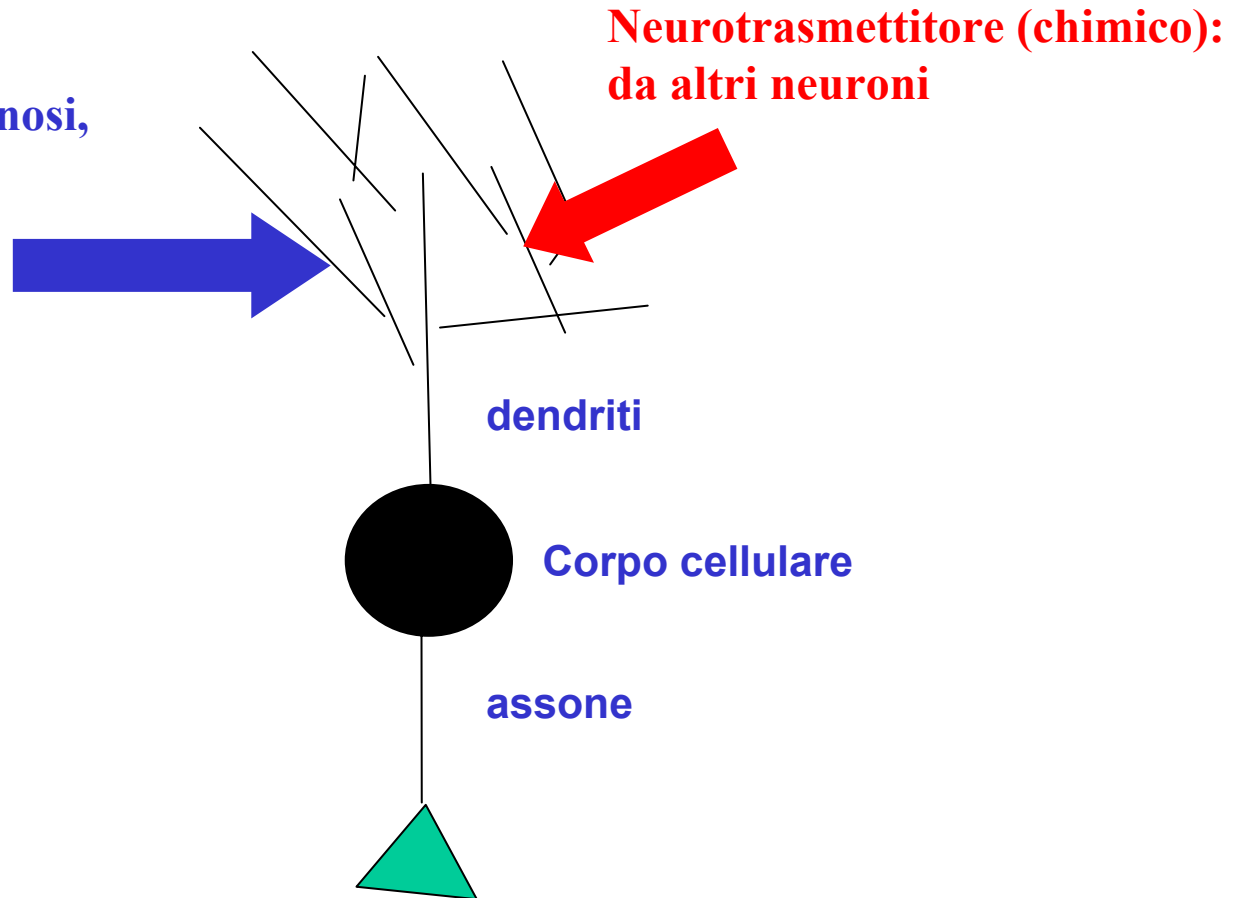


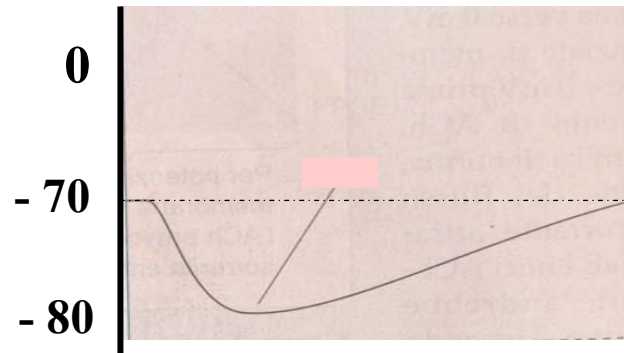
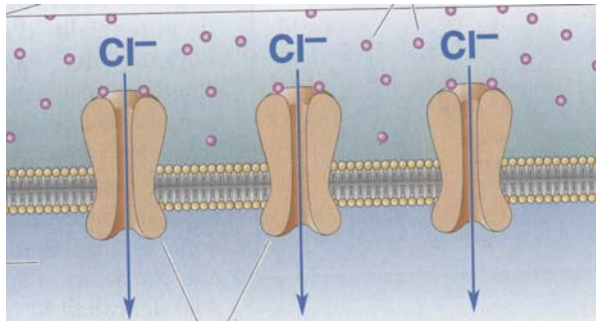
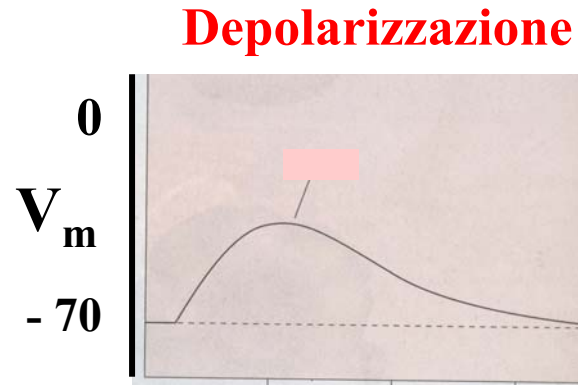
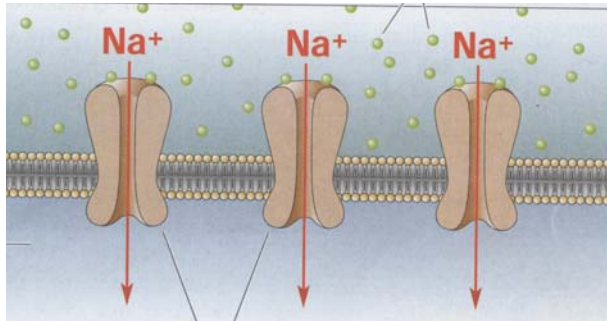
**Cosa succede quando uno o più  
stimoli raggiungono il  
neurone?**

# Che tipo di stimoli possono raggiungere un neurone?

**Stimoli sensoriali**  
(meccanici, termici, luminosi,  
