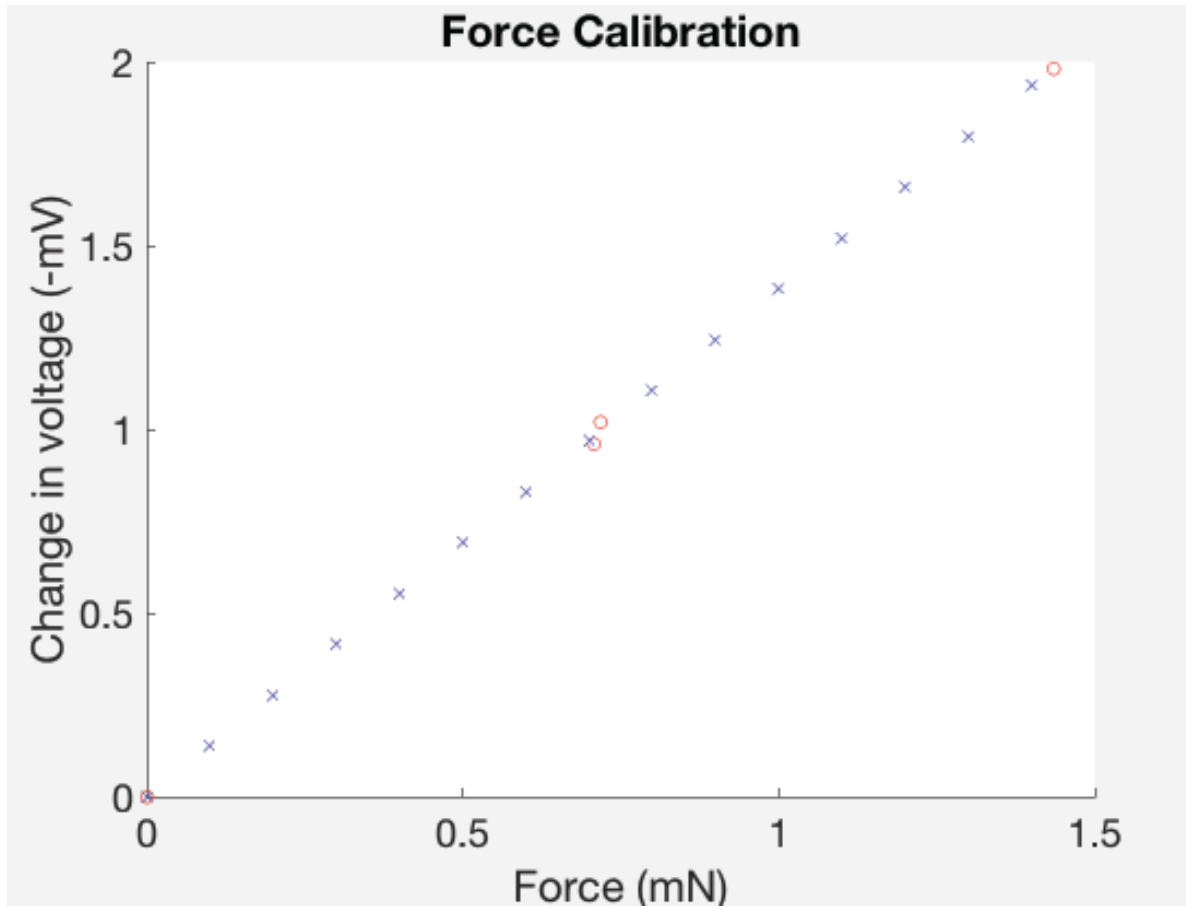


Figure 1: Calibration of force curve. Red circles represent measured changes in voltage for a set of known forces (using the paperclips and gravity). The blue Xs show the fit line depicting the relationship between change in voltage and force.

Results

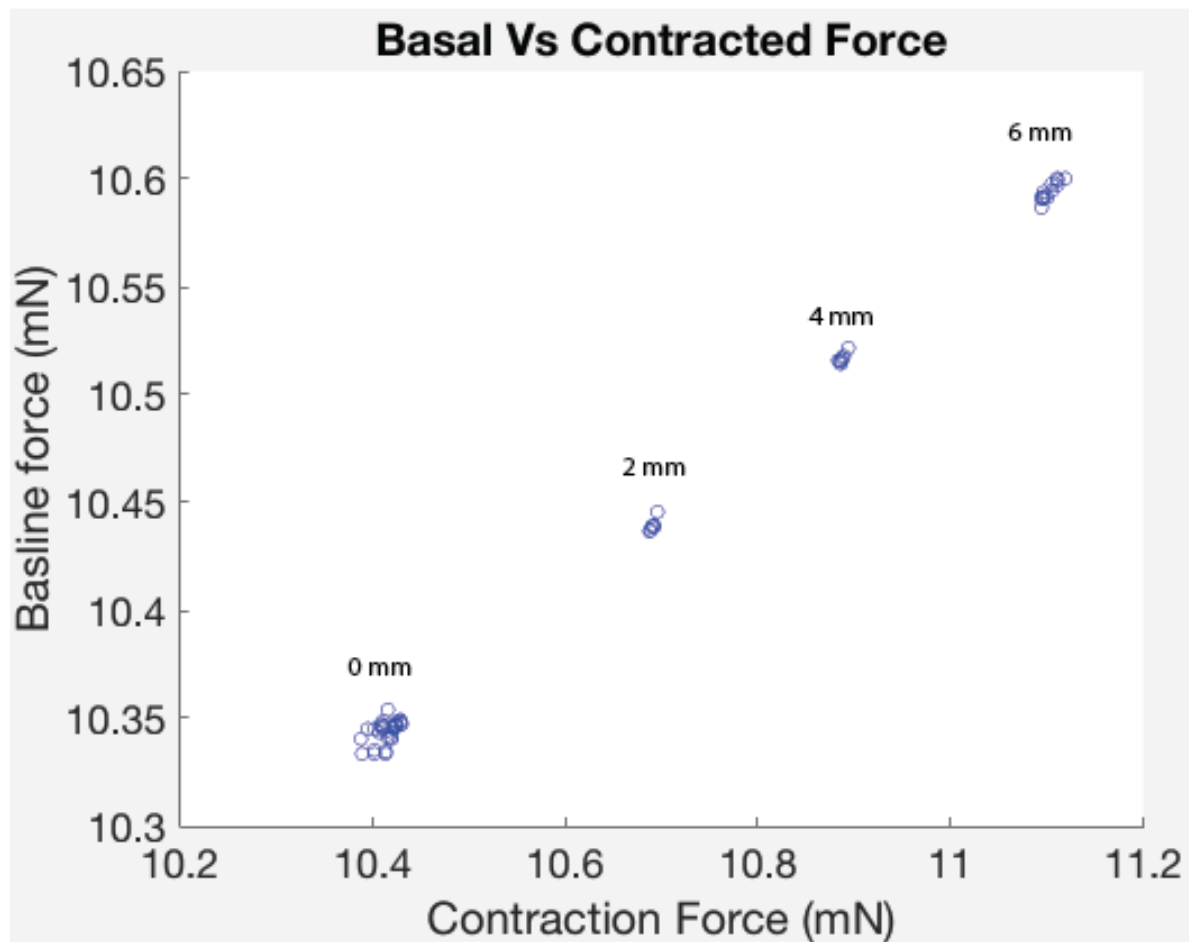


Figure 2: Frank Starling curve. On the x axis is contractile force and on the y axis is relaxed tension. Each cluster represents several beats at that particular stretch length from 0 mm to 6 mm.

