Supplementary Figure 1

Supplementary Figure 1. Recurrent circuitry underlying Delay cell firing.

In deep layer III of dIPFC, pyramidal neurons that share similar preferred directions excite each other through recurrent connections on dendritic spines. For example, a cluster of neurons receive highly processed information from the parietal association cortex regarding the visual spatial position at 180°. When the cue appears in their preferred direction (180°), the circuit is activated and the 180° neurons excite each other recurrently, allowing each individual neuron to maintain persistent firing across the Delay period when there is no longer sensory stimulation. In contrast, when the cue appears in their nonpreferred directions (e.g. 0°), neurons representing 0° are activated and suppress the firing of 180° neurons through inhibitory interneurons (e.g. B symbolizes a GABAergic basket cell). Thus, neuron ensembles are able to generate spatially-tuned persistent firing across the delay period.
Supplementary Figure 2. APDC effects on Delay cell firing for the preferred and nonpreferred directions.

Population Delay firing in Control, APDC low dose (5-15nA) and APDC high dose (20-100nA) condition for the neurons’ preferred (solid line; data are shown in Figure 3c) and nonpreferred directions (dashed line); mean±s.e.m.. Low doses of APDC enhanced firing for both preferred ($t_{dep}(42)=-5.132, P<0.001$) and nonpreferred directions ($t_{dep}(42)=-4.232, P<0.001$), but more for the preferred directions (repeated two-way ANOVA, $F_{direction\times\text{drug}}(1,42)=16.479, P<0.001$). High doses eroded the enhancing effect of low doses for the preferred directions ($t_{dep}(15)=2.996, P=0.009$) but not for the nonpreferred directions ($P>0.7$). There are no significant differences between APDC high dose and Control condition for both preferred ($P>0.5$) and nonpreferred directions ($P>0.2$). *** $P<0.001$, n.s. non-significant, compared with Control condition.
Supplementary Figure 3. Normalized dose-response curves of Delay firing and d’ with APDC.

Normalized firing was calculated for each cell at each drug dose as follows: the values of Delay firing and d’ in the drug conditions were divided by the values from each neuron’s Control condition. The mean of all the cells was calculated for each drug dose. APDC produced an inverted-U dose-response for both Delay firing and d’, with strong improvements at 5-15nA, but not with higher doses.
**Supplementary Figure 4. LY379268 effects on Delay cell firing and d'.**

(a) Population Delay firing in Control, LY379268 low dose (5-15nA) and LY379268 high dose (30-60nA) condition for the neurons’ preferred (solid line) and nonpreferred (dashed line) directions; mean±s.e.m.. Low doses of LY379268 selectively enhanced firing for the neurons’ preferred directions ($t_{dep}(18)=-4.612$, $P<0.001$), without changing the nonpreferred directions ($P>0.2$) (repeated two-way ANOVA, $F_{direction\times drug}(1,18)=29.107$, $P<0.001$). High doses of LY379268 did not change the firing any further compared to low doses for both preferred ($P>0.9$) and nonpreferred directions ($P>0.07$). Compared to Control condition, LY379268 high dose increased Delay firing for the preferred directions ($t_{dep}(12)=-2.355$, $P=0.036$) and not for the nonpreferred directions ($P>0.09$) * $P<0.05$, *** $P<0.001$, n.s. non-significant, compared with Control condition. (b) Population d’ in Control, LY379268 low dose (5-15nA) and LY379268 high dose (30-60nA) condition; mean+s.e.m.. Low dose LY379268 significantly enhanced d’ ($t_{dep}(18)=-3.644$, $P=0.002$); high dose did not change d’ compared to Control condition ($P>0.9$). ** $P<0.01$, n.s. non-significant, compared with Control condition.
Supplementary Figure 5. 8-Br-cAMP effects on Delay firing.

Population Delay firing in Control and 8-Br-cAMP condition for the neurons’ preferred directions; mean±s.e.m.. 8-Br-cAMP at 10nA (the dose that reversed the effects of APDC) had no significant effect on Delay firing when this compound was iontophoresed on its own.