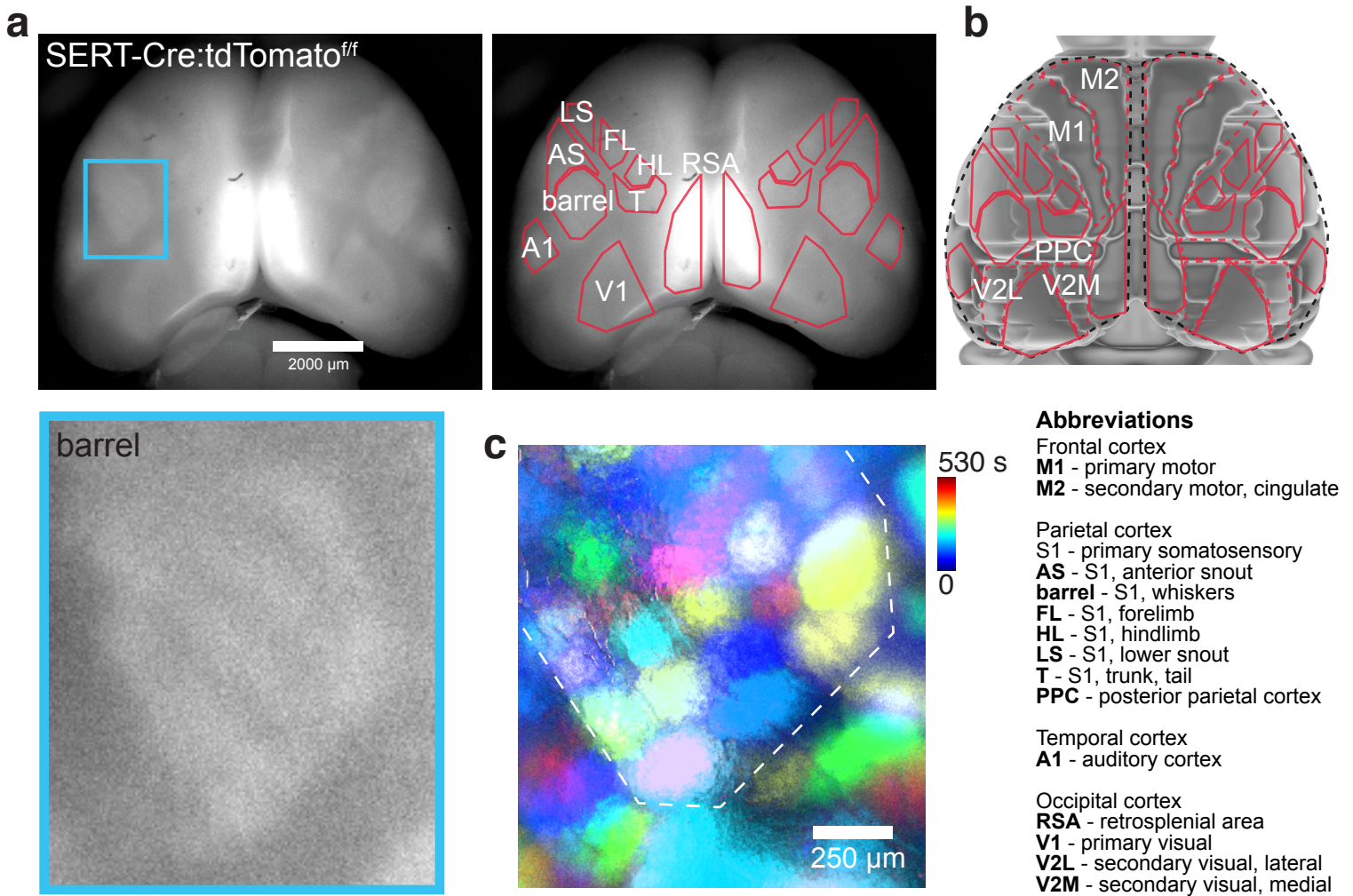


Structured dynamics of neural activity across developing