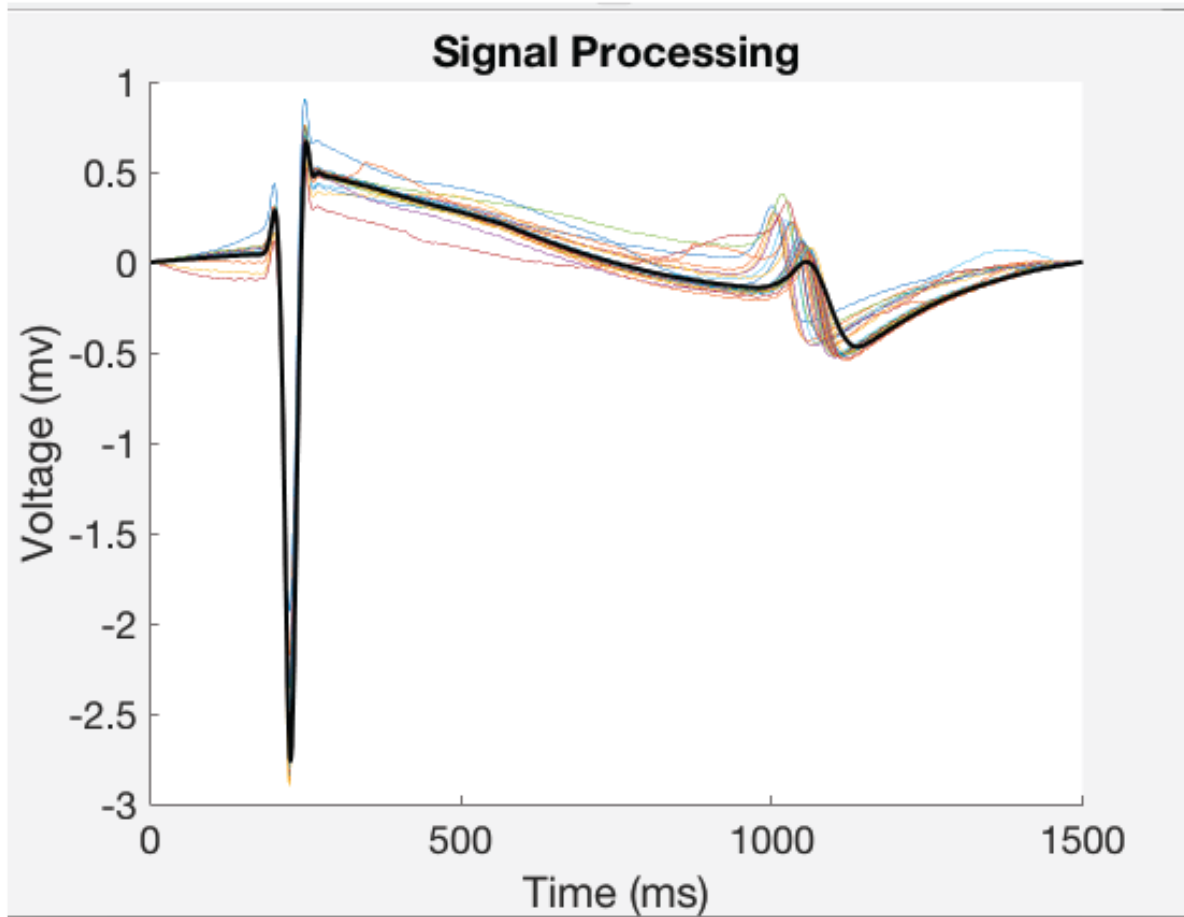


Figure 3: An example for the beat averaging. Several autofiducialized beats are shown. The beats are averaged into the signal averaged beat (black line) which has greatly reduced noise.

Table 1: Numerical results. Mean and Median heart rate are shown as calculated from electrode signals and force probe signals. Mean and Median contractile force is shown.

Drug		HR	Contraction Force
Basal	From Electrode	31.61	0.34
	From Force Probe	31.63	
Cold Ringers	From Electrode	26.45	0.23
	From Force Probe	24.32	
Caffeine	From Electrode	33.25	0.19
	From Force Probe	31.01	
Mystery Drug	From Electrode	34.12	0.18
	From Force Probe	33.95	
Calcium 0.55 mM	From Electrode	35.21	0.14
	From Force Probe	35.04	
Calcium 4.4 mM	From Electrode	31.25	0.11
	From Force Probe	32.05	
Epinephrine	From Electrode	33.12	0.09
	From Force Probe	32.65	
Acetylcholine	From Electrode	25.34	0.02
	From Force Probe	26.53	
Atropine	From Electrode	30.01	0.07
	From Force Probe	31.25	
Potassium	From Electrode	30*	0.07*
	From Force Probe	30.41*	

