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Supplemental information

A deep learning strategy to identify cell types across species from high-density extracellular recordings

Maxime Beau, David J. Herzfeld, Francisco Naveros, Marie E. Hemelt, Federico D'Agostino, Marlies Oostland, Alvaro Sánchez-López, Young Yoon Chung, Michael Maibach, Stephen Kyranakis, Hannah N. Stabb, M. Gabriela Martínez Lopera, Agoston Lajko, Marie Zedler, Shogo Ohmae, Nathan J. Hall, Beverley A. Clark, Dana Cohen, Stephen G. Lisberger, Dimitar Kostadinov, Court Hull, Michael Häusser, and Javier F. Medina

Supplemental Tables

	Purkinje cell simple spikes (n=69)	**Purkinje cell complex spikes** (n=58)	**Molecular layer interneurons** (n=27)	**Golgi cells** (n=18)	**Mossy fibers** (n=30)
Mean firing rate (spikes/s)	104.9±38.1	1.2±0.3	27.3±22.5	18.9±12.0	17.3±15.6
CV	0.45±0.17	0.95±0.3	0.81±0.23	0.76±0.37	1.6±0.9
CV2	0.36±0.09	0.88±0.08	0.69±0.18	0.6±+0.15	0.92±0.28
ISI std (ms)	4.9±2.6	905.9±470.5	106.7±183.8	62.4±51.0	172.0±172.8
Bursting (95th percentile of instantaneous firing rate) (spikes/s)	201.3±68.1	9.7±1.9	142.3±99.3	105.6±92.2	507.9±328.4
Waveform peak-to-trough (ms)	0.27±0.08	0.36±0.27	0.42±0.12	0.37±0.09	0.16±0.09
Peak-to-trough ratio	0.39±0.17	0.72±0.39	0.37±0.22	0.61±0.22	0.48±0.26
Recovery constant (ms)	0.45±0.27	0.40±0.41	0.47±0.2	0.28±0.09	0.24±0.32
% spatial decay @ 24µm	52.6±15.4	49.7±17.9	54.3±16.9	40.7±16.0	61.9±15.9

Table S1 (related to Figure 4). Mean and standard deviation of commonly reported metrics used to characterize waveform and firing statistics, displayed for the cell types in the ground-truth library. The table shows the extent of overlap across cell types for statistical measures of firing and waveform properties, to allow comparison with measures reported in previous studies[1–6]. For each unit, we measured metrics related to firing properties, including the mean firing rate, coefficient of variation (CV), mean CV2[7], and the standard deviation of the interspike interval distribution. We devised a metric to measure the maximal instantaneous firing rate for each unit while remaining robust to noise by computing the instantaneous firing rate as the inverse of adjacent interspike intervals and reporting the 95th percentile of the resulting distribution. We also report metrics commonly used to summarize waveform properties, including the peak-to-trough width[8], peak-to-trough ratio[8,9] and recovery constant, also called "end-slope"[9]. Finally, we computed a metric to summarize the spatial decay of each unit's electrical footprint across channels of the Neuropixels by computing the percentage of the peak-to-peak amplitude measured on each unit's largest channel that was lost on adjacent diagonal contacts, 24 µm away.

	Purkinje cell simple spikes	Purkinje cell complex spikes	Molecular layer interneurons	Golgi cells	Mossy fibers
Mouse lateral cerebellum (n=1291)	11%	39%	11%	9%	30%
Monkey floccular complex (n=527)	23%	26%	5%	37%	9%
Ground-truth library (n=202)	34%	29%	13%	9%	15%

Table S2 (related to Figures 4 and 5): Distribution of cell types across the samples from mice, monkeys, and in the ground-truth library. We estimated the distribution of cell-types in our recordings by applying our fully-trained deep learning classifier (see Figure 5) to two large, unlabeled samples of well-isolated neurons from the lateral cerebellar cortex (Crus I, Crus II, paramedian lobule, paraflocculus, and lateral simplex) of mice and the floccular complex of monkeys. The relative proportion of cell types differ across samples, probably because of the properties of the Neuropixels used in mice versus the s-Probes used in monkeys as well as genuine differences in different regions of the cerebellum. They also do not mirror the enrichment of recordings from Purkinje cells in our ground-truth library (Figure 4C) because Purkinje cells are larger and easier to isolate than many other cerebellar neurons.

	Maxime Beau[1]	David J. Herzfeld[1]	Francisco Naveros[1]	Marie E. Hemelt[1]	Federico D'Agostino[1]	Marlies Oostland[1]	Alvaro Sánchez-López[1]	Young Yoon Chung	Michael Maibach	Stephen Kyranakis	Hannah N. Stabb	M. Gabriela Martínez Lopera	Agoston Lajko	Marie Zedler	Shogo Ohmae	Nathan J. Hall	Beverley A. Clark[2]	Dana Cohen[2]	Stephen G. Lisberger[2]	Dimitar Kostadinov[2]	Court Hull[2]	Michael Häusser[2]	Javier F. Medina[2]
Conceptualization	•	•														•	•	•	•	•	•	•	
Mouse data collection	•	•		•		•	•	•	•		•			•	•				•	•			
Mouse data analysis	•		•	•	•	•	•			•		•											
Monkey data collection		•																					
Monkey data analysis		•													•								
Classifier design	•	•			•																		
Software development	•	•	•		•							•	•										
Manuscript, led writing																		•					
Manuscript, major contribution to figures	•	•			•														•				•
Manuscript, major contribution to writing	•	•																•	•	•	•	•	•
Manuscript, contribution to figures and/or writing	•	•	•	•	•	•	•										•	•	•	•	•	•	•
Supervision	•													•		•	•	•	•	•	•	•	•
Funding																•		•		•	•	•	•

Table S3: Author contributions. Significant contributions are denoted with a dot (•).
[1]These authors contributed equally as first author.
[2]These authors contributed equally as senior author.

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