neocortex

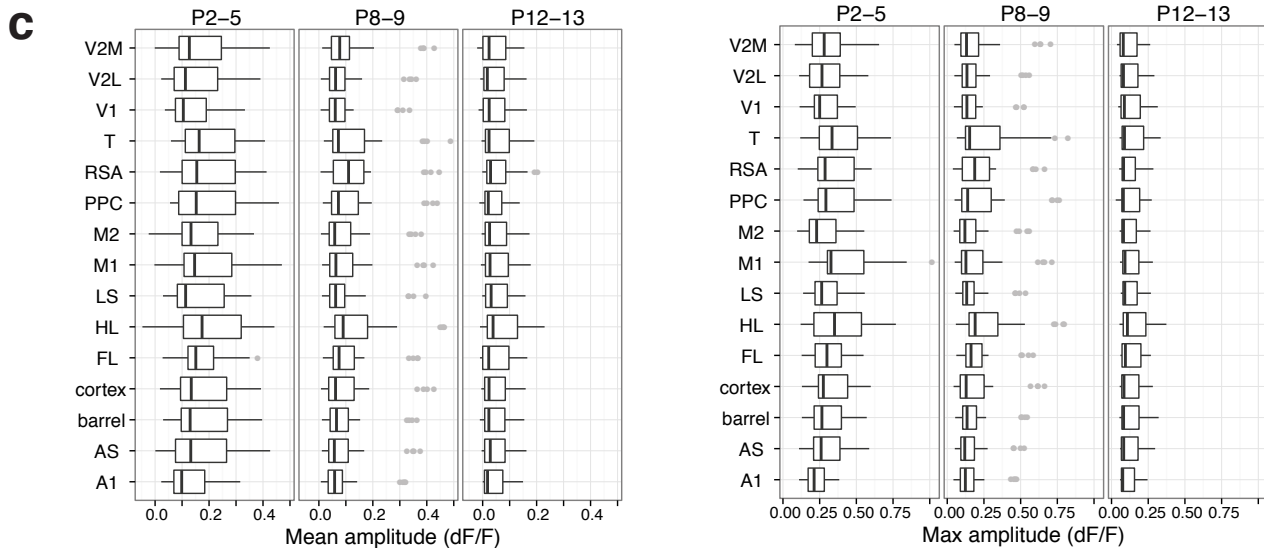
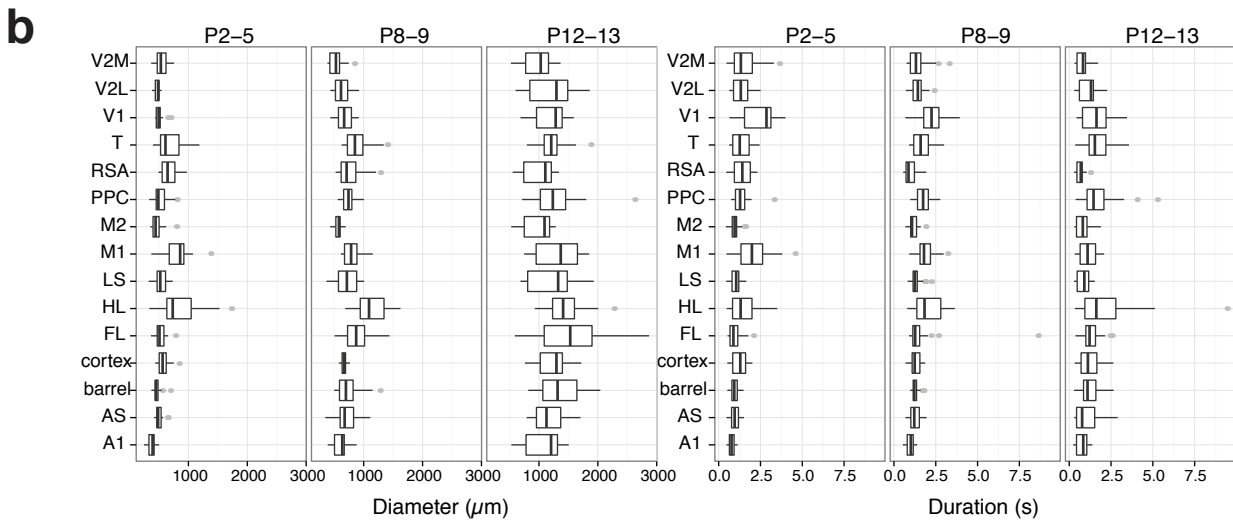