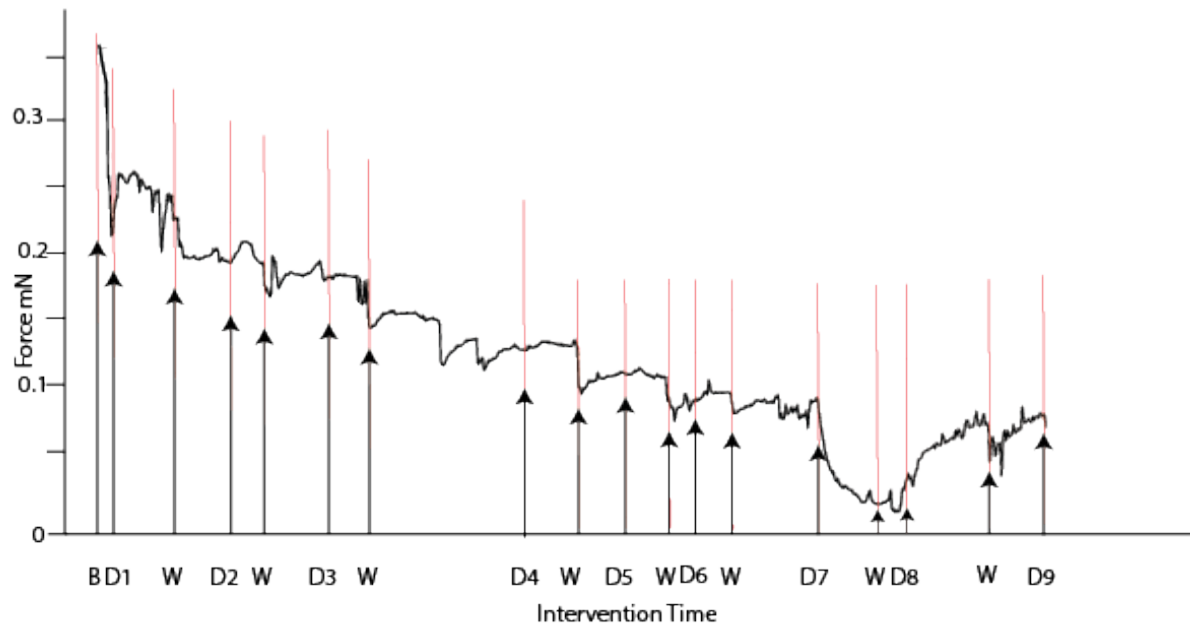


Figure 4: Graph of changes in contractile force during the experiments. B represents the baseline measurement. Each W represents a time at which the heart was flushed with ringer's lactate solution to wash out. D1 was addition of Cold ringers. D2: caffeine, D3: Mystery drug, D4: 0.55 mM calcium, D5: 4.4 mM calcium. D6: Epinephrine, D7: Acetylcholine, D8: Atropine, D9: Potassium Chloride

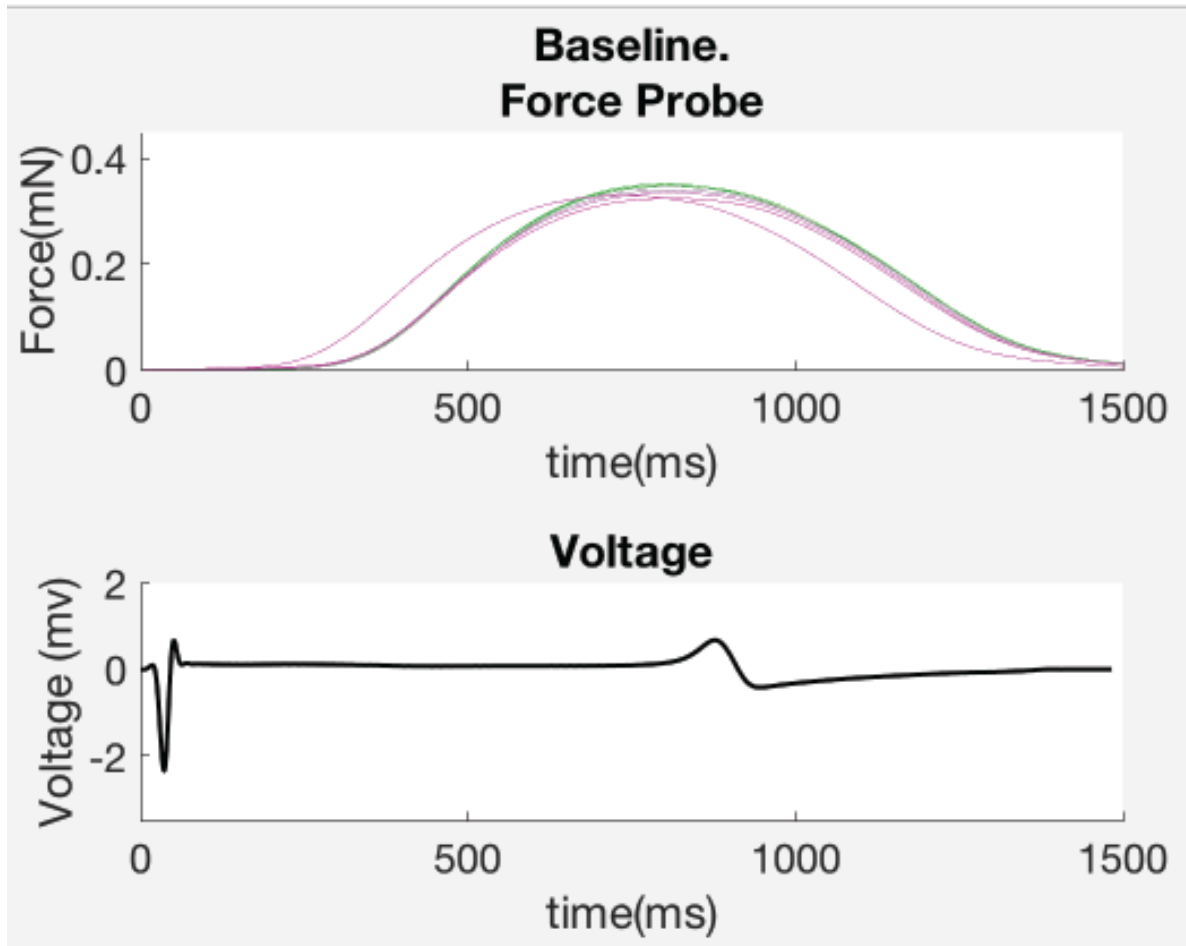


Figure 5: Force curve and signal averaged electrical recording. (Top) Force Probe recorded force. The curves progress from green to gray to pink with time. (Bottom) Signal averaged voltage from the ventricles shown in black.

