A deconvolution-based method with high sensitivity and temporal resolution for detection of spontaneous synaptic currents in vitro and in vivo

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Script 1. Implementation of deconvolution in Mathematica 8.0.1

```
deconvTrace = ListDeconvolve[template, EPSCTrace]/sampleInt;

(* template is the multiexponential function used, EPSCTrace is the raw data, and deconvTrace is the
deconvolution result *)

(* For further documentation, see:
http://reference.wolfram.com/mathematica/tutorial/ConvolutionsAndCorrelations.html *)

index = Flatten[Position[Partition[deconvTrace, 3, 1], x_ /; ((x[[1]]< x[[2]] > x[[3]]) && (x[[2]] >
crit*sd)) , {1}, Heads -> False]] +1;

(* determine local maxima in the deconvolution trace - crit is the critical value of the signal-to-noise
ratio, and sd is the standard deviation of baseline noise *)
```

Script 2. Implementation of deconvolution in Igor 6.22A

```
•FFT/OUT=1/DEST=Trace_FFT EPSCtrace

•FFT/OUT=1/PAD={NumPnts(EPSCtrace)}/DEST=Template_FFT Template // PAD={EPSCtrace samples}

•Make/N=300001/D/C DECFFT

•DECFFT=Trace_FFT/Template_FFT

•IFFT/DEST=DEC DECFFT     // DEC is the deconvolved trace

// The Igor local maxima detection procedure file (UF_FBrainDetData.ipf) is available upon request.

//Note: An implementation for Octave/MATLAB is available in BIOSIG-toolbox (http://biosig.sf.net).
```

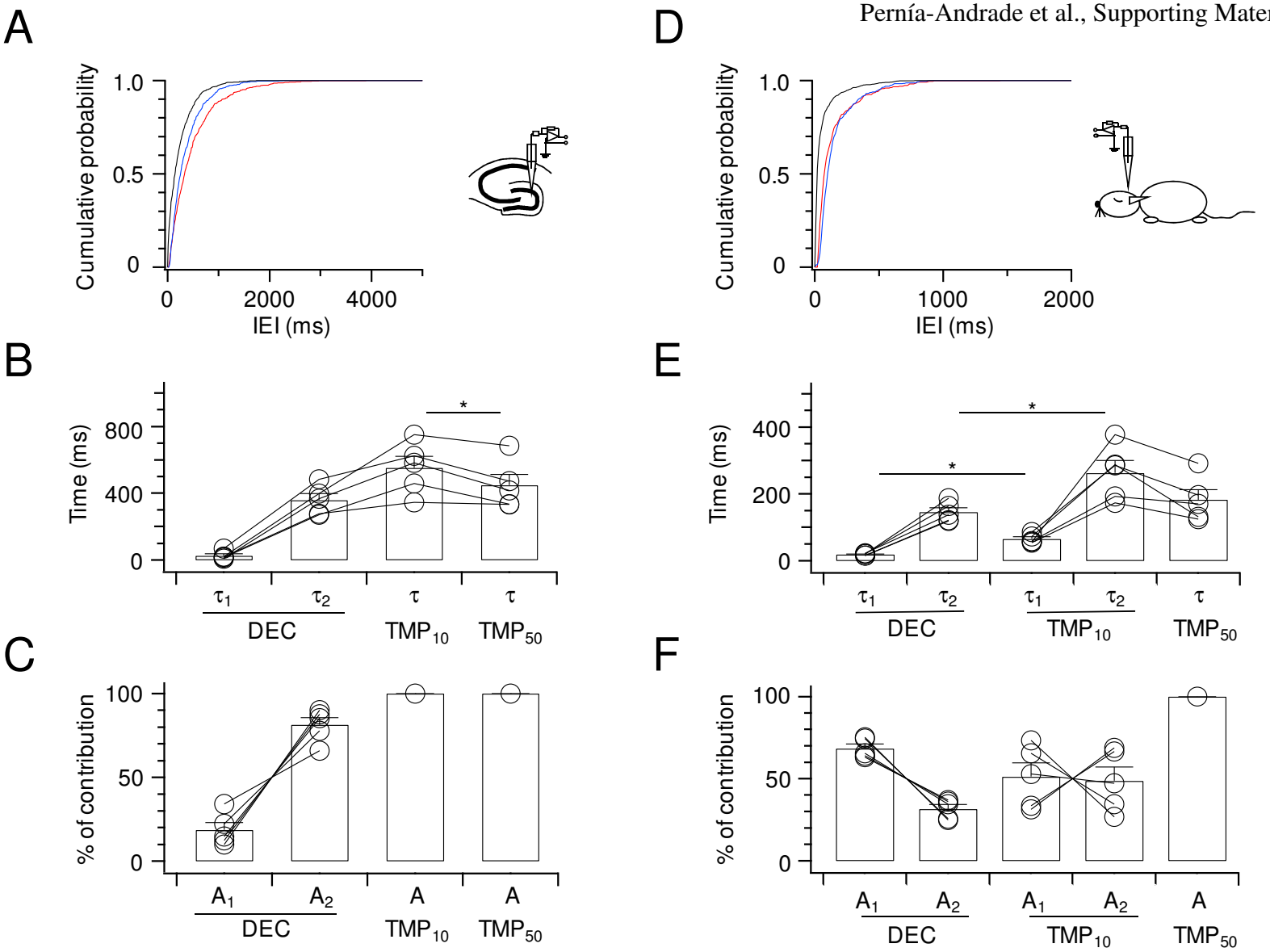
A
Cumulative probability
1.0
0.5
0
0
2000
4000
IEI (ms)
D
Cumulative probability
1.0
0.5
0
0
1000
2000
IEI (ms)
B
Time (ms)
800
400
0
*
τ1
τ2
τ
τ
DEC
TMP10
TMP50
E
Time (ms)
400
200
0
*
*
τ1
τ2
τ1
τ2
τ
DEC
TMP10
TMP50
C
% of contribution
100
50
0
A1
A2
A
A
DEC
TMP10
TMP50
F
% of contribution
100
50
0
A1
A2
A1
A2
A
DEC
TMP10
TMP50