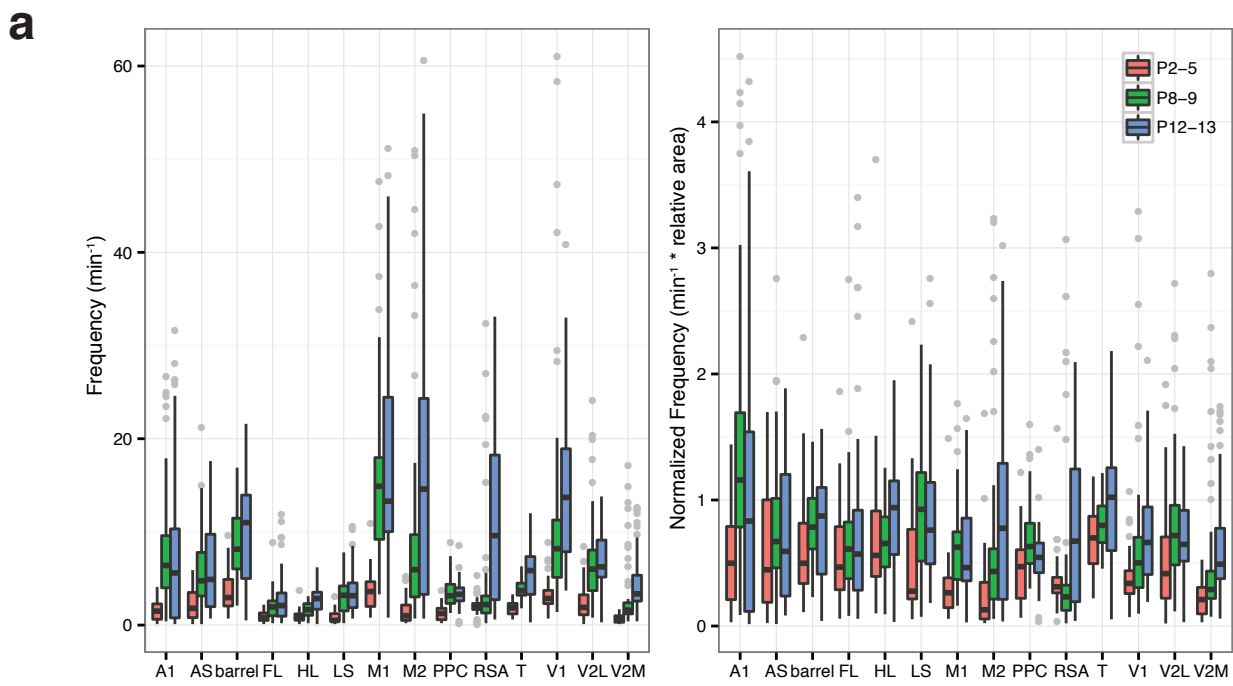
James B. Ackman, Hongkui Zeng, and Michael C. Crair