chimici ...):  
**Recettori Sensoriali**



# Apertura dei canali ionici:



**Iperpolarizzazione**

**Depolarizzazione:** potenziale diventa più positivo (ad es., -10, 0 mV)

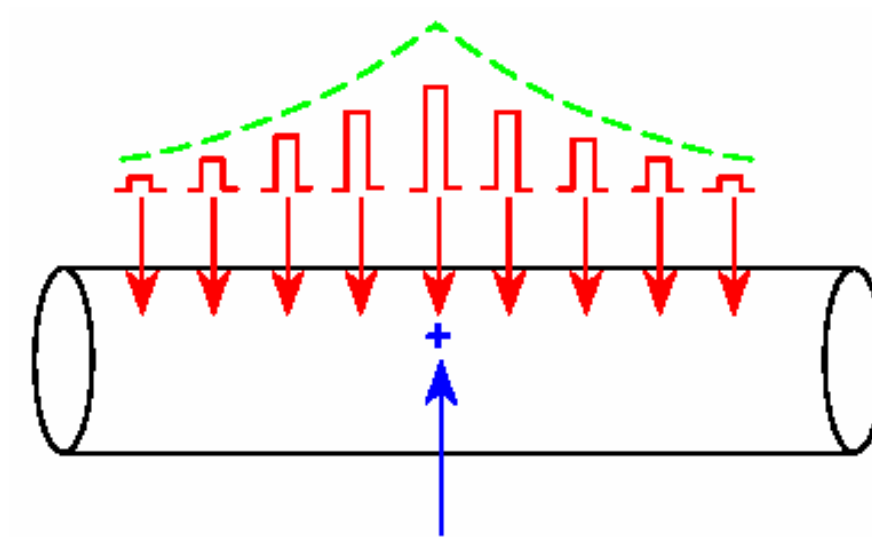
entrata ioni + ( $\text{Na}^+$ ,  $\text{Ca}^{++}$ )

uscita ioni – ( $\text{Cl}^-$ )

