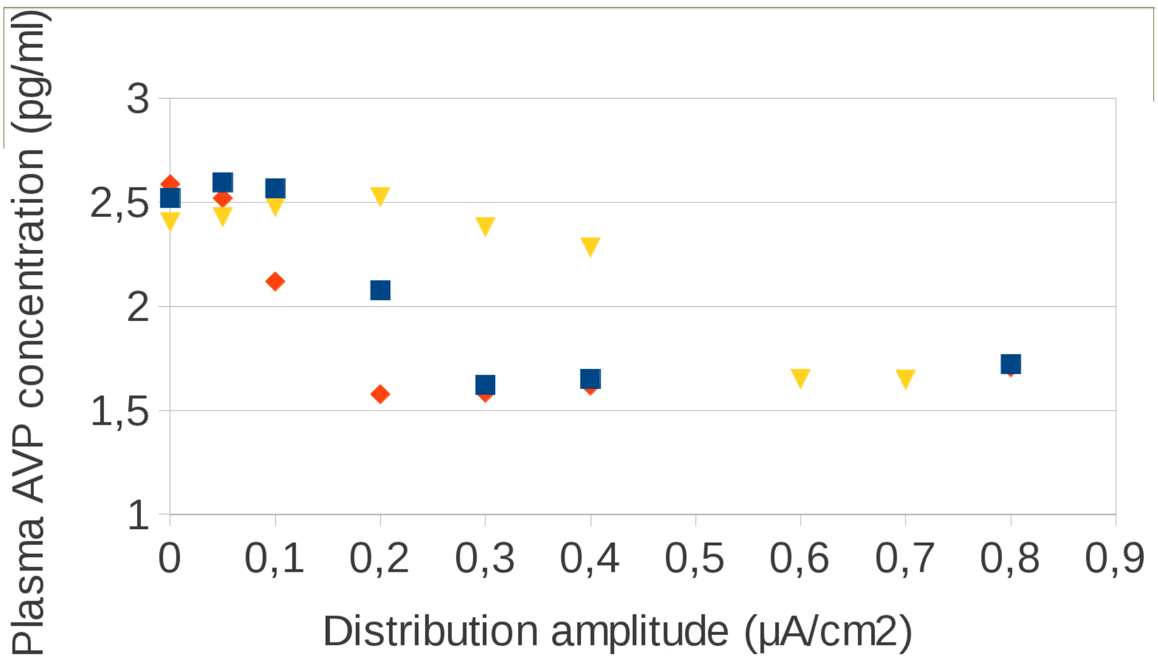
Online Resource 4 – Effect of varying the distribution of the current injection on plasma [AVP]

Implementation of a distribution of the resting membrane potential in the population of MCNs was necessary to obtain a realistic simulation of AVP secretion at the neurohypophysis (see results for detail). The distribution of the current amplitude injected in the MCNs was fixed at ± 0.2 μA/cm^2 (≈1 mV), which corresponds to the standard error reported in Mason's study (1983). However, variation of the membrane potential around the mean resting potential (-67 mV) appears larger (≈20 mV, see results for detail) and such variation might affect the physiological realism of plasma [AVP]. Therefore, the robustness of our assumption of using 0.2 μA/cm^2 was tested by simulating plasma [AVP] as a function of the distribution of the current injection.



Effect of the distribution of the current injection on plasma [AVP] under three different osmotic concentrations : -10 mosmol/L (orange diamond), 0 mosmol/L (blue square) and +10 mosmol/L (yellow triangle).

The results validate the assumption of using ± 0.2 μA/cm^2 as the distribution of the current injection in the MCNs. At the level of the overall MCN population, the distribution of injected current (-0.2; 0; +0.2 µA/cm^2) in each subtype of firing behavior (irregular, phasic and continuous firing) gives the best simulation of plasma [AVP] in response to a change in extracellular osmolality. Note that current distribution below 0.2 μA/cm^2 predicted maximal AVP secretion due to the step-function of the mean firing frequency of the MCN population (see results for detail). Current distribution above 0.2 μA/cm^2 predicted a low level of plasma [AVP]. This collapse of [AVP] was due to the combined action of (1) the DYN-mediated reduction in burst length in the increased neuronal population displaying a phasic pattern of firing and (2) the efficient conductance failure occurring in the increased neuronal population displaying a fast continuous firing pattern.