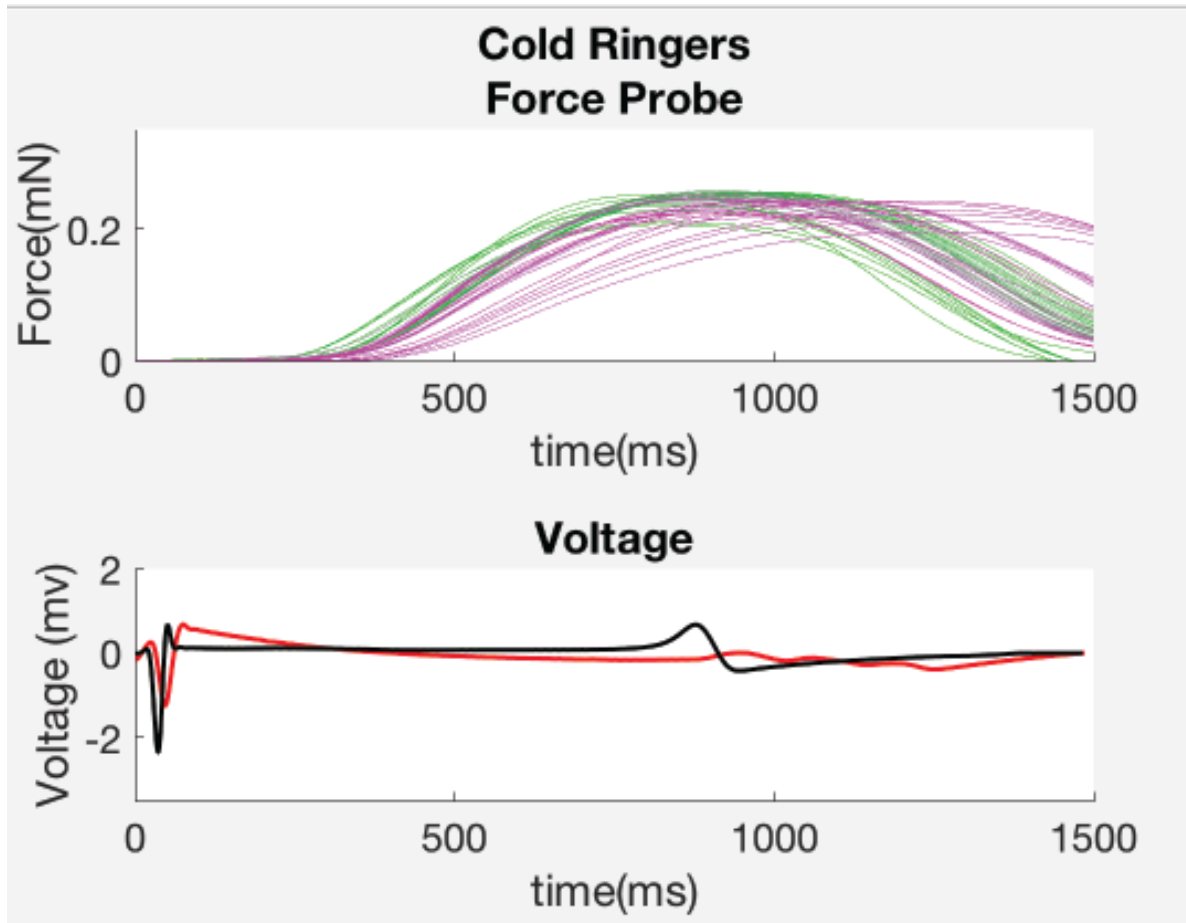


Figure 6: Force curve and signal averaged electrical recording. (Top) Force Probe recorded force. The curves progress from green to gray to pink with time. (Bottom) Signal averaged voltage from the ventricles. Baseline signal shown in black, cold rings signal shown in red.

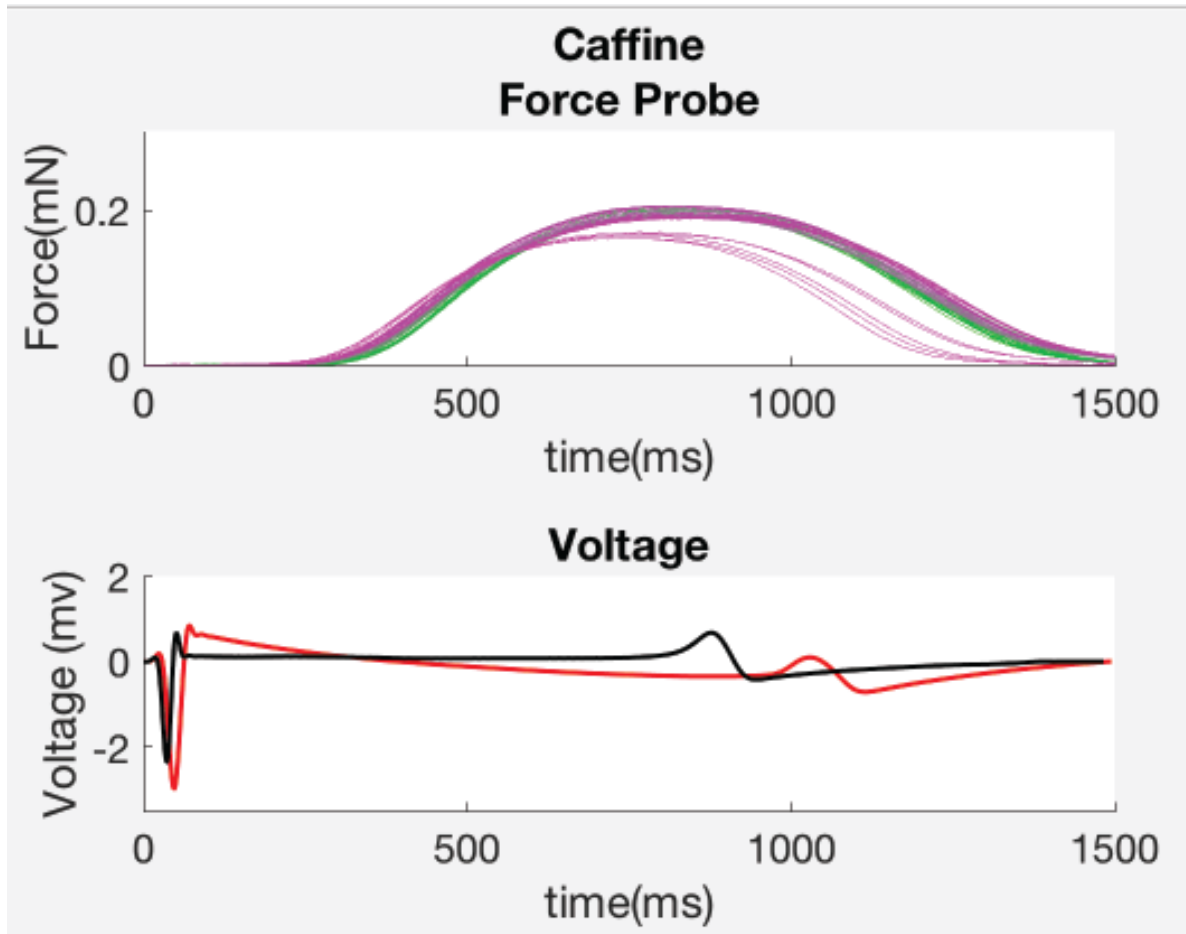


Figure 7: Force curve and signal averaged electrical recording. (Top) Force Probe recorded force. The curves progress from green to gray to pink with time. (Bottom) Signal averaged voltage from the ventricles. Baseline signal shown in black, caffeine signal shown in red.

