

# The study of short term memory using frog muscle

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## Discussion

## Abstract

The purpose of our experiment is to study short term memory (STP) and its relation to long term memory (LTP). Frog is our organism model. We perform experiments on the neuromuscular junction of the frog's sciatic nerves and calf muscles. The materials we use are: a beaker with a hook, labscribe hardware (and software), and computer. Synaptic memory is observed by applying two simultaneous twitches. The behavior of the muscle following stimulation involves various molecular factors. Curare, synaptic blocking pharmaceutical, is used in order to observe synaptic memory. The data obtained from experiments clearly justify the presence of STP.

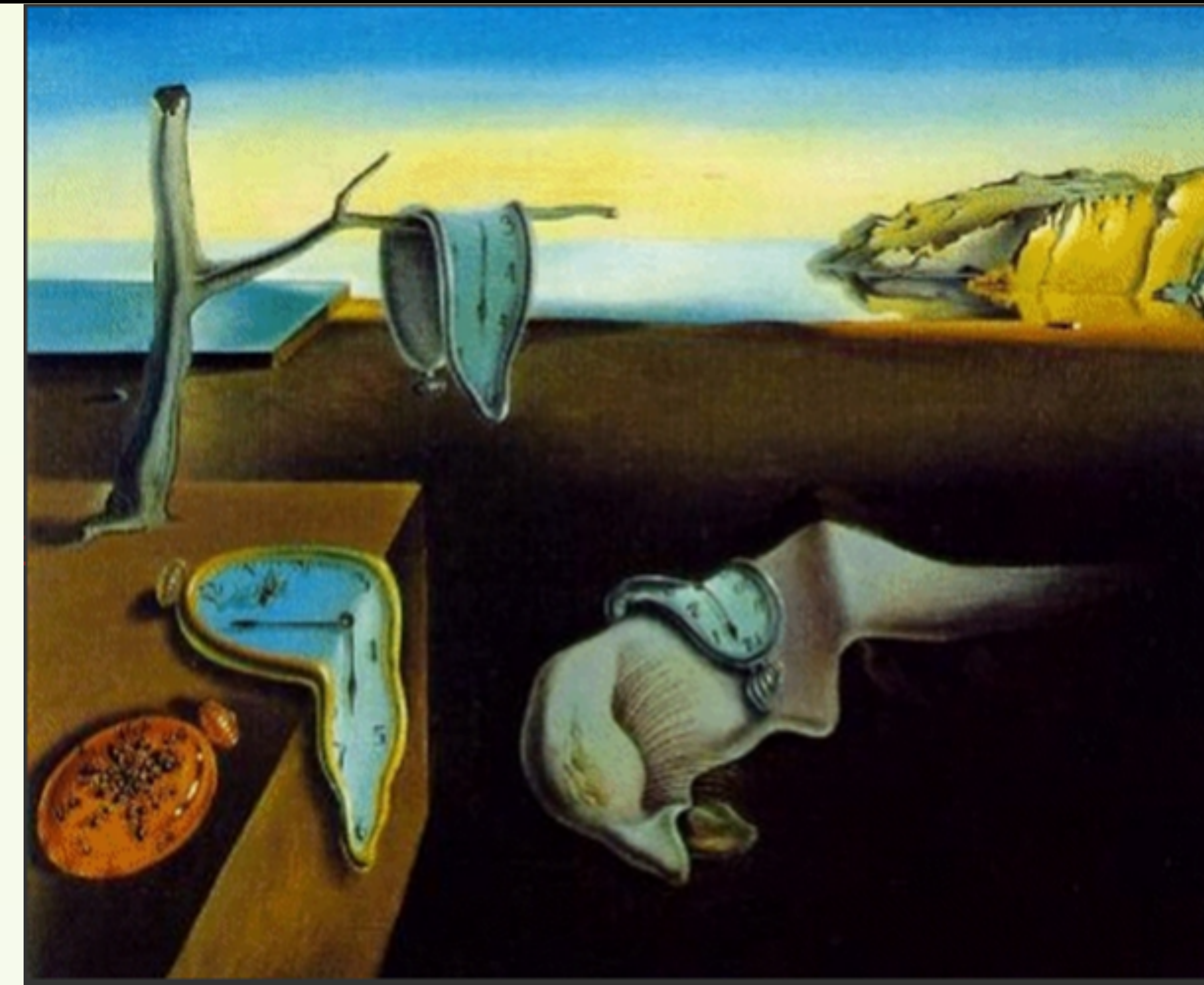


Figure 1. The persistence of memory by Salvador dali  
Credit: people .tribe.net

## Materials and Methods

The preparation for this experiment is very simple. First of all a frog is killed humanly and once it's dead, the head is cut off. By performing standard dissection procedure a sciatic nerve and calf muscle is removed. A ligature is tied on the tendon of the ankle and a hook is tied to a knee muscle. Then a saline bathing solution for living tissue is poured into a beaker with a hook attached to the bottom. Then the muscle is hooked into the beaker from knee side and tied into the force transducer "twitch recorder" from tendon side. The sciatic nerve is placed on the surface of the electrode that induces the electric stimulus. The labscribe software can be manipulated to get to do various types of experiments with the same preparation. The control trains experiment, which is completed before inducing muscle fatigue, is recorded by using the trains labscribe setup. Then, the muscle is continuously stimulated for about 30 minutes in the presence of curare to induce fatigue and make it possible to observe the role memory plays during this process. After inducing muscle fatigue, the twitches are recorded at various intervals of time.

## Introduction

"Some moments become lasting recollections while other evaporate." (the persistence of memory- Salvador Dali) (fig. 1) And "How does a gene know when to strengthen the synapse permanently and when to let a fleeting moment fade unrecorded? (Tribe 2013)"

The STP is very important for learning and memory. The very often repetition of short term memory causes a change in gene at molecular level so that new synapses are created in the brain i.e. Long term memory (LTP). Similar process found in neurons of the brain can be demonstrated by performing frog muscle experiment. Two twitches are created at different time interval between them. When the interval between the double stimulation is shorter, the second twitch is bigger, showing that the action of the twitch is remembered the most. Similarly, when the interval between the stimulation is longer, less memory occurs and the test/second twitch, is smaller.

