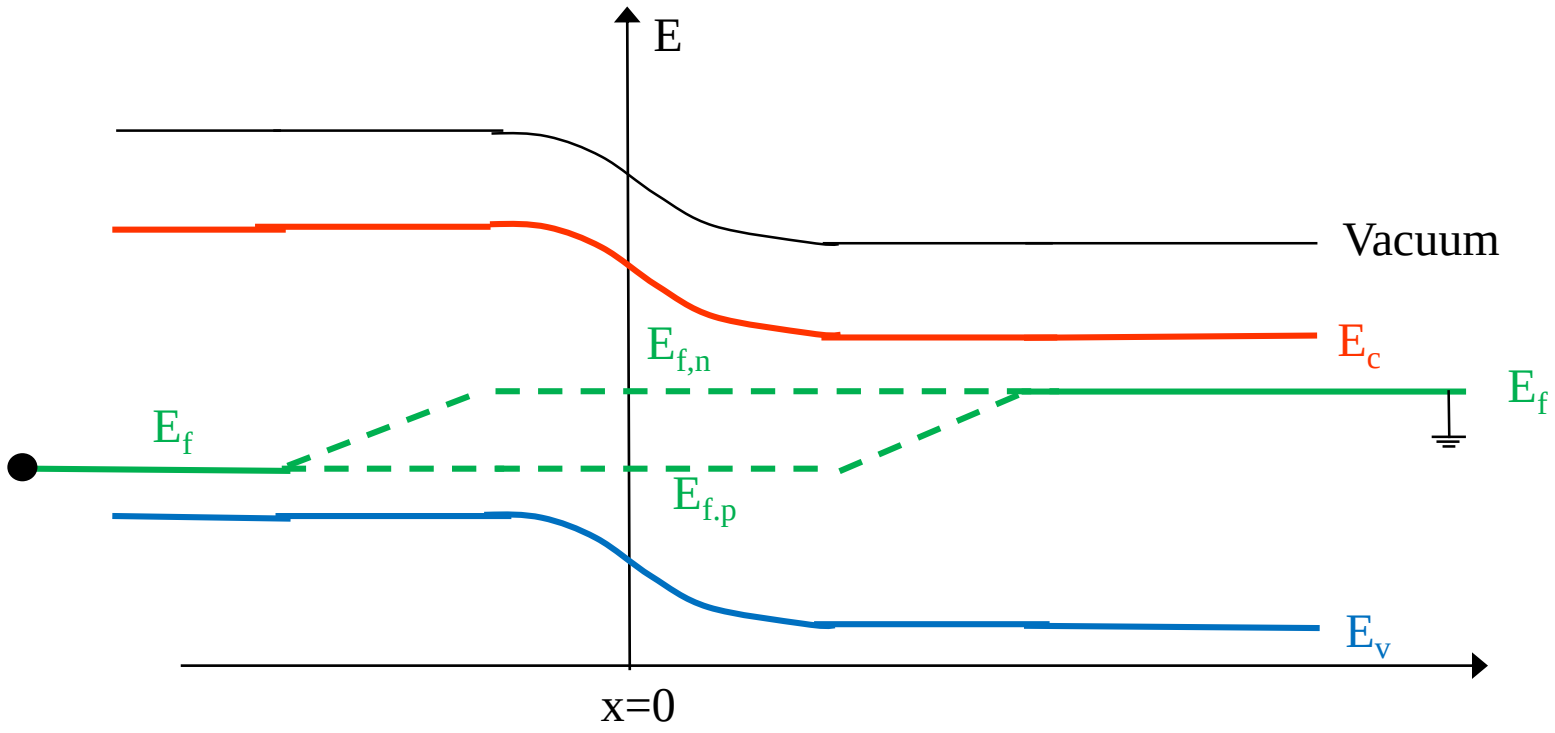
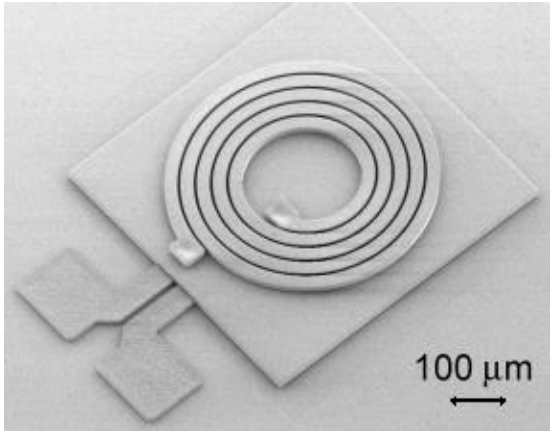
Exercice E4.1: Schéma de bande à interpréter

