

## **Neural Mechanisms of Temporal Discounting**

### **Results:**

Our first goal was to determine which brain areas represent the temporal delay of reward and to find the shape of the neural discounting function. Our results indicate that temporal delay of reward is reflected in the activation of caudate nucleus and nucleus accumbens. This is the first study to identify neural correlates of discounted value free of confounds of decision-related activation.

Our second goal was to investigate brain activation during *decisions* between delayed outcomes, i.e. intertemporal choice. We found that activation in the caudate and the accumbens activation was driven by *chosen value*. We found a strong correlation in the left caudate nucleus between the steepness of the behavioral and neural discount functions. Thus, this region might underlie individual differences in intertemporal choice behavior.

Our third goal was to look for neural correlates of a behavioral framing effect we had observed in temporal discounting. However, further testing showed this effect to be an experimental artifact that arose from the fact that no real payoffs were involved in the original experiment. Psychologists studying economic decision-making have generally assumed that subjects make similar decisions both when real payoffs are involved, and when the questions are purely hypothetical. Our results challenge this assumption and underscore the importance of using real payoffs in economic decision-making experiments.

### **Published work:**

We are currently writing this project up for publication

### **Researchers' Contacts:**

Margaret Livingstone  
Department of Neurobiology  
Harvard Medical School  
220 Longwood Ave, Boston, MA 02115  
Phone: 617 432 1664  
Fax: 617 734 7557  
Email: [mlivingstone@hms.harvard.edu](mailto:mlivingstone@hms.harvard.edu)