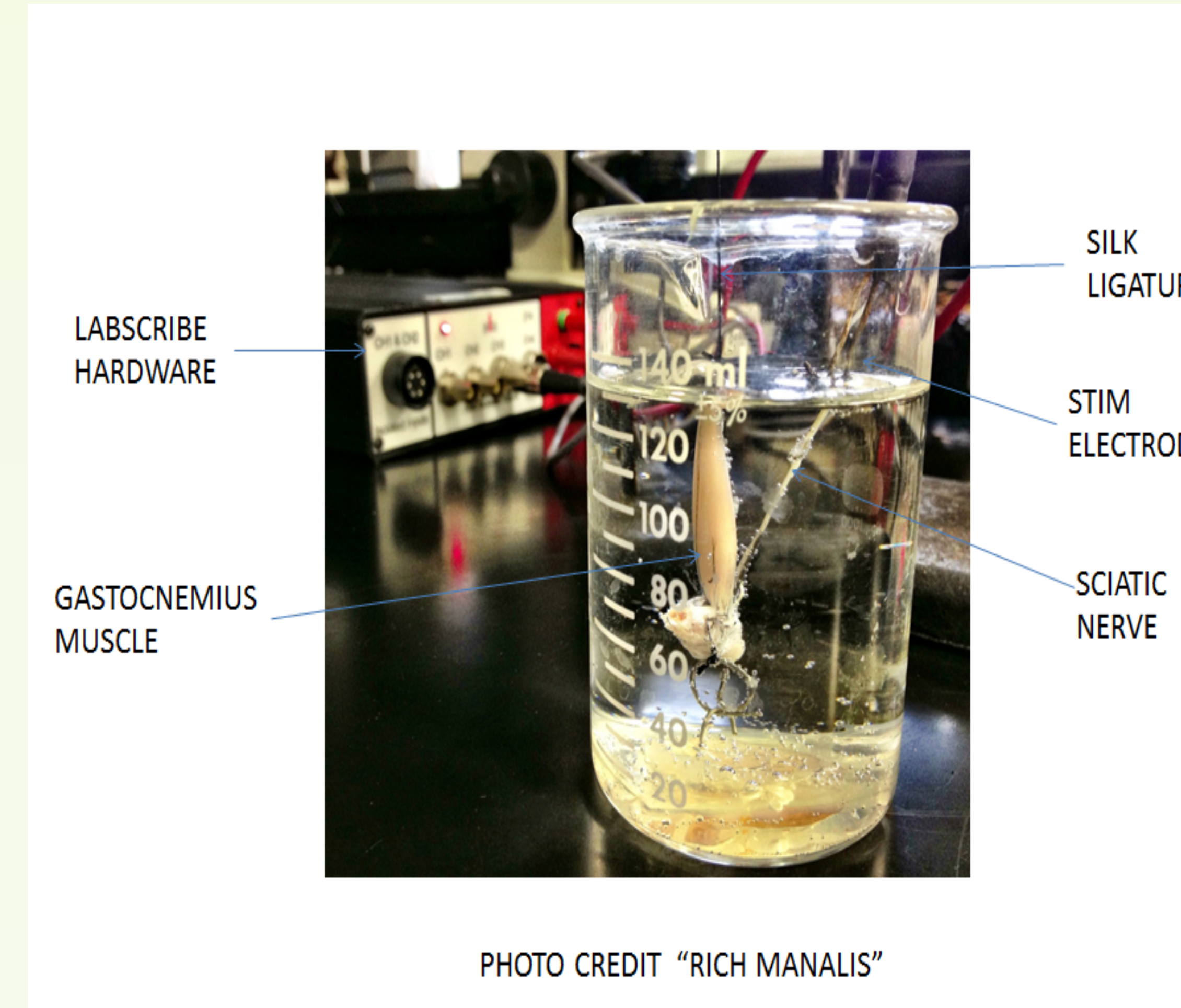


Figure 2. Experimental set up

## Results

In fig 4. T/C ratio "memory" is plotted on Y-axis and time interval between twitches is plotted on X-axis

-Graphs in green represents T/C ratio before adding curare and before inducing fatigue.

-Graphs in yellow represents T/C ratio after tiring muscle in the presence of curare.

