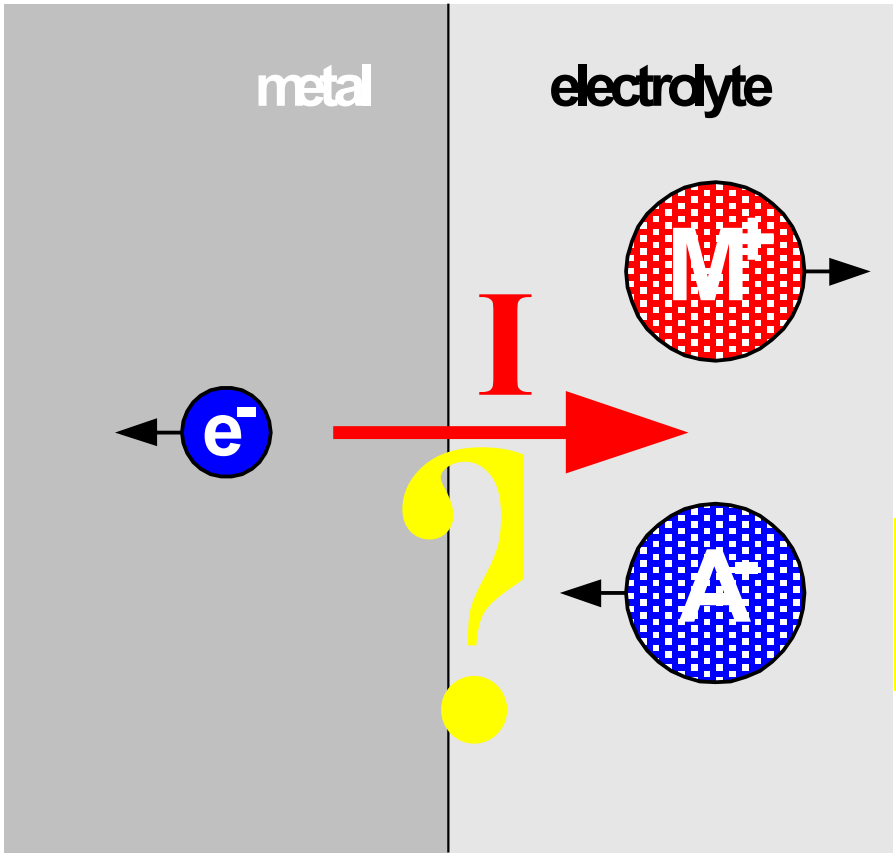
UNIT – 3

BIOPOTENTIAL ELECTRODES & CONFIGURATION

Electrode & Interface

the interface problem



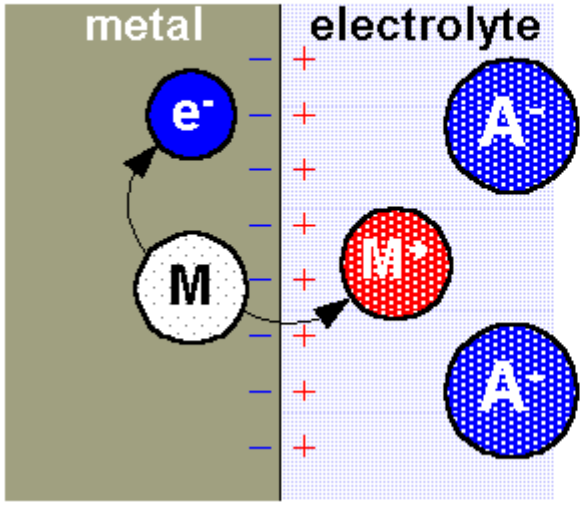
To sense a signal
a current **I must flow** !

But no electron e^- is passing the interface!

metal cation

leaving into the electrolyte

No current



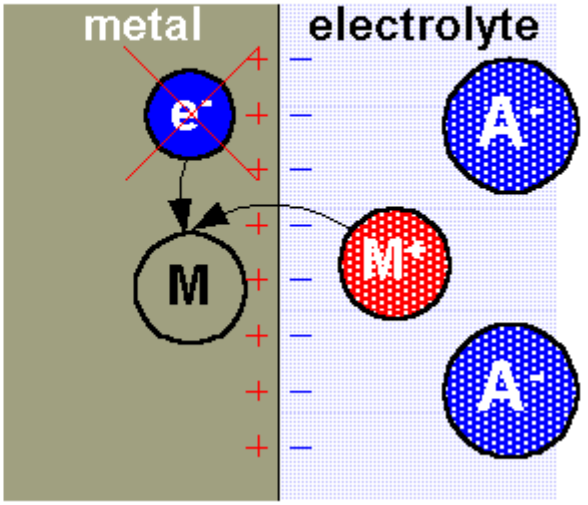
One atom M out of the metal
is oxidized to form
one cation M^+ and giving off
one free electron e^-
to the metal.