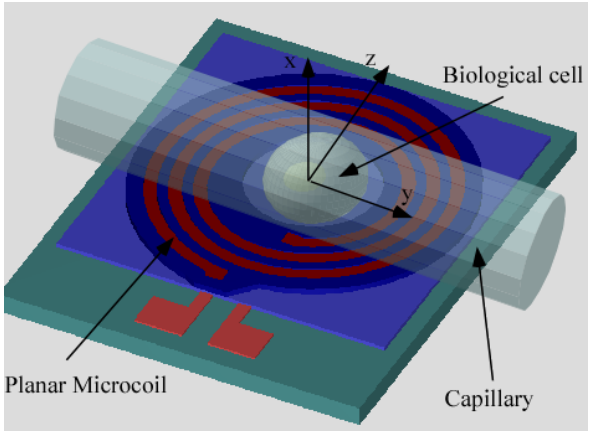


E 4.2: Frog Oocyte: MRI image

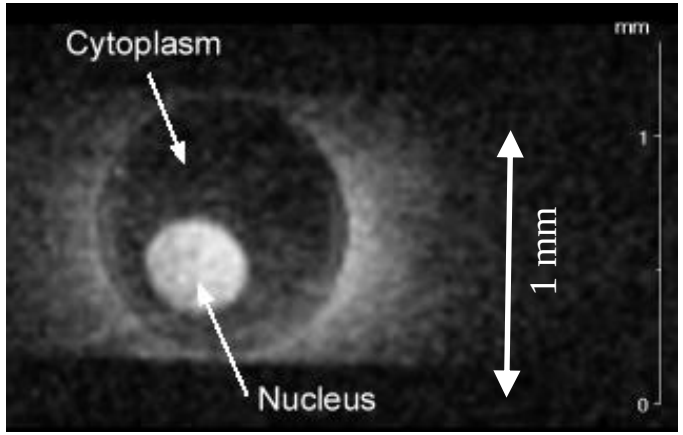
Micro-coil



Micro-fluidic capillary

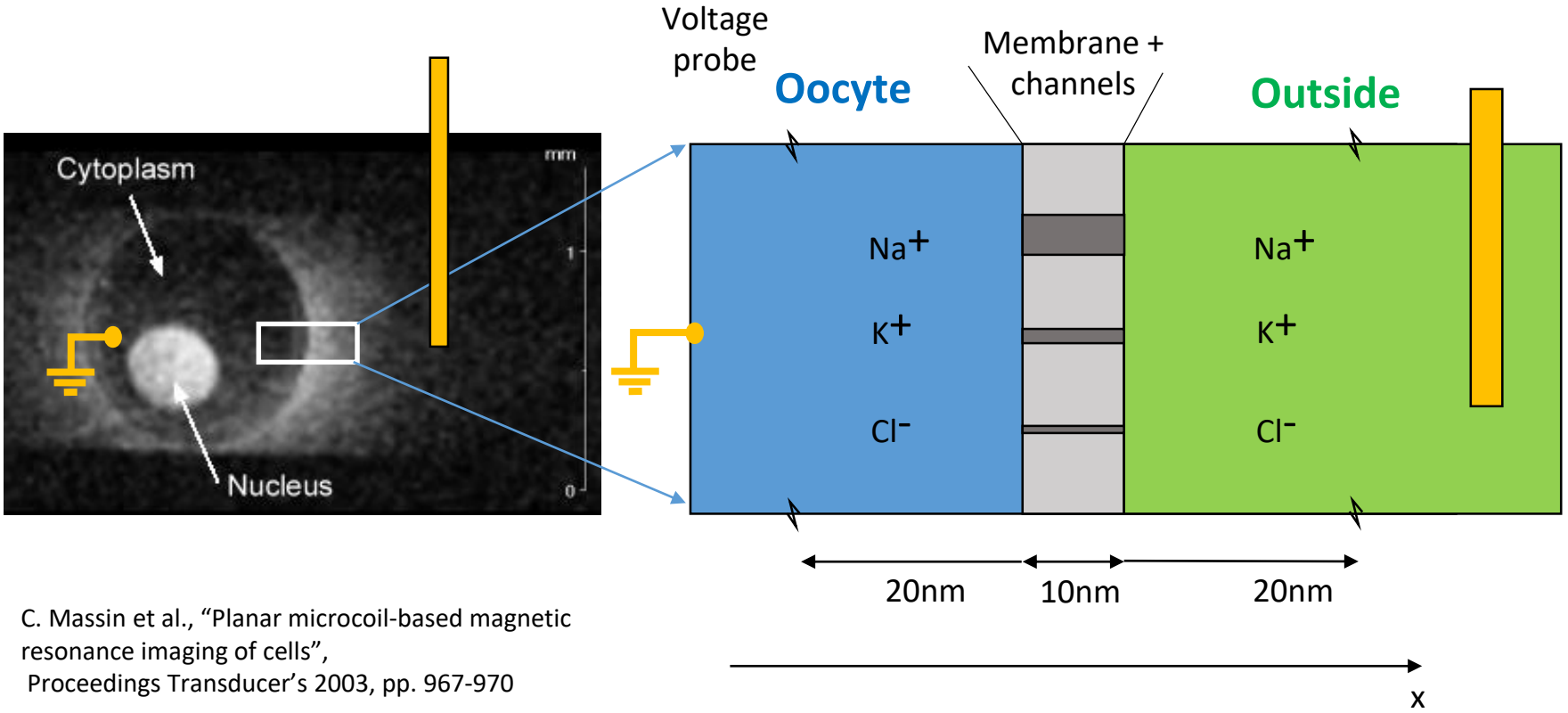


Oocyte



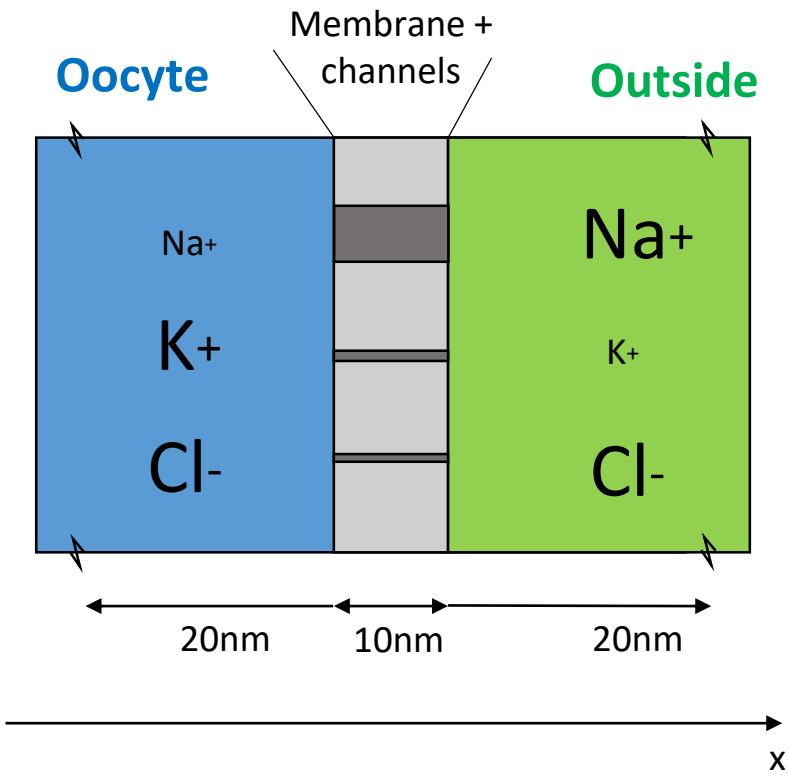
C. Massin et al., "Planar microcoil-based magnetic resonance imaging of cells", Proceedings Transducer's 2003, pp. 967-970

E 4.2: Frog Oocyte: planar model



C. Massin et al., "Planar microcoil-based magnetic resonance imaging of cells", Proceedings Transducer's 2003, pp. 967-970

E 4.2: Start situation: all channels closed



Concentrations when all the channels are closed.

Constant concentrations in each region

	Oocyte	Outside	V_{nernst}
Na+	10 mM	90 mM	+ 56 mV
K+	90 mM	10 mM	- 56 mV
Cl- and anions-	100 mM	100 mM	0 mV

