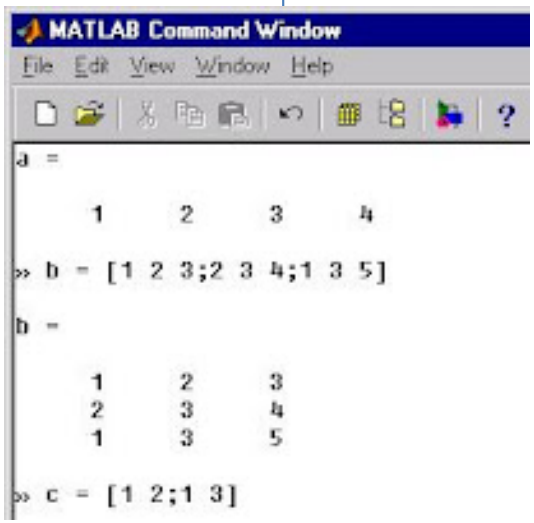
Suppl. Figure 1

a

{
...
Electrode1 Time1 Strength1
Electrode2 Time1 Strength2
Electrode3 Time1 Strength3
...
}

MATLAB / Python / etc.: Experimenter's Script

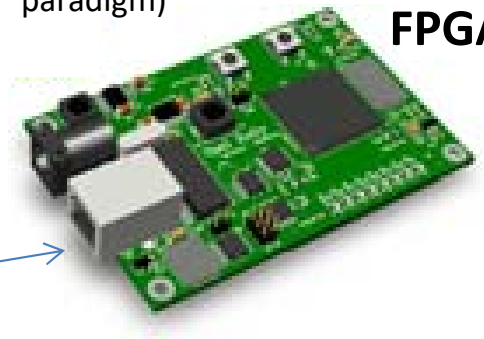


USB

b

(send temporally precise stimulation paradigm)

Commercial FPGA



Voltage Instructions

c

D/A

Digital/Analog Converter

Voltage Sequence for Fast Routing: 2, 0, 5, 0

d

Synchronized Electrode Addresses, to Sample and Hold: 001, 010, 011, 100

< µs

Each electrode is equipped with a dedicated sample and hold

e

"Release"

f

#1 2 → **2.0 V**

#2 0 → **0.0 V**

#3 5 → **5.0 V**

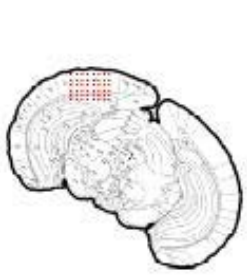
#4 0 → **0.0 V**

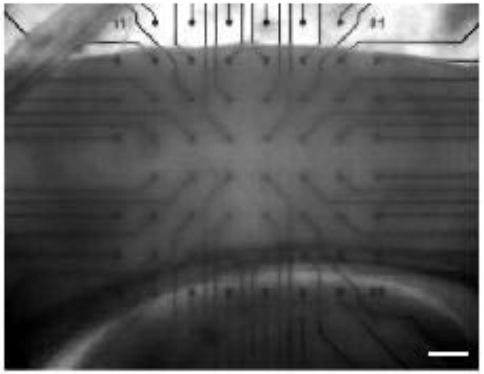
...