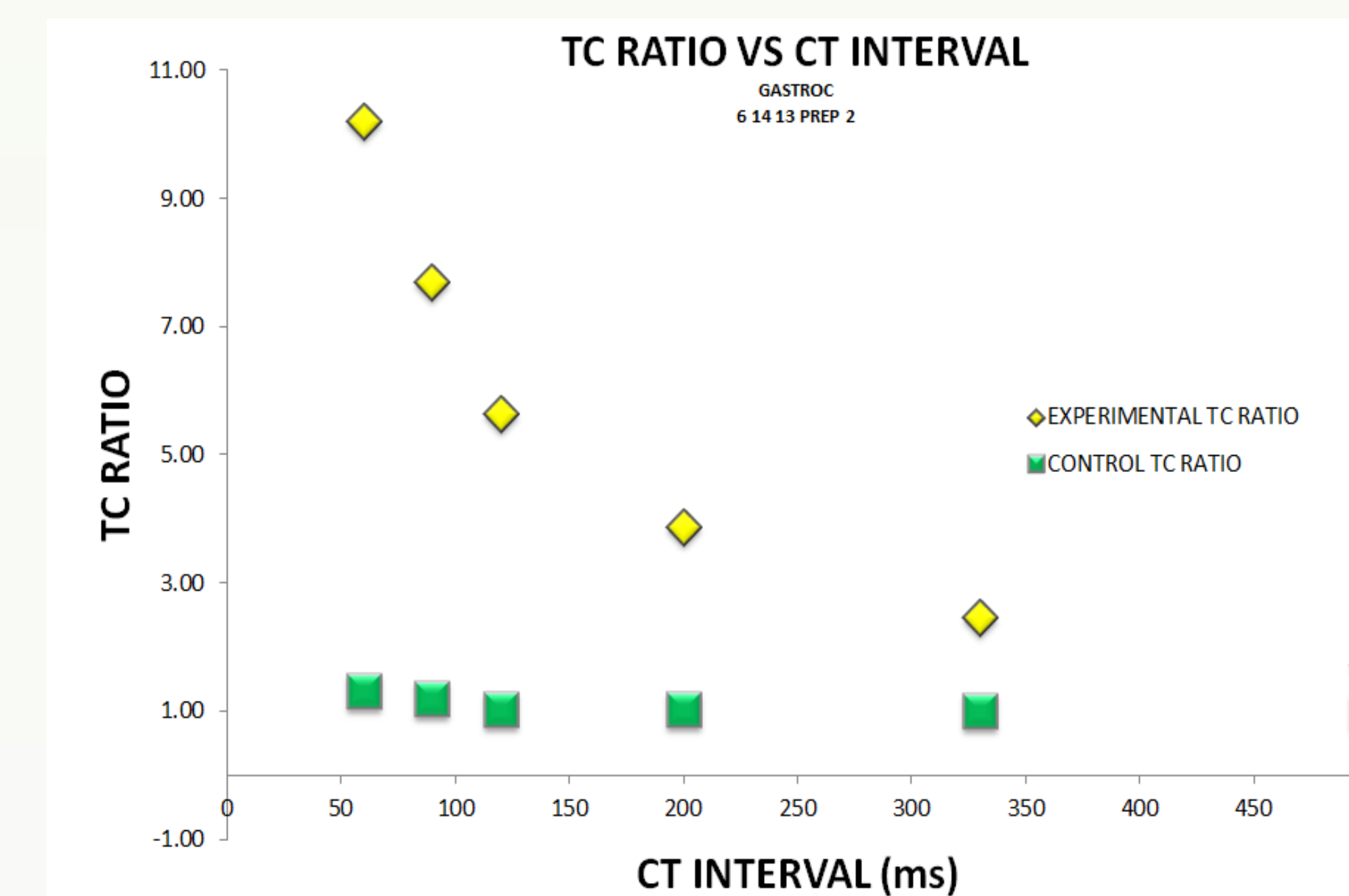


Figure 3. level of memory at different time interval

The role that memory plays during muscle stimulation and contraction, involves various molecular activities. For example, if the calf muscle contained 1,000,000 muscle cells, all 1,000,000 muscle cells would contract with a very high stimulation. When muscle fatigue is induced, only 400,000 muscle cells would contract. When curare is used during the induction of fatigue, the synapses are blocked; blocking the pathway for neurotransmitters that spread the stimulus, and hence, a reduced amount (~100,000) of muscle cells would contract. The T/C ratio (memory) before induction of fatigue is (~ 1), which shows absence of memory (Green, Fig 3). The T/C ratio ( $\geq 1$ ) shows presence of memory (Yellow, Fig 3). The facilitation of T twitch after C twitch occurs due to memory. During C twitch only few acetylcholine molecules attach to receptors but more ach attach to receptors during T twitch (Fig 4 & 5).