**Hyperpolarizzazione:** potenziale diventa più negativo (ad es., -80, -90mV)

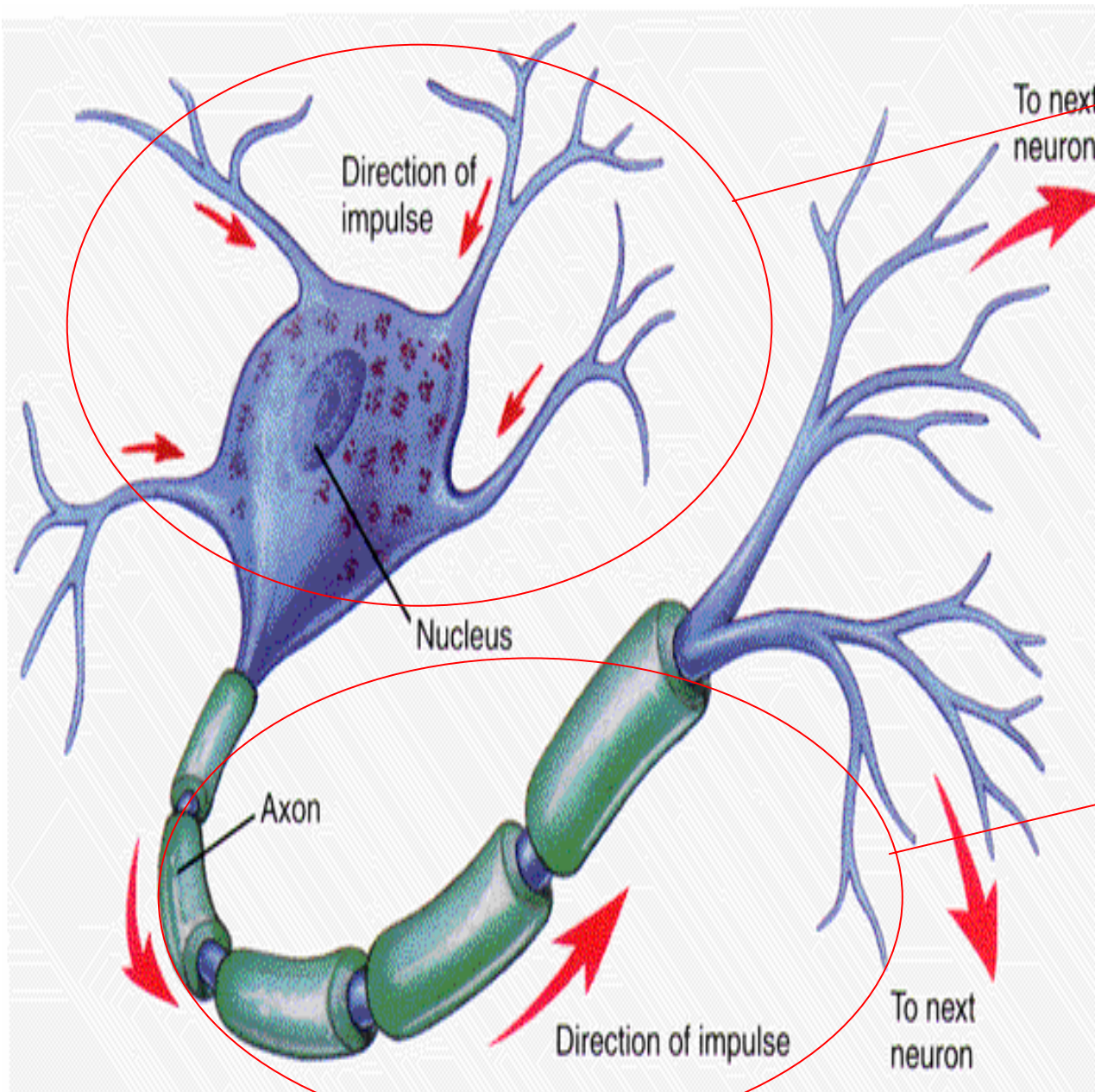
uscita ioni + ( $\text{K}^+$ )

entrata ioni – ( $\text{Cl}^-$ )