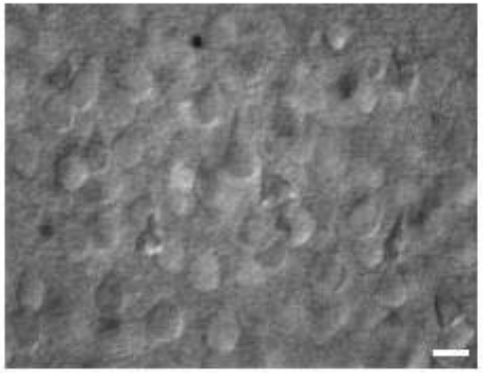
#64 3.24 → **3.24 V**

Suppl. Figure 2

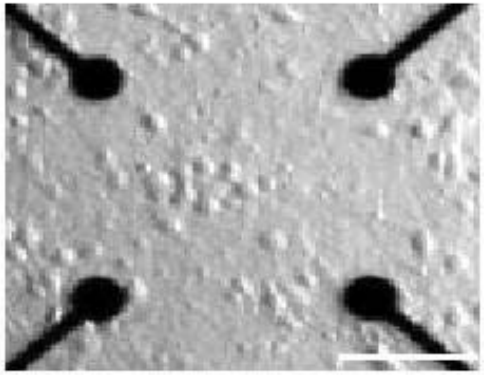
a. Interface to Acute Slices



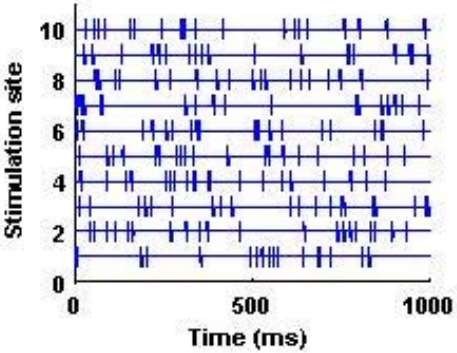


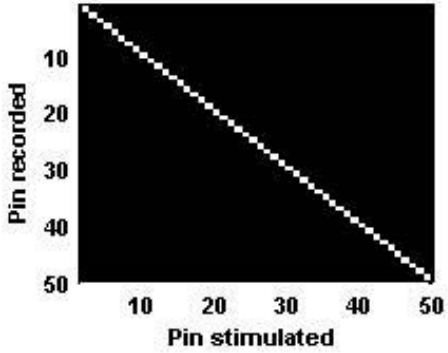


b. Dissociated Cultures