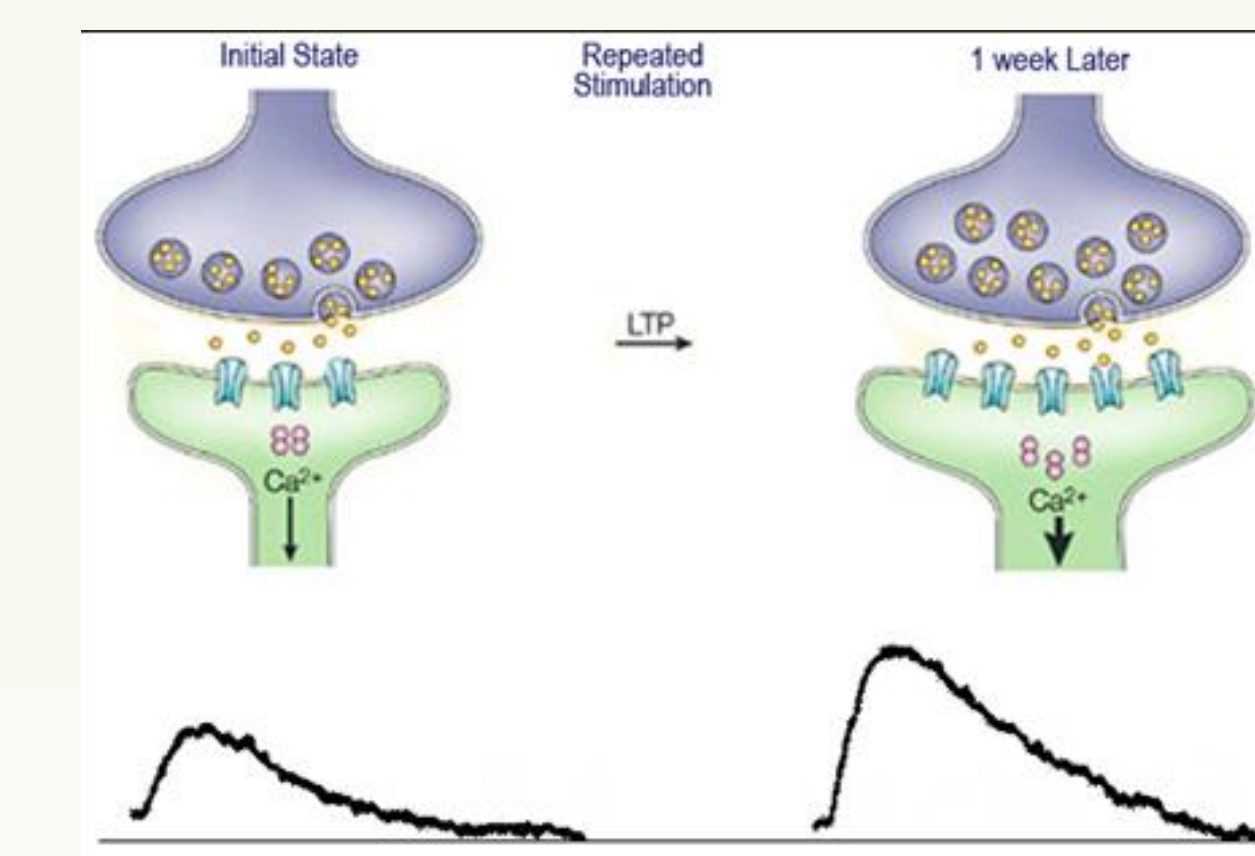


Figure 4 . synaptic plasticity (Wellspring 2013)



Figure 5. synaptic efficacy

## References

- "The Persistence of Memory tribe.net." *tribes*. N.p., 4 Nov. 2011. Web. 23 July 2013. <<http://people.tribe.net/shazlaw/blog/8711fd6e-66bf-4c7e-8c10-bb12586a85b4>>.
- "Brain Plasticity - Wellspring Learning " *Wellspring learning*. N.p., n.d. Web. 23 July 2013. <<http://www.wellspringlearningcenter.com/brain-plasticity.html>>.