## Potenziali locali (elettrotonici)

- Passivi
- Condotti solo per pochi mm
- Decremento con la distanza
- Ampiezza variabile
- Sommabili

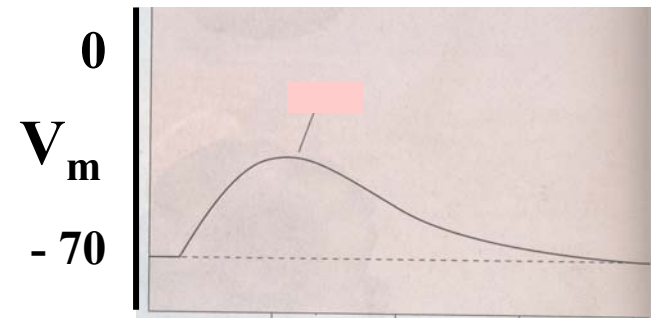
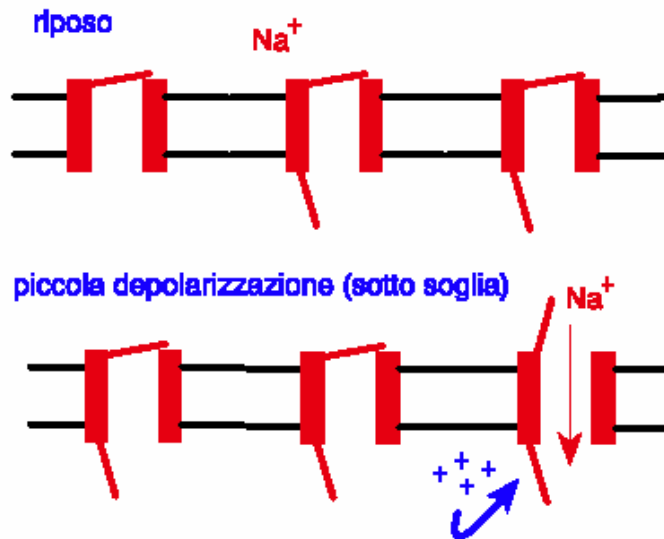


**Potenziali  
locali**

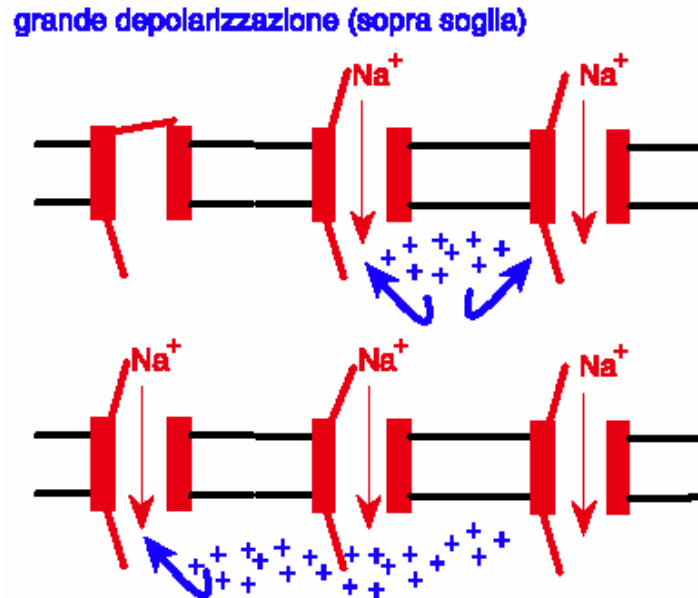
?