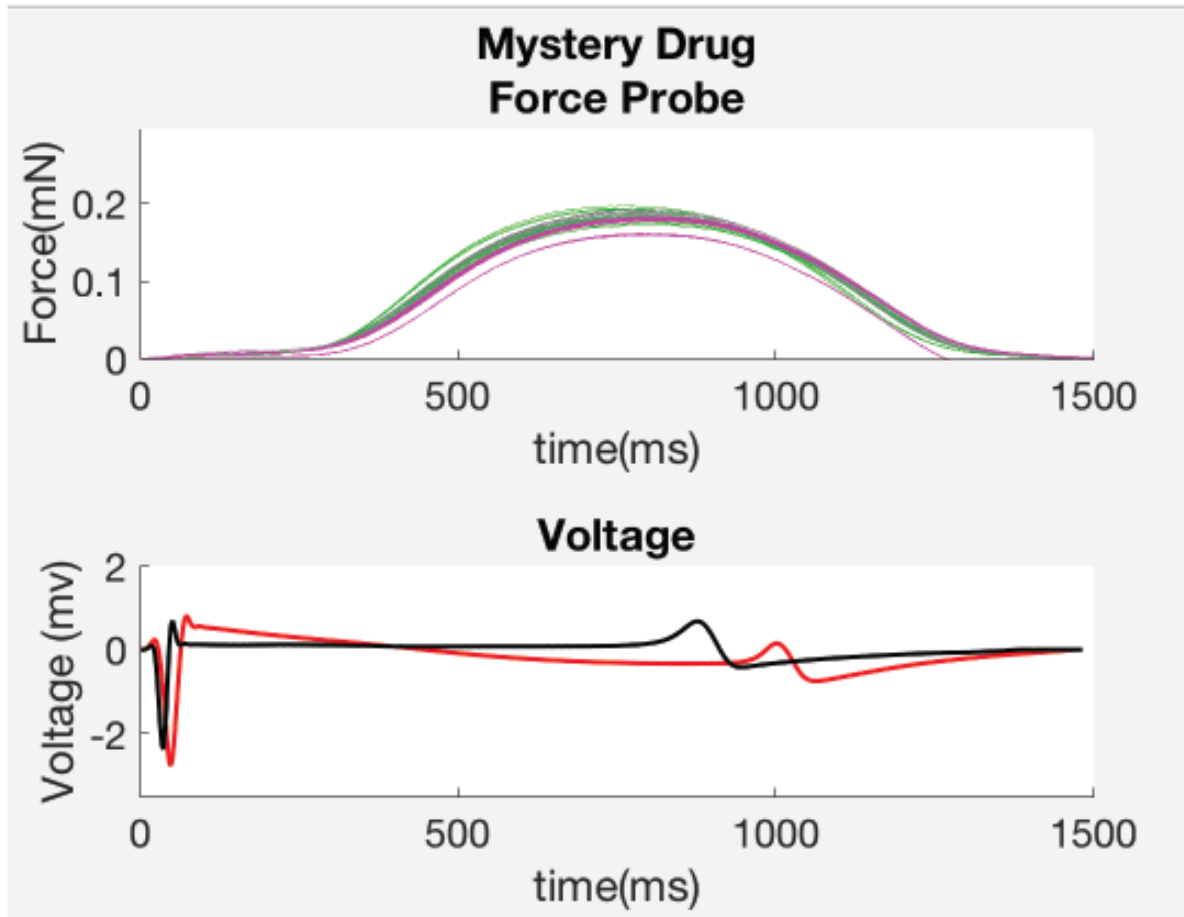


Figure 8: Force curve and signal averaged electrical recording. (Top) Force Probe recorded force. The curves progress from green to gray to pink with time. (Bottom) Signal averaged voltage from the ventricles. Baseline signal shown in black, mystery drug signal shown in red.

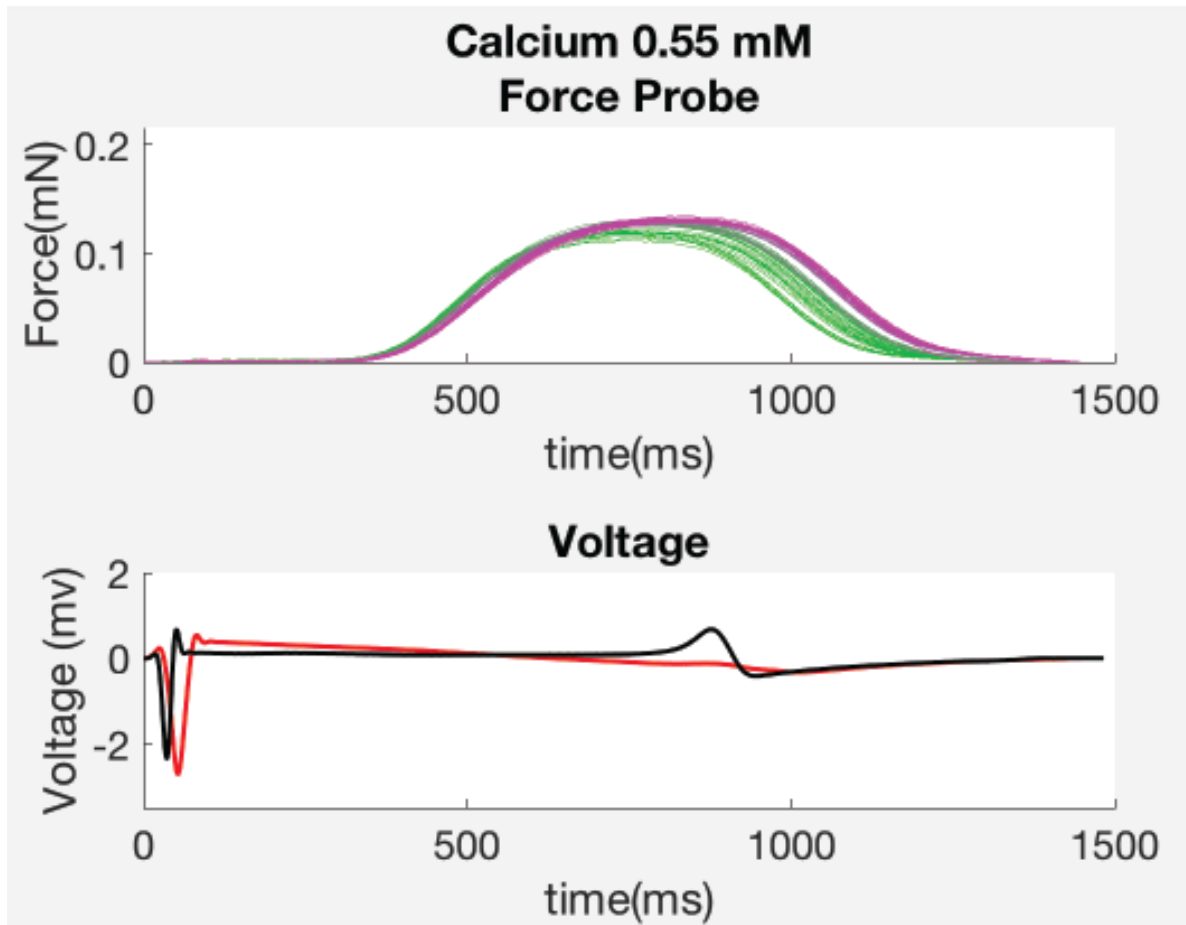


Figure 9: Force curve and signal averaged electrical recording. (Top) Force Probe recorded force. The curves progress from green to gray to pink with time. (Bottom) Signal averaged voltage from the ventricles. Baseline signal shown in black, 0.55 mM Calcium signal shown in red.