Supplementary Figs. 1 – 4

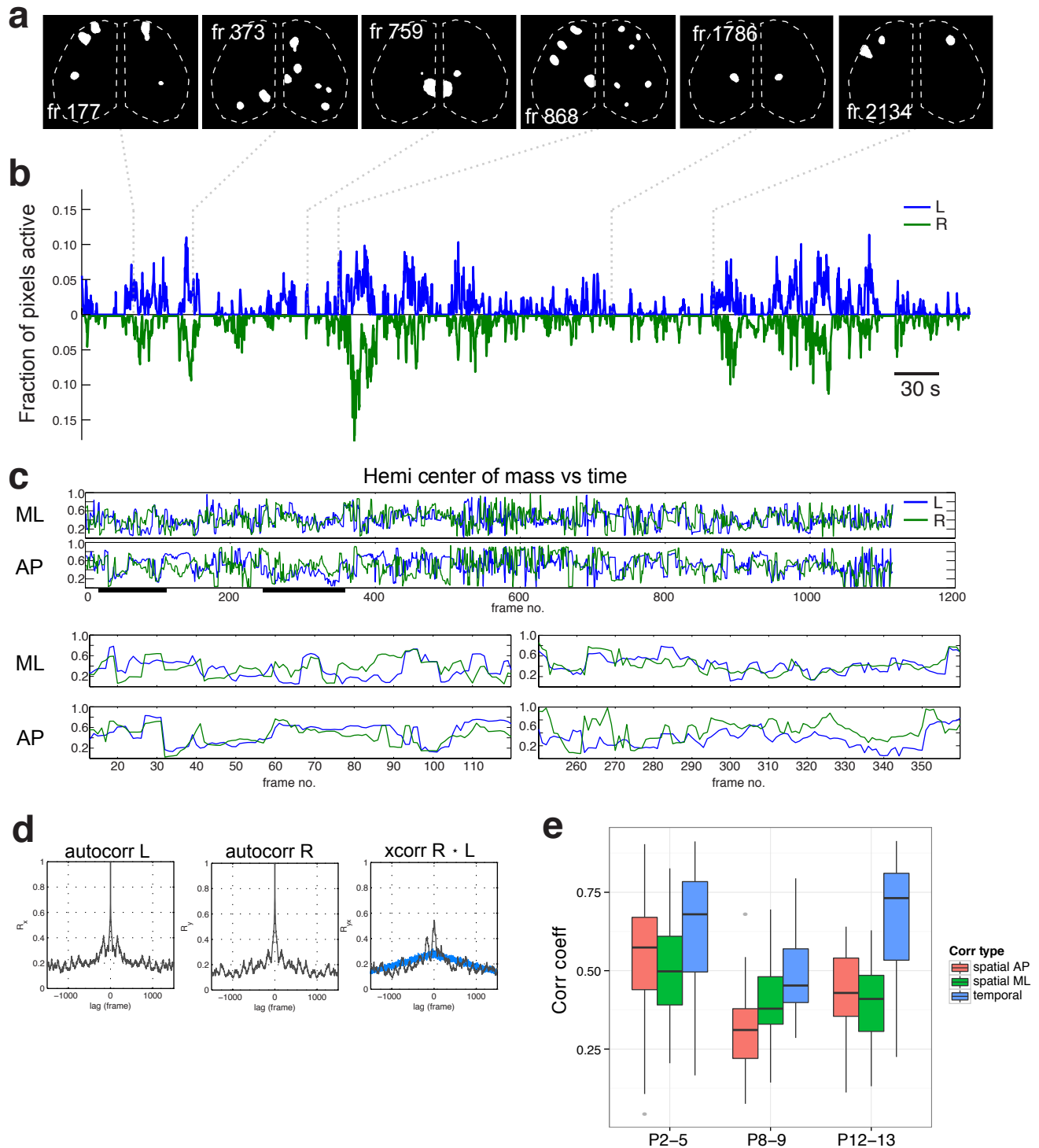
Captions for Supplementary Movies 1 – 6



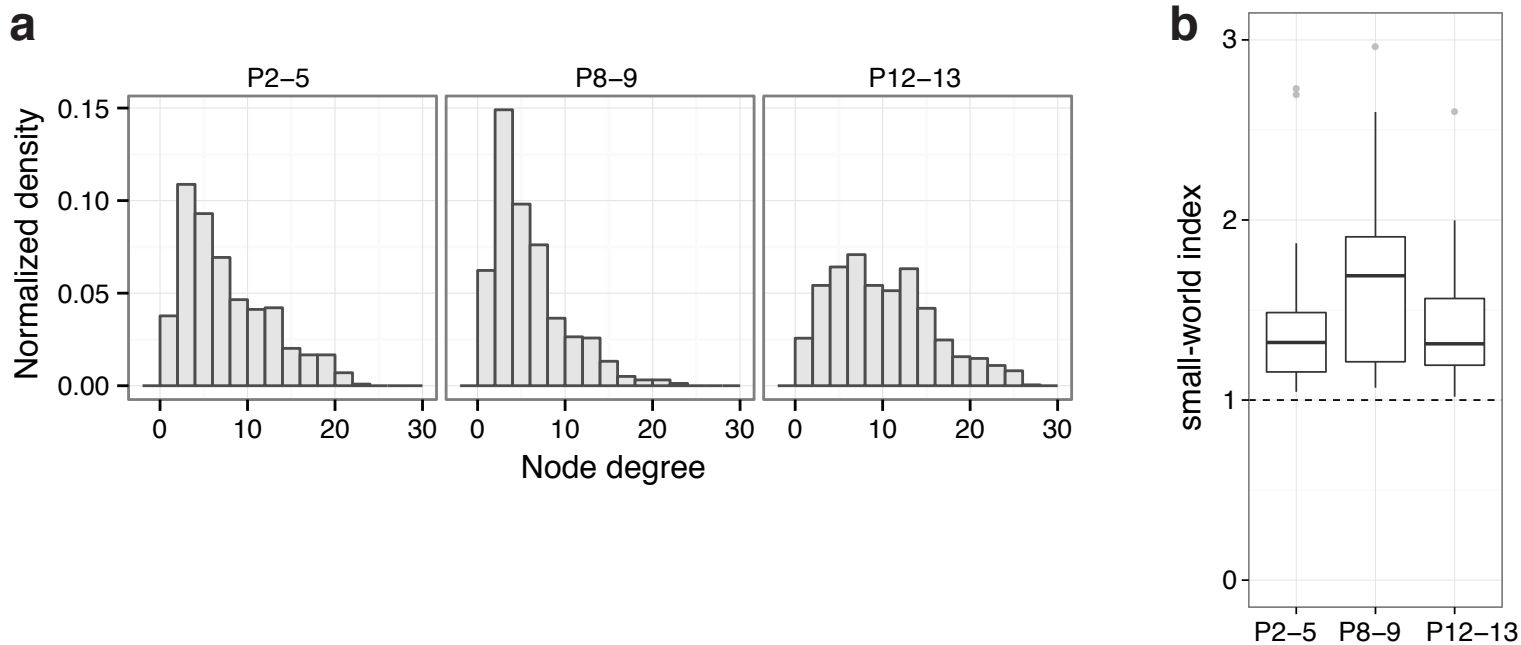
Supplementary Figure 1. Functional parcellation of developing neocortex. **a**, Image of tdtomato mouse brain at P7. Notice most tdTomato expression is in thalamocortical axons within primary sensory areas and the appearance of individual whisker barrel rows (high magnification inset, bottom panel) in S1-barrel cortex. **b**, Overlay of parcellations with Allen Brain mouse atlas reference image. **c**, Time projection map of activity in barrel cortex. Notice individual whisker barrel activations at different time points during the recording.



Supplementary Figure 2. Spatiotemporal properties of cortical activity domains. **a**, Boxplot distributions of cortical domain frequency by region. **b**, Relative cortical domain frequency, normalized to area. **c**, Mean and max domain signal intensity by cortical region (P2–5, N = 22; P8–9, N = 30; P12–13, N = 38 movies/region).



