Simulation of Experimental Artefacts in the Electrophysiology of Small Cells

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ELECTROPHYSIOLOGICAL RECORDINGS FROM CARTILAGE CELLS
Cartilage Cells - Chondrocytes
Patch clamp allows direct electrical connectivity with the cell interior. Allows characterization of cell electrophysiology.
Electrode Attached to a Chondrocyte

15 µm
CellML Model of Small Cell
Seal Currents

- $K^+$
- $Na^+$
- $Cl^-$

Graph showing relationship between $V_m$ (mV) and $I$ (pA) for $K^+$, $Na^+$, and $Cl^-$, with dashed line representing net seal current and solid line representing linear seal current.
2 Independent Variables

![Diagram showing independence of variables R and V over time.](image)
Apparent Resting Potential

- $R_s = 30\, \Omega$
- $R_s = 10\, \Omega$
- $R_s = 3\, \Omega$

Graph showing $V_m (\text{mV})$ and $I_e (\text{pA})$ relationships.

- Stable depolarized
- Unstable
- Stable polarized

$E_K$
Conclusion

The standard electrophysiological recording techniques can be dramatically compromised for small cells.

Mathematical modelling allows for the correct interpretation of the measured data.

Modified recording protocols can be designed to mitigate the artefacts of the recording electrode.
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Single Channel Recordings

25 single channel recordings approximate one whole-cell.