Fig. S1. Fast EPSC-IEI components detected by the deconvolution method cannot be properly detected by template fit algorithms.

IEI analyses for the in vitro (A-C) and in vivo (D-F) data shown in Fig. 7D.

(A) EPSC-IEI cumulative probability for one in vitro experiment, obtained by deconvolution (black trace) and template fit algorithm with 10 ms (red trace) and 50 ms (blue trace) template duration.

(B) Summary bar graphs of the fast (τ_1) and slow time constants (τ_2) of IEI cumulative distributions. For deconvolution (DEC), two exponential components could be distinguished. For template fit analysis, only a single exponential component was detected using either 10-ms template (TMP_{10}) or 50-ms template (TMP_{50}).

(C) Summary bar graphs of the % of contribution A_1 and A2 (DEC), and A ($TMP_{10,}$ TMP_{50}) corresponding to τ_1 (DEC), τ_2 (DEC), τ (TMP_{10}) and τ (TMP_{50}) respectively.

(D) EPSC-IEI cumulative probability for one in vivo experiment generated by DEC, $TMP_{10,}$ and TMP_{50} (the color coding is the same as in A).

(E) Summary bar graphs of the fast (τ_1) and slow time constants (τ_2) of IEI cumulative distributions. For deconvolution (DEC), two exponential components could be distinguished. For template fit analysis, two exponential components were distinguished with TMP_{10}, whereas only a single exponential was found with TMP_{50}.

(F) Summary bar graphs of the % of contribution A_1 and A2 (DEC), and A ($TMP_{10,}$ TMP_{50}) corresponding to τ_1 (DEC), τ_2 (DEC), τ (TMP_{10}) and τ (TMP_{50}) respectively.

In B and E: $P < 0.05$ (*).

Pernía-Andrade et al., Supporting Material