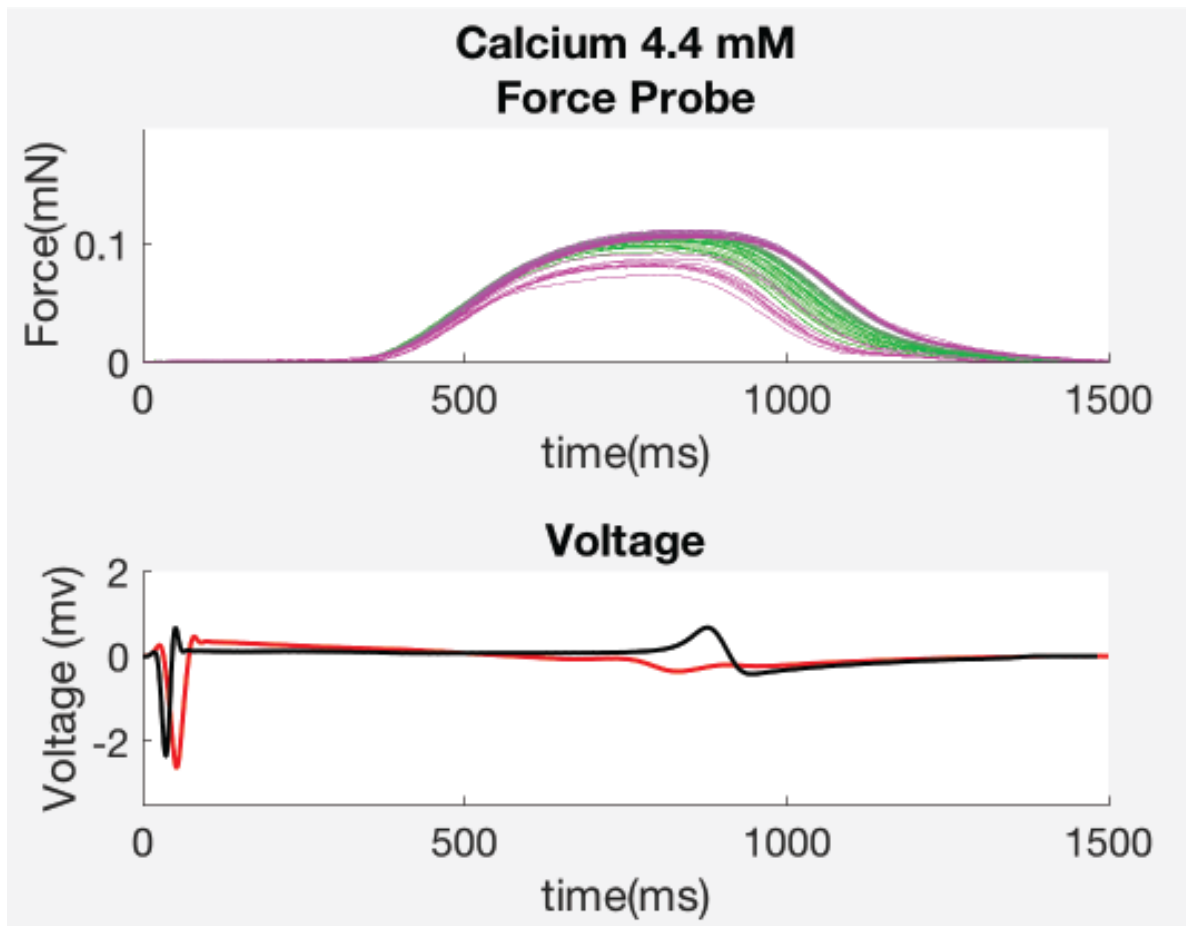


Figure 10: Force curve and signal averaged electrical recording. (Top) Force Probe recorded force. The curves progress from green to gray to pink with time. (Bottom) Signal averaged voltage from the ventricles. Baseline signal shown in black, 4.4 mM Calcium signal shown in red.