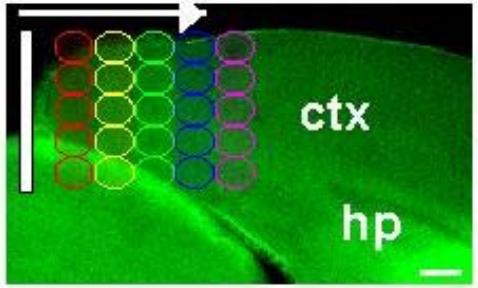


c. Independence of Stimulation Sites

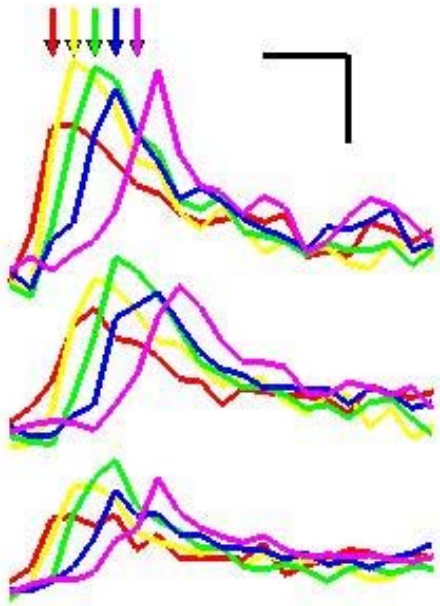




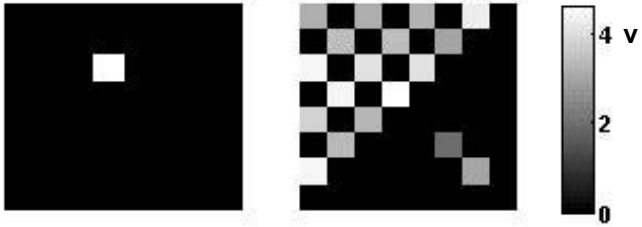
d. Temporal Network Activation



e. Distributed Optical Responses

