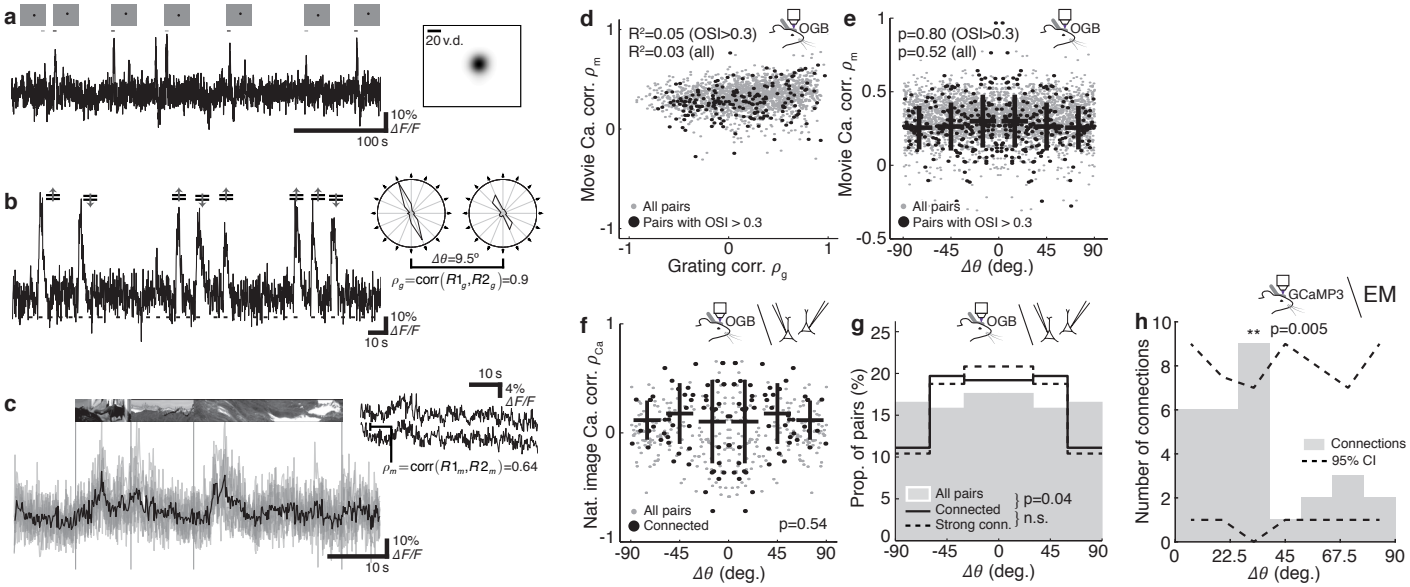

Supporting Figure 1: Connected neurons span a wide range of preferred orientations in mouse V1. a Characterisation of receptive field location using sparse drifting/rotating grating stimuli. Single-trial OGB calcium responses (black); presentation time of optimal stimulus and sub-optimal stimulus indicated (black and grey bars). Right inset: estimated RF location for the same neuron. **b** Single-trial OGB calcium response to drifting grating stimuli (black); presentation of optimal stimulus orientation indicated above, all stimulus presentation times indicated below. Right inset: calculation of grating response similarity ρ_g between two neurons. **c** Single-trial (grey) and trial-averaged OGB calcium response (black) to natural movie stimuli. Vertical lines indicate timing of movie sequence onset. Right inset: calculation of movie response similarity (ρ_m), using signal correlations over trial-averaged responses from two neurons. **d** Pairs of neurons with high signal correlations to natural movies (ρ_m), which predicts a high probability of connection [21], can have similar or dissimilar grating responses. Pairs of neurons with similar orientation preference are not more likely to have high ρ_m (**e**) or high signal correlation to flashed natural scenes ρ_{Ca} (**f**) than pairs with dissimilar orientation preference. **g** Connected pairs are slightly more likely to share similar orientation preferences than unconnected pairs [21,24], but nevertheless span almost arbitrary orientation differences (≈20% of pairs with close to orthogonal orientation preference). **h** In data from functionally characterized neurons with connections reconstructed under electron microscopy [25], connected pairs are more likely to share similar preferred orientations. An excess of connections was present at orientation preference differences of around 30° (p = 0.005, Monte-Carlo test). Dashed lines: 95% bootstrap confidence intervals (CI). d–e: in vivo two-photon calcium imaging; f–g: in vivo calcium imaging coupled with in vitro simultaneous patching to detect connected pairs; data from [24]. h: in vivo calcium imaging coupled with electron microscopy (EM) reconstruction to identify connected neurons; data from [25]. e–f: Kruskal-Wallis tests; g: Ansari-Bradley test; h: Monte-carlo test. n.s.: p > 0.05. Strong connections: strongest 50% of connected pairs, measured by EPSP amplitude. Corr: correlation; conn.: connection.