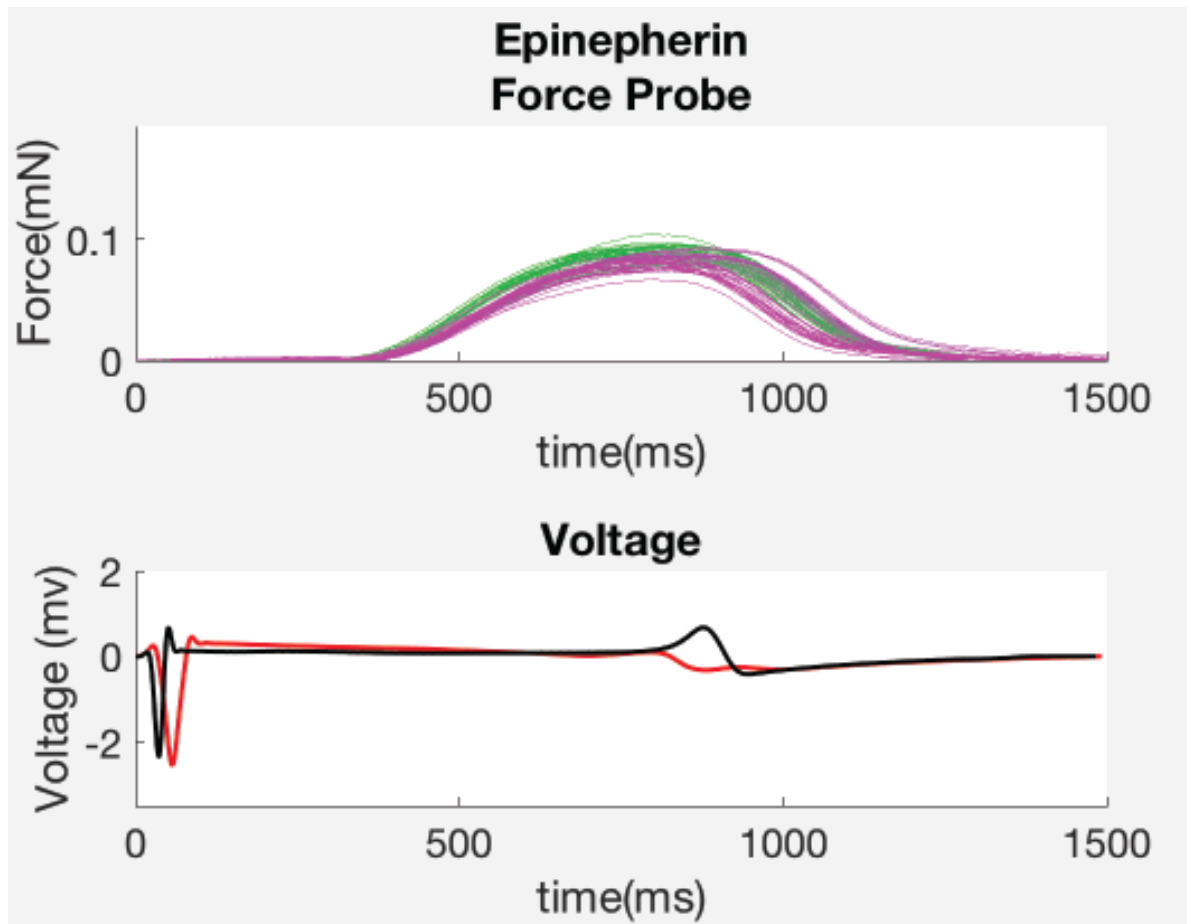


Figure 11: Force curve and signal averaged electrical recording. (Top) Force Probe recorded force. The curves progress from green to gray to pink with time. (Bottom) Signal averaged voltage from the ventricles. Baseline signal shown in black, epinephrine signal shown in red.

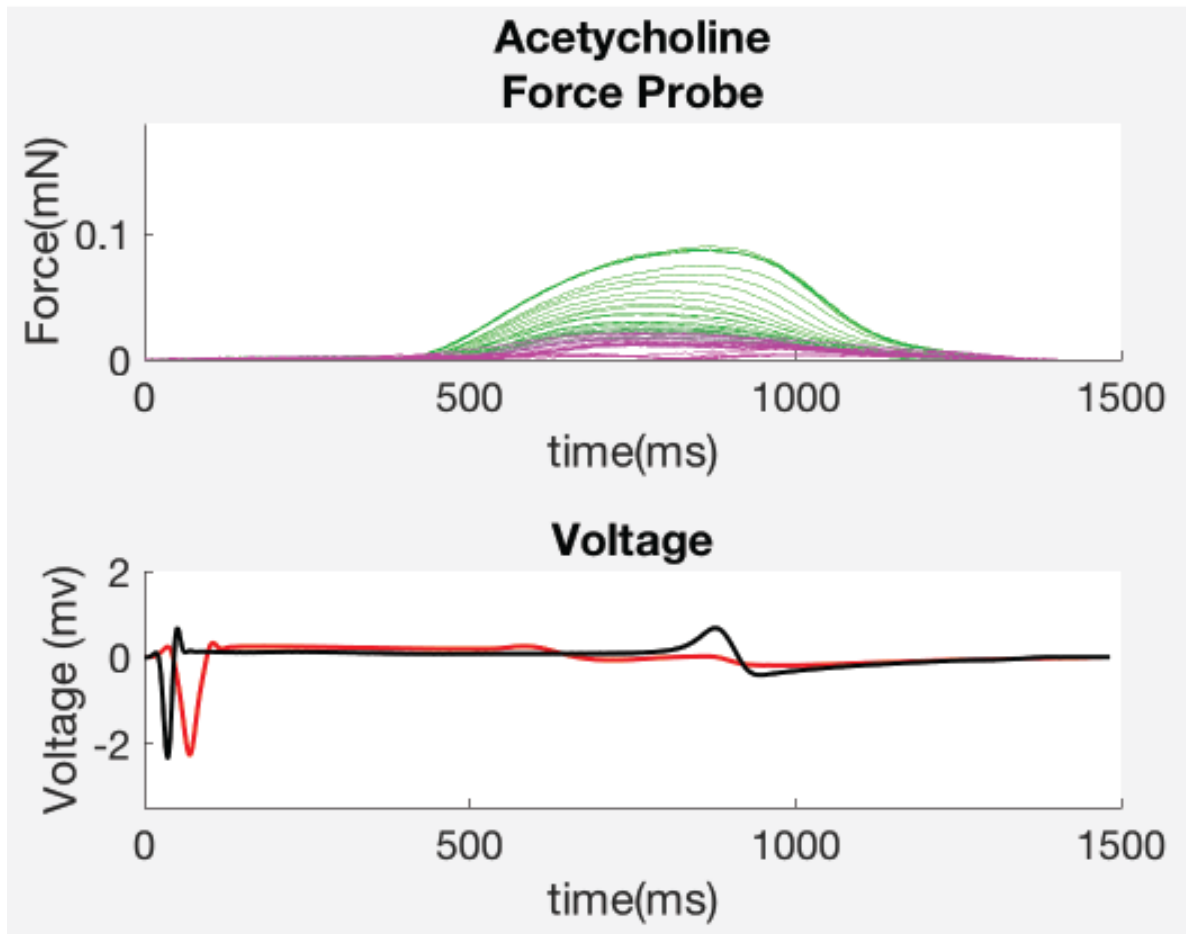


Figure 12: Force curve and signal averaged electrical recording. (Top) Force Probe recorded force. The curves progress from green to gray to pink with time. (Bottom) Signal averaged voltage from the ventricles. Baseline signal shown in black, acetylcholine signal shown in red.

