

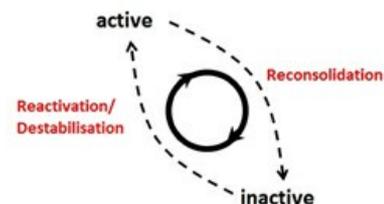
Research

Our research is principally focussed on memory reconsolidation in rodent associative memory settings. These include auditory fear conditioning, contextual fear conditioning and various appetitive pavlovian conditioning paradigms. We also study initial memory consolidation, as well as extinction of memories.

Current research

Newly-acquired memories are not immediately stably stored in the brain. Rather, they require a period of memory consolidation in order to persist into the long term. However, even once the consolidation process is complete, this does not mean that the resultant memory is "fixed in stone". Memories need to be flexible and modified in order to remain useful and relevant. This is where reconsolidation may come in. The retrieval of a memory sometimes, but not always, renders that memory vulnerable to disruption. It seems that when a memory is retrieved it can become reactivated or destabilised, necessitating a reconsolidation process in order to restabilise it back into an inactive stable form. Therefore, memories can undergo cycles of destabilisation and reconsolidation.

It appears that this cycle of reactivation and reconsolidation may allow memories to be updated. We have shown this for the updating of contextual fear memory strength and content. Given that learning theories seek to explain the amount of learning that is accrued on a given trial, this can also be conceptualised as memory updating. Therefore, it may be possible to integrate our understanding of memory reconsolidation with concepts of learning theory. In particular, we have previously argued that the prediction error signal, which is hypothesised to regulate the magnitude of learning, may be critical for the triggering of memory destabilisation.



Other research focusses on the potential for targeting reconsolidation (and extinction) processes in the treatment of disorders such as phobias, posttraumatic stress disorder and drug addiction. All these disorders feature abnormally strong and persistent memories that might be diminished either by disrupting the reconsolidation of destabilised memories or by exploiting the updating nature of reconsolidation to modify beneficially the previously-maladaptive memory. We have previously demonstrated that cue-induced cocaine seeking can be reduced by interfering with the cue-cocaine memory. Moreover, we have shown that a reactivated light-food memory can be modified with extinction training (in a retrieval-extinction procedure) to reduce cue-induced food seeking. This retrieval-extinction approach is a new area of research and we are currently investigating its underlying mechanisms.

One of the constraints of research into memory reconsolidation is knowing how successfully to reactivate and destabilise a memory. Retrieving a memory is not always sufficient to destabilise it. Our current hypothesis is that there has to be some updating information present at memory retrieval in order to engage the reconsolidation process. Therefore, we are currently very interested in the so-called boundary conditions on memory reconsolidation; that is, when it does and does not take place. Several boundary conditions, such as the strength and age of a memory, have been described by us and others. In particular, we are interested in the apparent competition between reconsolidation and extinction. This question is particularly important as without knowing whether a retrieval session engages reconsolidation or extinction preferentially, attempts to disrupt reconsolidation and diminish a memory may instead impair extinction to preserve the memory. Conversely, interventions aimed at potentiating extinction to diminish a memory might instead enhance reconsolidation and make the memory stronger.

We are also currently investigating whether instrumental memories undergo reconsolidation. These memories remain the last ones for which the only existing published studies of memory reconsolidation have failed to demonstrate its existence. We believe it is likely that all memories do undergo reconsolidation, at least under certain circumstances. Therefore, we are seeking to show that instrumental behaviours can be reduced by impairing memory reconsolidation.

Grants

Current grants

BBSRC Responsive Mode Research Grant

"Neural Mechanisms of Memory Updating" (/schools/psychology/labs/memory-persistence/research/neural-mechanisms.aspx)

3 yr; April 2013 – Mar 2016; £508k

UoB-UoN-FAPESP Collaborative Research Grant

"Cannabidiol regulation of fear memory processing and associated brain function"
£8868

Welcome Trust ISSF Pump-Priming Grant

"Reconsolidation of instrumental cocaine seeking memories"
£5589

Previous grants

Leverhulme Trust Research Project Grant

"Prediction Error and Memory Reconsolidation"
April 2011 - Mar 2014; £208k

MRC New Investigator Research Grant

"Neural Systems and Neurobiological Pathways Underlying Aversive Memories"
Mar 2009 - Feb 2012; £473k

Royal Society Research Grant

"Molecular Mechanisms of Fear Memory Reconsolidation and Extinction"
Oct 2007 - Sept 2008; £15k

Publications

Please see <http://www.researcherid.com/rid/A-9629-2008> (<http://www.researcherid.com/rid/A-9629-2008>)