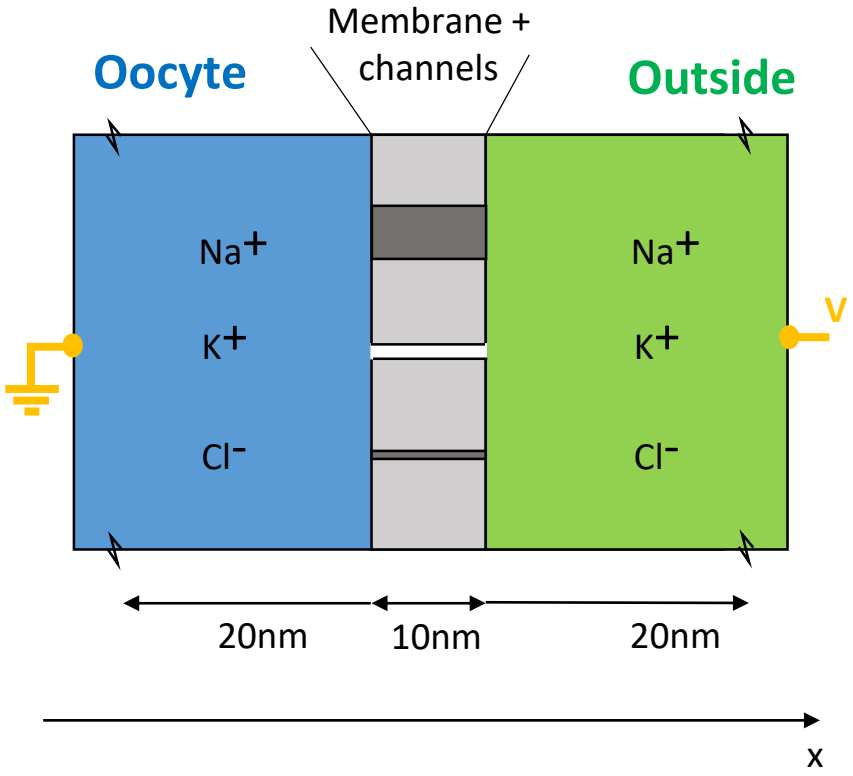
$$1\,mM \equiv 10^{-3}\ mole/liter = 10^{-3}\cdot N_A \cdot \frac{molecule}{1000\ cm^3} = 6\cdot 10^{17}\ molecule/cm^3$$

Nernst voltage: $$V_{nernst} \equiv \frac{RT}{F} Ln\left(\frac{[C_{out}]}{[C_{in}]}\right)$$

$$R \equiv k \cdot N_A$$

$$F \equiv |q_i| \cdot N_A$$

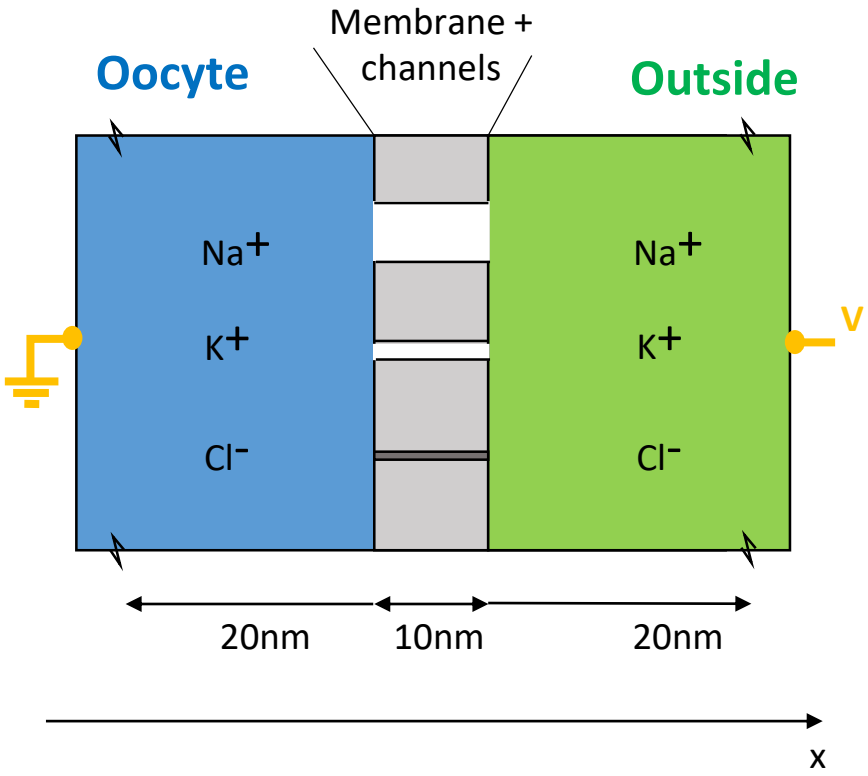
E 4.2: First situation: K+ channels open



Describe the physical phenomena appearing in the cell.

1) Where and why are net charges appearing ?
2) Where and why is an electric field appearing ?
3) Sketches the final concentrations.
4) Explain the voltage V and compare it with the N+/N diode.
5) Derive a mathematical model for the processes. (Re-use and adapt the basics equations describing semiconductor devices in non-equilibrium).

E 4.2: Second situation: Na+ channels open suddenly



We suppose Na^+ ions have a higher mobility than K^+ ions.

6) How are the net charges modified ?

7) How is the voltage V modified ?