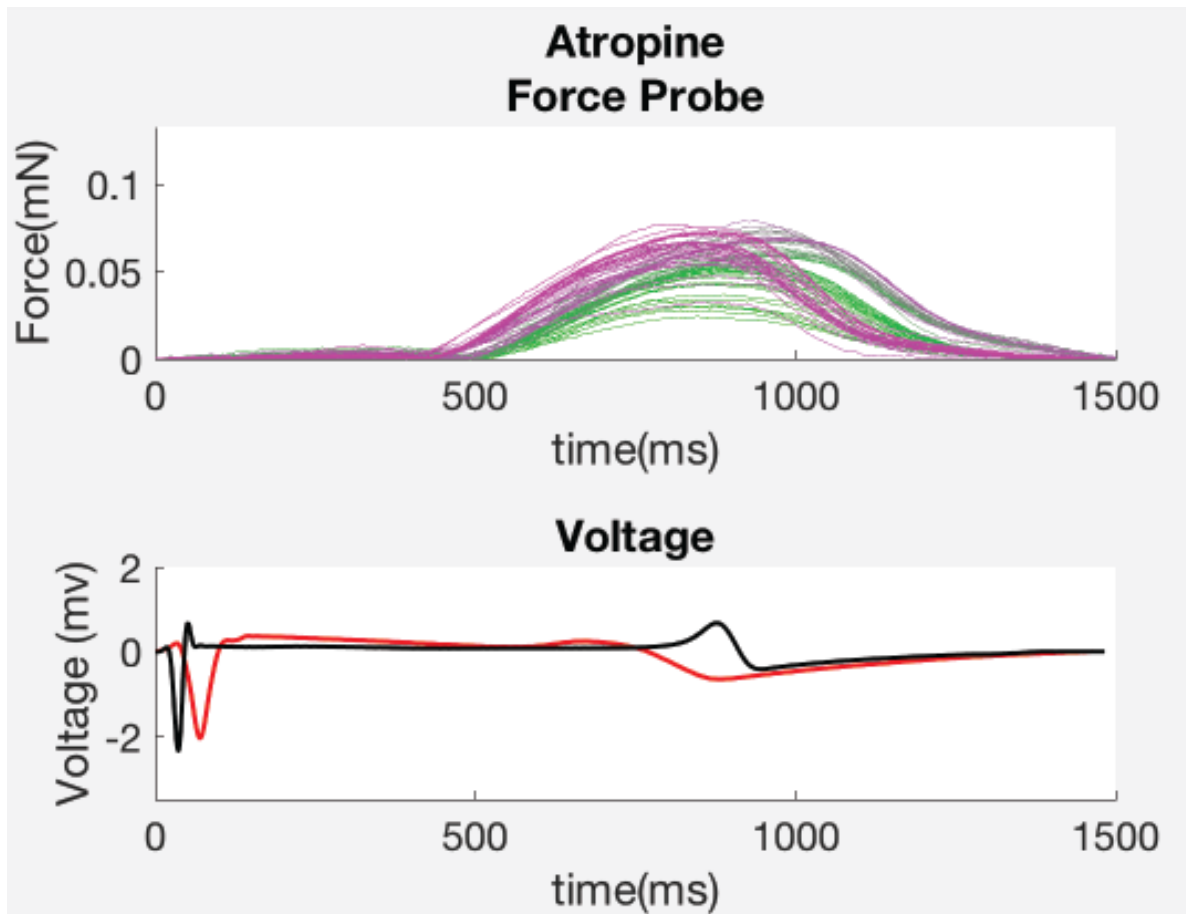


Figure 13: Force curve and signal averaged electrical recording. (Top) Force Probe recorded force. The curves progress from green to gray to pink with time. (Bottom) Signal averaged voltage from the ventricles. Baseline signal shown in black, atropine signal shown in red.

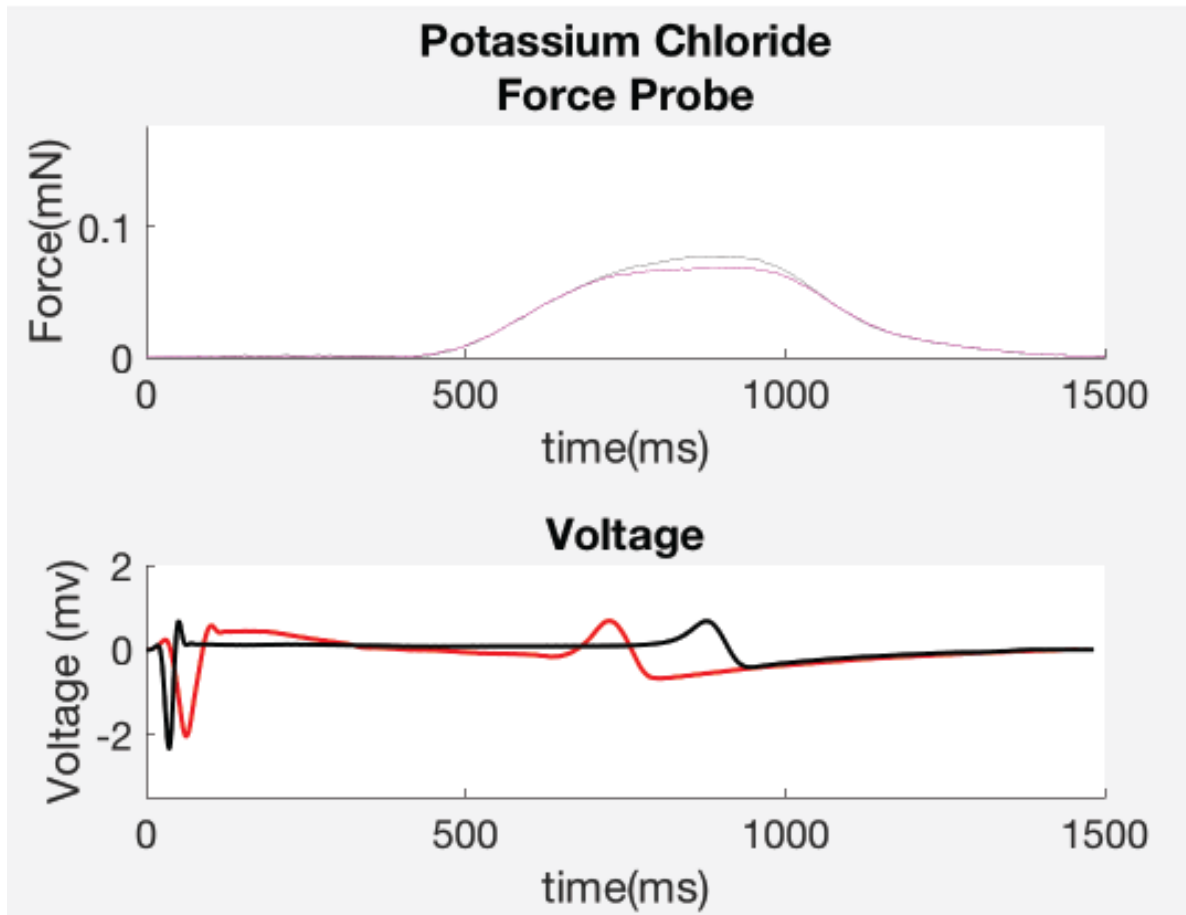


Figure 14: Force curve and signal averaged electrical recording. (Top) Force Probe recorded force. The curves progress from green to gray to pink with time. (Bottom) Signal averaged voltage from the ventricles. Baseline signal shown in black, potassium signal shown in red.

Discussion