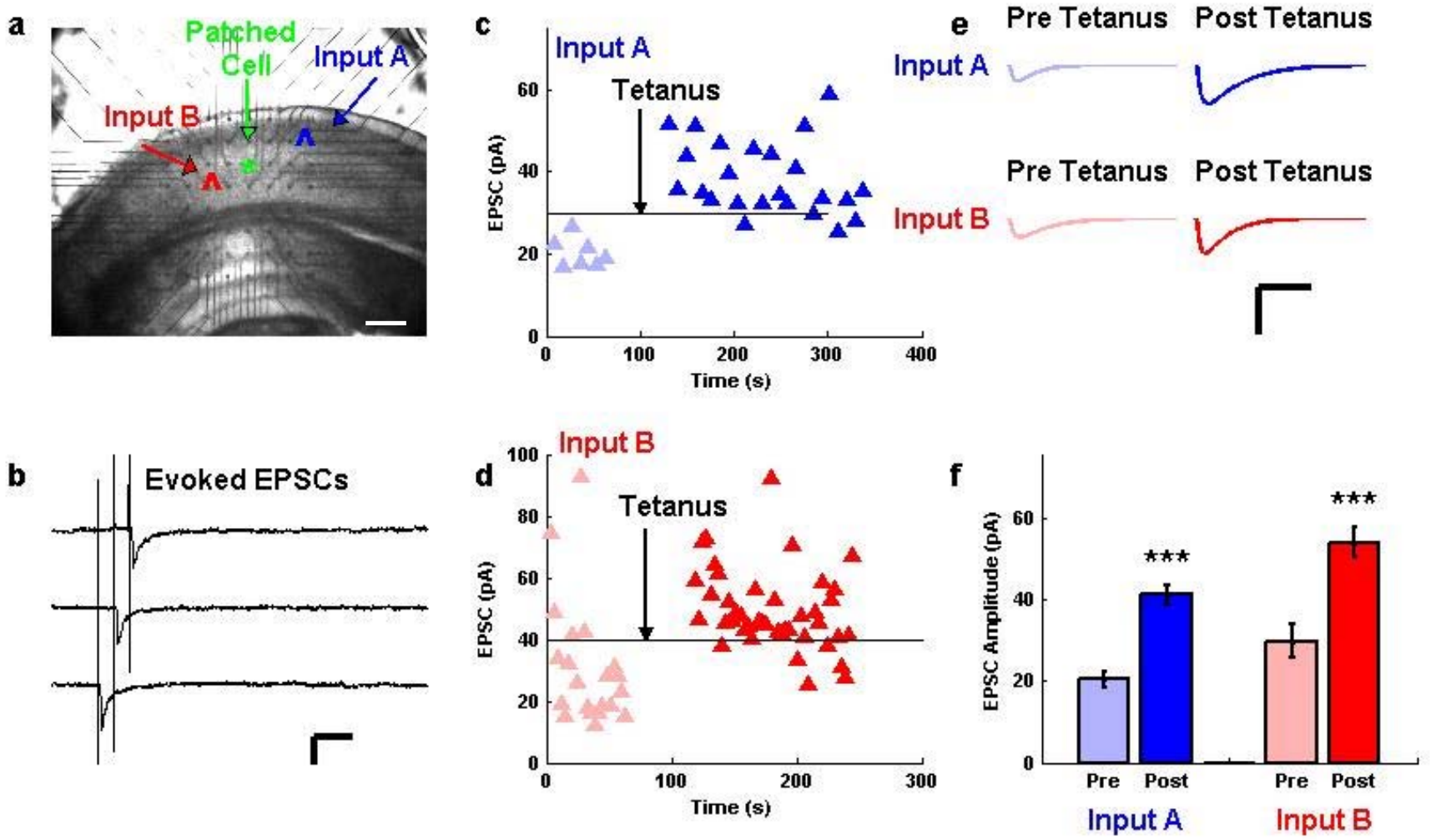


f. Other Sample Patterns: Spatial Encoding

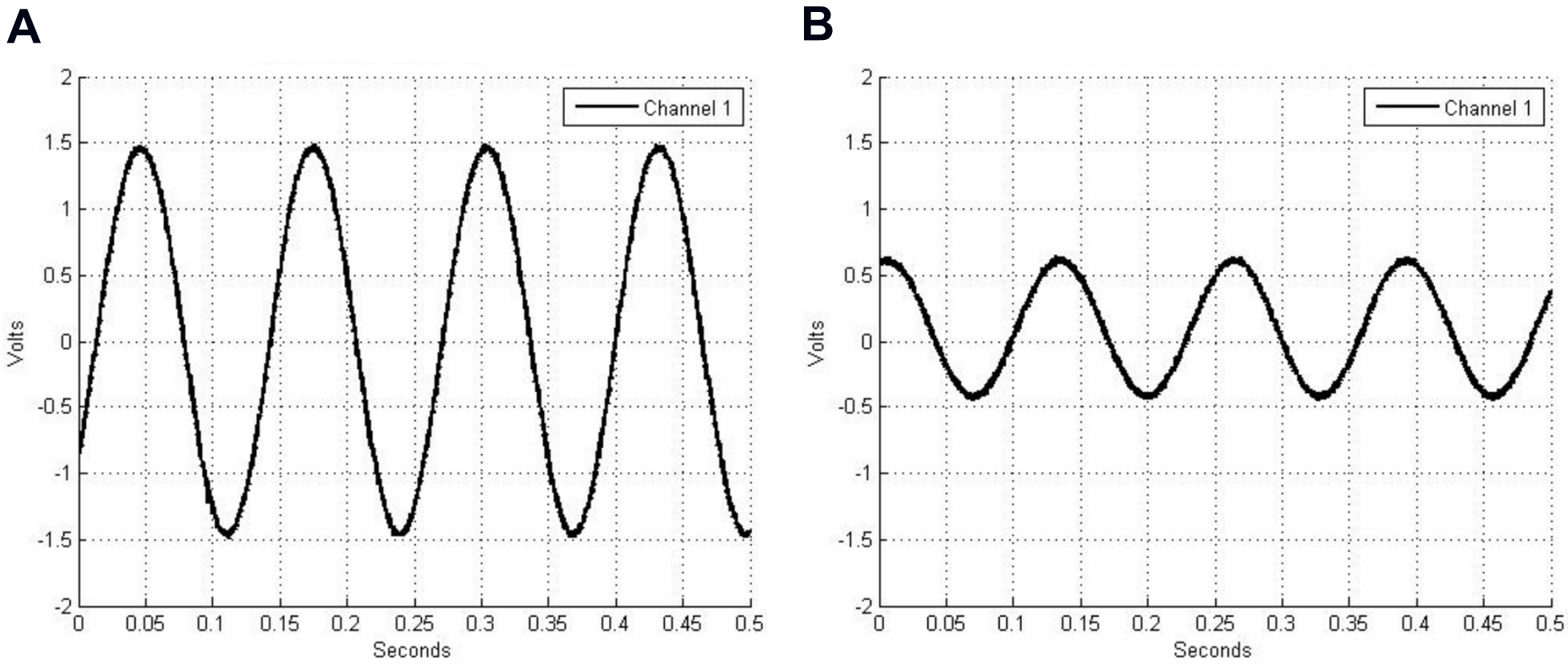


g. "Natural" Stimulation

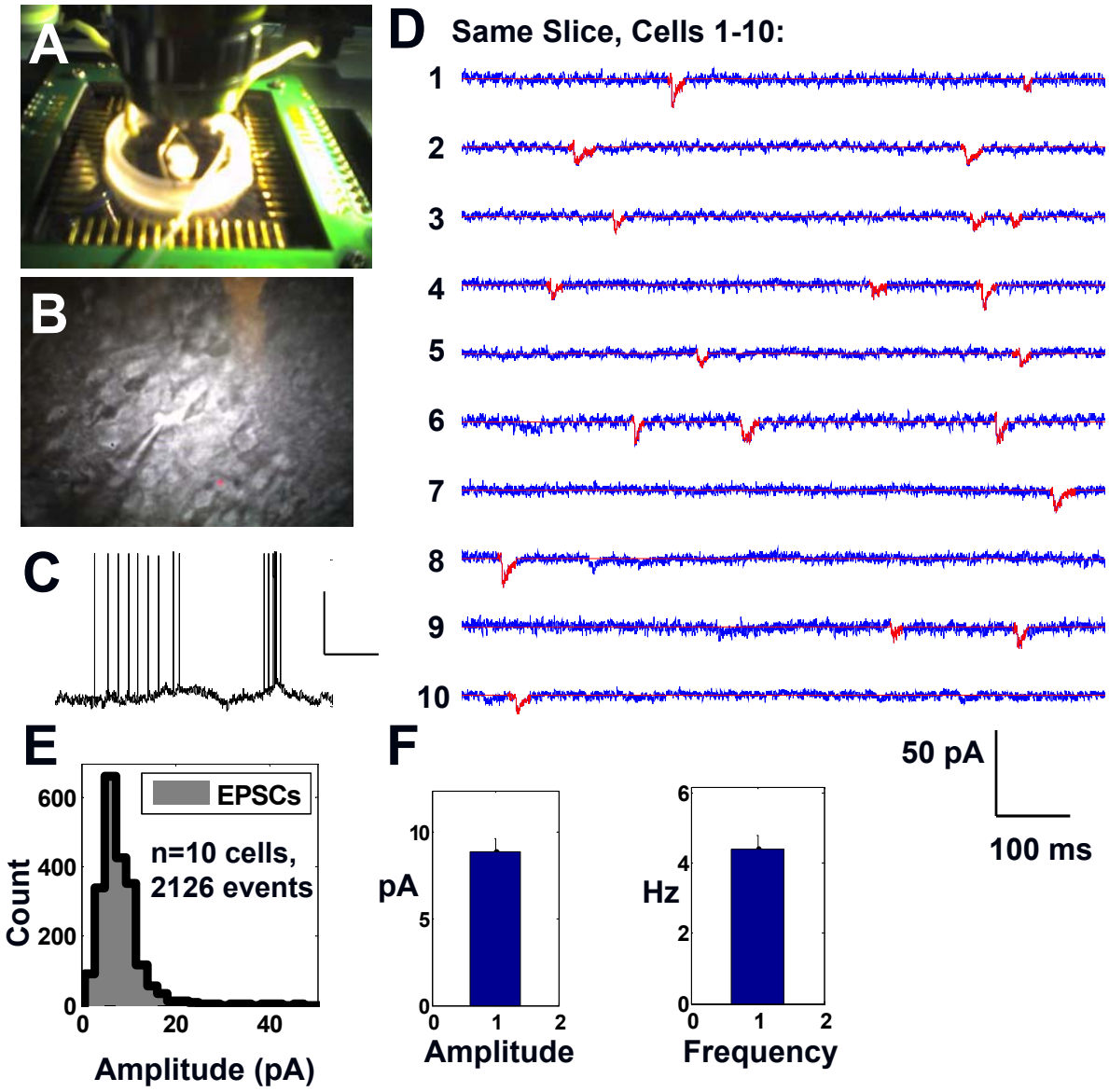
Suppl. Figure 3



Suppl. Figure 4



Suppl. Figure 5



Suppl. Figure 6