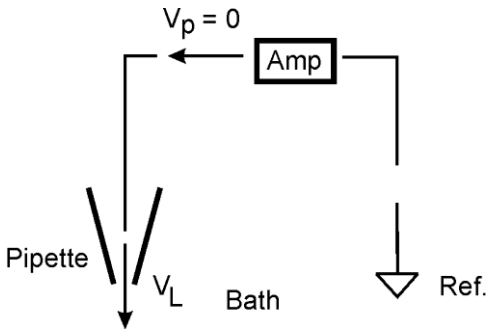
Application of Junction Potential Corrections AFTER and BEFORE an Experiment

Although we prefer to recommend applying liquid junction potential corrections after an experiment, another option that some people prefer is to do it at the beginning of the experiment. This is OK provided there are no solution changes during the experiment and the correction is applied correctly. The way this is done can be a bit confusing.

Please Note: In the original printed article on Liquid Junction Potential Corrections in *AxoBits* 39, there was a sign error in our article for some of the examples of the correction BEFORE an experiment. These are now corrected in the downloadable article available on the Axon website (now at http://mdc.custhelp.com/app/answers/detail/a_id/17450/~/axobits-newsletters)

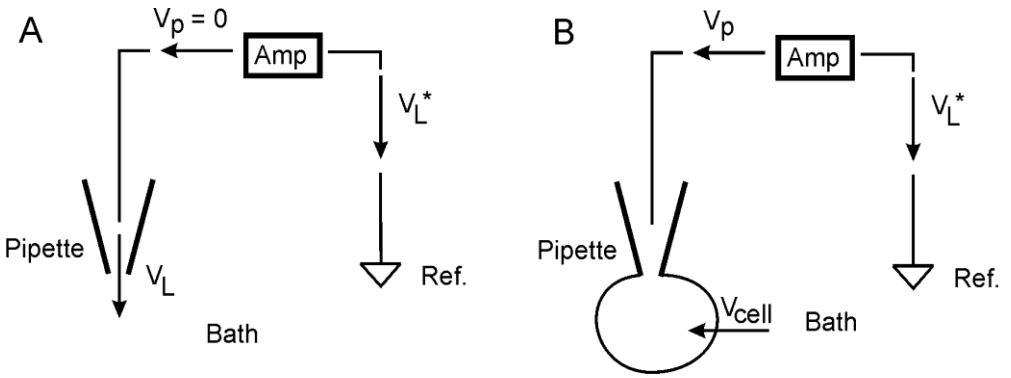
The following diagrams should clarify how such junction potential corrections need to be made. For comparison, I will show the normal way in which corrections are made after an experiment and then how they should be made before one.

The adjacent diagram shows the initial situation for a patch clamp amplifier and pipette prior to patching on to a cell. In the examples given below all of the other offsets in the circuit, including the liquid junction potential at the reference electrode, which will not change (assuming no change in the bathing solution) will be ignored.



Liquid Junction Potential Corrections Applied AFTER an Experiment

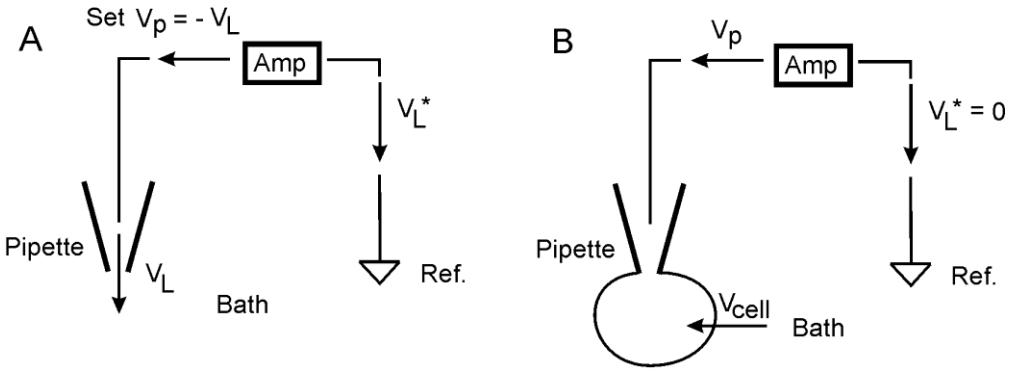
The next two diagrams show the situation, which we normally recommend, in which the corrections are made AFTER the experiment.



For the example above, in which we have a whole cell configuration, the potential of the cell, V_{cell} is, as indicated, related to the potential, V_p and liquid junction potential V_L by $V_{cell} = V_p - V_L$.

Liquid Junction Potential Corrections Applied BEFORE an Experiment

The next two diagrams show the situation, in which the corrections are made BEFORE the experiment. This method should never be used if the bath solution is going to be changed during the experiment.



Null amplifier

$V_L^* = V_L + V_p = V_L - V_L = 0$

$V_L^* = 0$

Patch Cell (Whole Cell)

$V_p - V_{cell} - V_L^* = 0$

Hence, $V_{cell} = V_p - V_L^* = V_p$

In this situation, before we zero the amplifier, we use the calculated (or measured) value of the liquid junction potential, defined to be V_L (bath with respect to pipette) and apply a command potential of $-V_L$, as in Panel A. Then we null the amplifier to balance all other sources of potential offsets. Note however, that we are no longer balancing V_L with an equal and opposite (non-zero) V_L^*. In fact, as indicated, there is no need for a V_L^* offset. That is, $V_L^* = 0$, as indicated in Panel B.

Again, for the example in which we have a whole cell configuration , as shown in Panel B, the potential of the cell, V_{cell} is, as indicated, related to the command potential, V_p simply by $V_{cell} = V_p$.

P. H. Barry, Sep 16, 2005

Interactive Electrophysiology Software:

- https://medicalsciences.med.unsw.edu.au/research/research-services/ies
- http://web.med.unsw.edu.au/phbsoft/default.htm (old site)