metal cation

joining the metal

No current

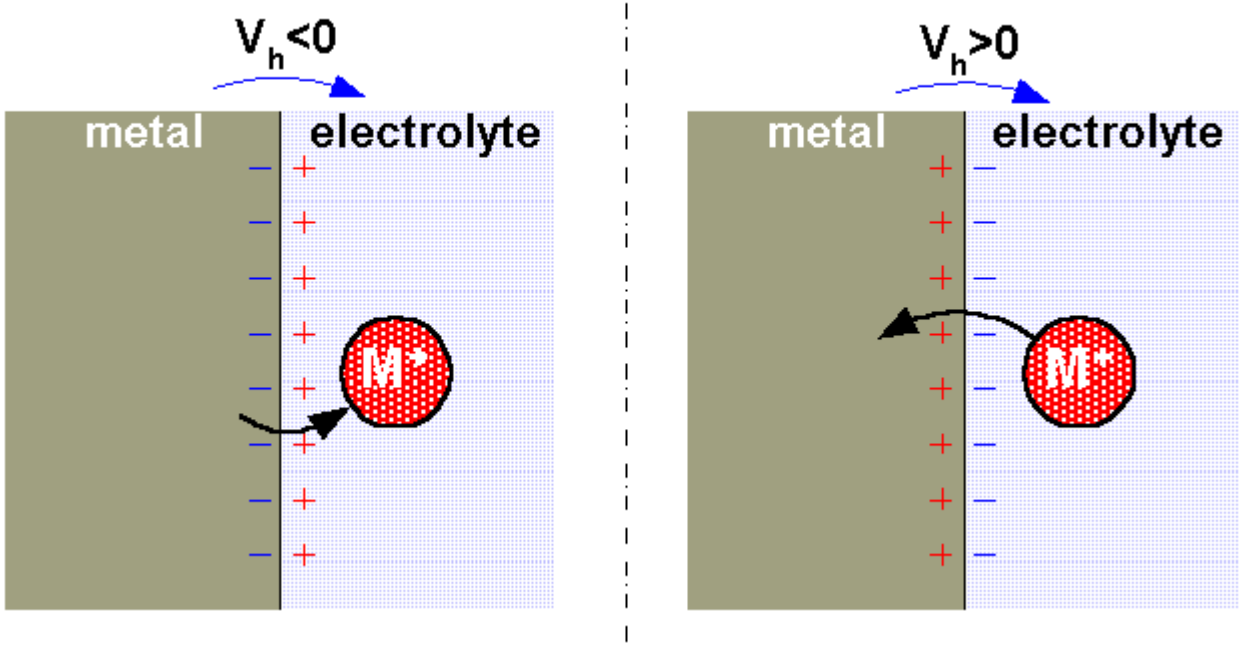
One cation M^+
out of the electrolyte
becomes one neutral atom M
taking off one free electron
from the metal.



half-cell voltage

No current, 1M salt concentration, T = 25ºC

metal:	Li	Al	Fe	Pb	H	Ag/AgCl	Cu	Ag	Pt	Au
V_h / Volt	-3,0	negativ			0	0,223	positiv			1,68



Half Cell Potential

A characteristic potential difference established by the electrode and its surrounding electrolyte which depends on the metal, concentration of ions in solution and temperature (and some second order factors) .

