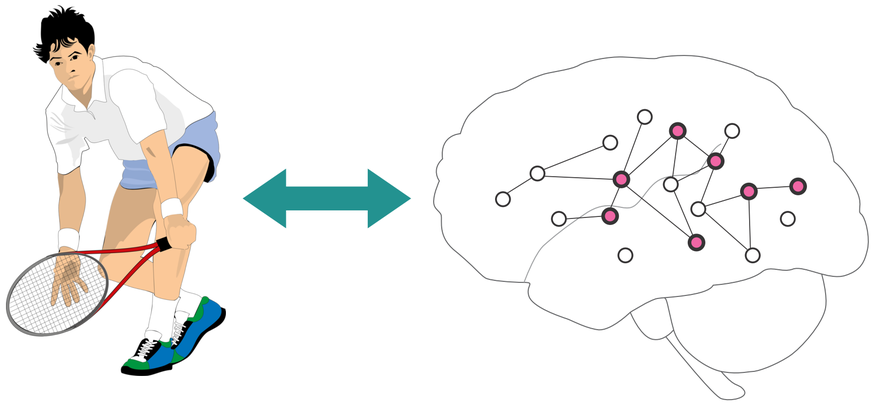
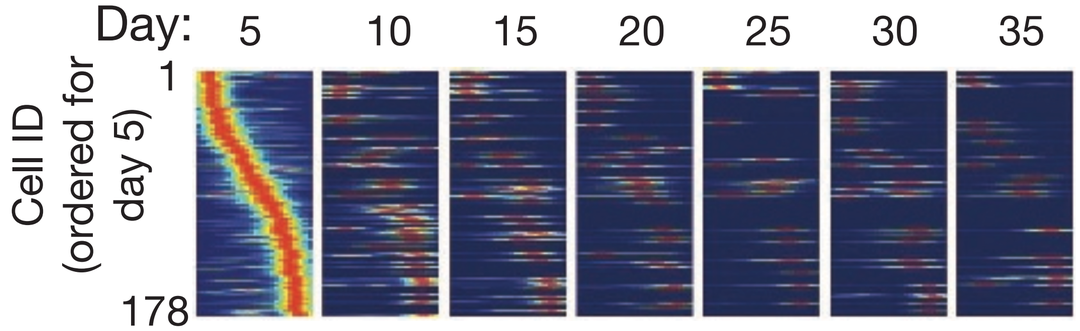
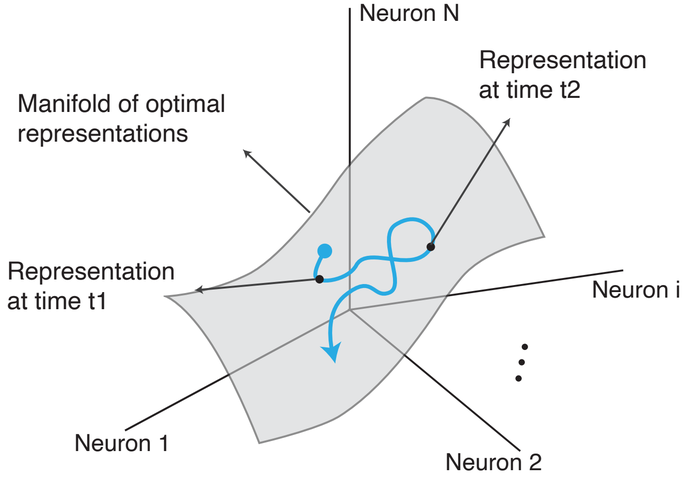
Dynamics of representational drift during noisy representation learning

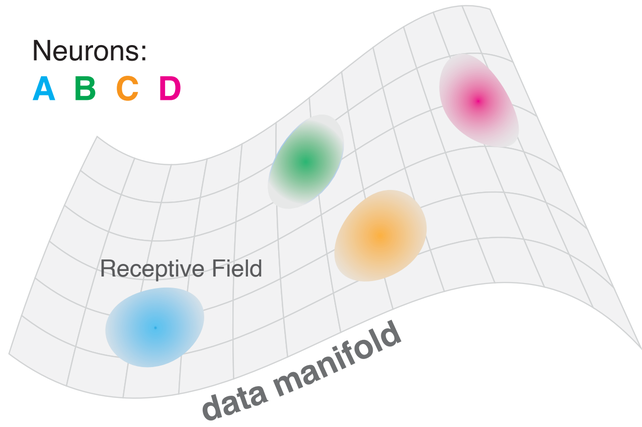
- Continuous reconfiguration of neural representations associated with stereotyped behavior

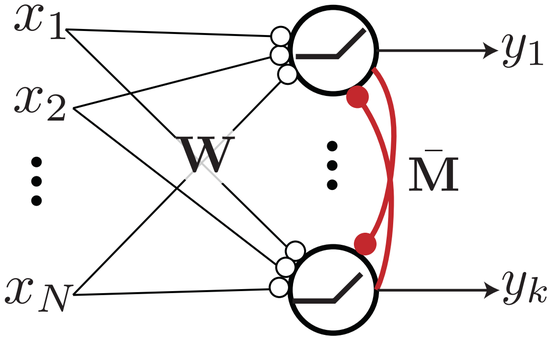




(Ziv et al., Nat Neuro, 2013, Gonzalez et al. Science, 2019; Lee et al., Cell 2020)







○ **Hebbian** ● **anti-Hebbian synapses**

Neural dynamics:

$$\frac{du_i}{d\tau} = -u_i + [\mathbf{W}\mathbf{x}_t]_i - \alpha b_i - [\bar{\mathbf{M}}\mathbf{y}_t]_i$$

$$y_i = \max\{u_i/\mathrm{M}_{ii}, 0\}$$

Learning rule with synaptic noise:

$$\Delta\mathbf{W} = \eta(\mathbf{y}_t\mathbf{x}_t^\top - \mathbf{W}) + \xi^{\mathbf{W}},$$

$$\Delta\mathbf{M} = \eta(\mathbf{y}_t\mathbf{y}_t^\top - \mathbf{M}) + \xi^{\mathbf{M}},$$

$$\Delta\mathbf{b} = \eta(\alpha\mathbf{y}_t - \mathbf{b})$$

Synaptic noise