Supplementary Figure 3. Cortical domain activity exhibits bilateral symmetry. **a**, Examples of domains exhibiting spatially symmetric activations. Notice most timepoints contain a mixture of symmetric and asymmetric domain activations. **b**, Cortical active fraction timecourses for both hemispheres. **c**, Hemispheric domain centers of mass for coactive frames in **a** recording along medial-lateral (ML) and anterior-posterior (AP) extents. Bottom left panels show the periods indicated by black bars at expanded view. Pearson's correlation: ML, $r = 0.3241$, $p = 1.1591e-28$; AP, $r = 0.1479$, $p = 7.0982e-07$. **d**, Example temporal autocorrelation and cross-correlation functions for hemispheric cortical activity. Notice the peaks above gaussian distributed noise (blue traces). **e** Boxplots showing distribution of spatial and temporal correlation between the cortical hemispheres (P2–5, $N = 22$; P8–9, $N = 30$; P12–13, $N = 38$ movies).



Supplementary Figure 4. Functional connectivity properties of developing neocortical networks. **a**, Degree distribution (no. of links) for cortical areas (nodes) across all movies. Notice the distribution tail shifting towards higher degrees at the end of the second postnatal week. **b**, Small-world index of developing neocortical networks. Values above 1 indicate significant small-world network architecture (see Methods) (P2-5, N = 22; P8-9, N = 30; P12-13, N = 38 movies).

Supplementary Movie 1

The movie shows an example of typical transcranial cortical activity patterns during the first postnatal week (SNAP25-GCaMP6 mouse imaged at P5). Movie is 36 s total recording time played back at 6x (30 fps) as dF/F. Forelimb and snout movements are visible in the upper portion of the field of view, which is 11 mm x 13 mm (MPEG-4; 5.8 MB).

Supplementary Movie 2

The movie shows an example of typical transcranial cortical activity patterns during the beginning of the second postnatal week (SNAP25-GCaMP6 mouse imaged at P8). Movie is 36 s total recording time played back at 6x (30 fps) as dF/F. Forelimb and snout movements are visible in the upper portion of the field of view, which is 11 mm x 13 mm (MPEG-4; 8.9 MB).

Supplementary Movie 3

The movie shows an example of typical transcranial cortical activity patterns at the end of the second postnatal week (SNAP25-GCaMP6 mouse imaged at P12). Movie is 36 s total recording time played back at 6x (30 fps) as dF/F. Forelimb and snout movements are visible in the upper portion of the field of view, which is 14 mm x 17 mm (MPEG-4; 9.1 MB).

Supplementary Movie 4

The movie shows an example of a slow, wave-like, infrequently occurring, global cortical activation at the end of the second postnatal week (SNAP25-GCaMP6 mouse). The global activation shifts caudally to rostrally and ceases halfway through the movie (during motor twitches of limbs and face), followed by more typical ongoing cortical activity patterns. Movie is 50.2 s total recording time played back at 6x (30 fps) as dF/F mouse. Field of view is 20 mm x 24 mm (MPEG-4; 12.9 MB).

Supplementary Movie 5

The movie shows an example of transcranial cortical activity patterns at P8 before and after 2.5% isoflurane anesthesia induction (SNAP25-GCaMP6 mouse). Movie is 249 s total recording time played back at 6x (30 fps) as dF/F. Field of view is 20 mm x 24 mm. (MPEG-4; 23.5 MB).

Supplementary Movie 6

The movie shows an example of transcranial cortical activity patterns at P13 before and after 2.5% isoflurane anesthesia induction (SNAP25-GCaMP6 mouse). Movie is 249 s total recording time played back at 6x (30 fps) as dF/F. Field of view is 20 mm x 24 mm. (MPEG-4; 23.7 MB).