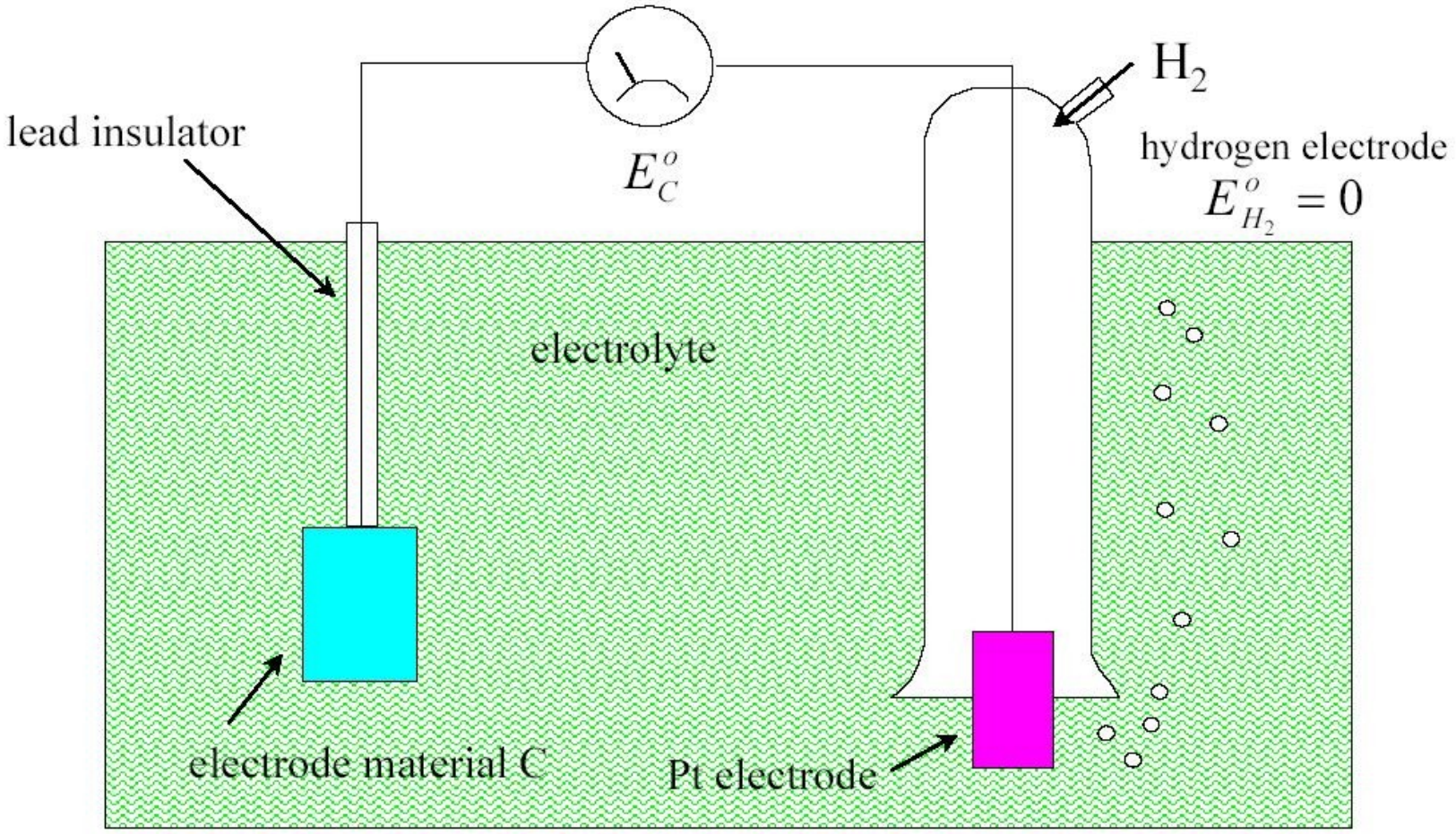
Half cell potential cannot be measured without a second electrode.

The half cell potential of the standard hydrogen electrode has been arbitrarily set to zero. Other half cell potentials are expressed as a potential difference with this electrode.

Reason for Half Cell Potential : Charge Separation at Interface

Oxidation or reduction reactions at the electrode-electrolyte interface lead to a double-charge layer, similar to that which exists along electrically active biological cell membranes.

Measuring Half Cell Potential



Note: Electrode material is metal + salt or polymer selective membrane

reduction reaction	$E^o\ (V)$
$Al^{3+} + 3e^- \rightarrow Al$	-1.662
$Zn^{2+} + 2e^- \rightarrow Zn$	-0.762
$Cr^{3+} + 3e^- \rightarrow Cr$	-0.744
$Fe^{2+} + 2e^- \rightarrow Fe$	-0.447
$Cd^{2+} + 2e^- \rightarrow Cd$	-0.403
$Ni^{2+} + 2e^- \rightarrow Ni$	-0.257
$Pb^{2+} + 2e^- \rightarrow Pb$	-0.126
$2H^+ + 2e^- \rightarrow H_2$	0.000
$AgCl + e^- \rightarrow Ag + Cl^-$	$+0.222$
$Hg_2Cl_2 + 2e^- \rightarrow 2Hg + 2Cl^-$	$+0.268$
$Cu^{2+} + 2e^- \rightarrow Cu$	$+0.342$
$Cu^+ + e^- \rightarrow Cu$	$+0.521$
$Ag^+ + e^- \rightarrow Ag$	$+0.780$
$Au^{3+} + 3e^- \rightarrow Au$	$+1.498$
$Au^+ + e^- \rightarrow Au$	$+1.692$

Some half cell potentials

Standard Hydrogen electrode

Note: Ag-AgCl has low junction potential & it is also very stable -> hence used in ECG electrodes!