**Potenziale  
d'azione**

# Stimoli (potenziali locali) di bassa intensità ("sotto soglia")



# Stimoli (potenziali locali) intensi: SOGLIA: POTENZIALE D'AZIONE



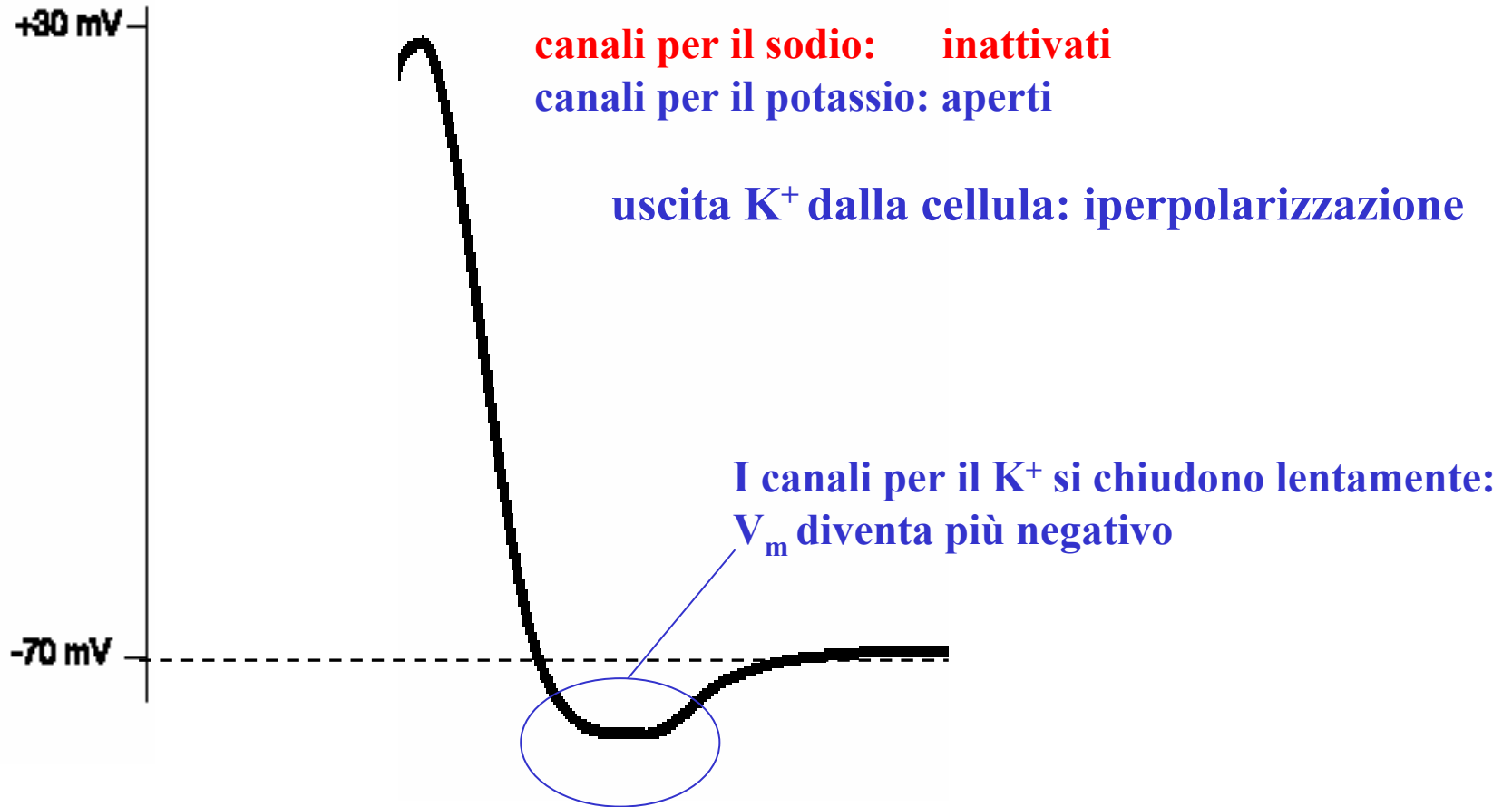
Stimoli sopra soglia:  
potenziale d'azione

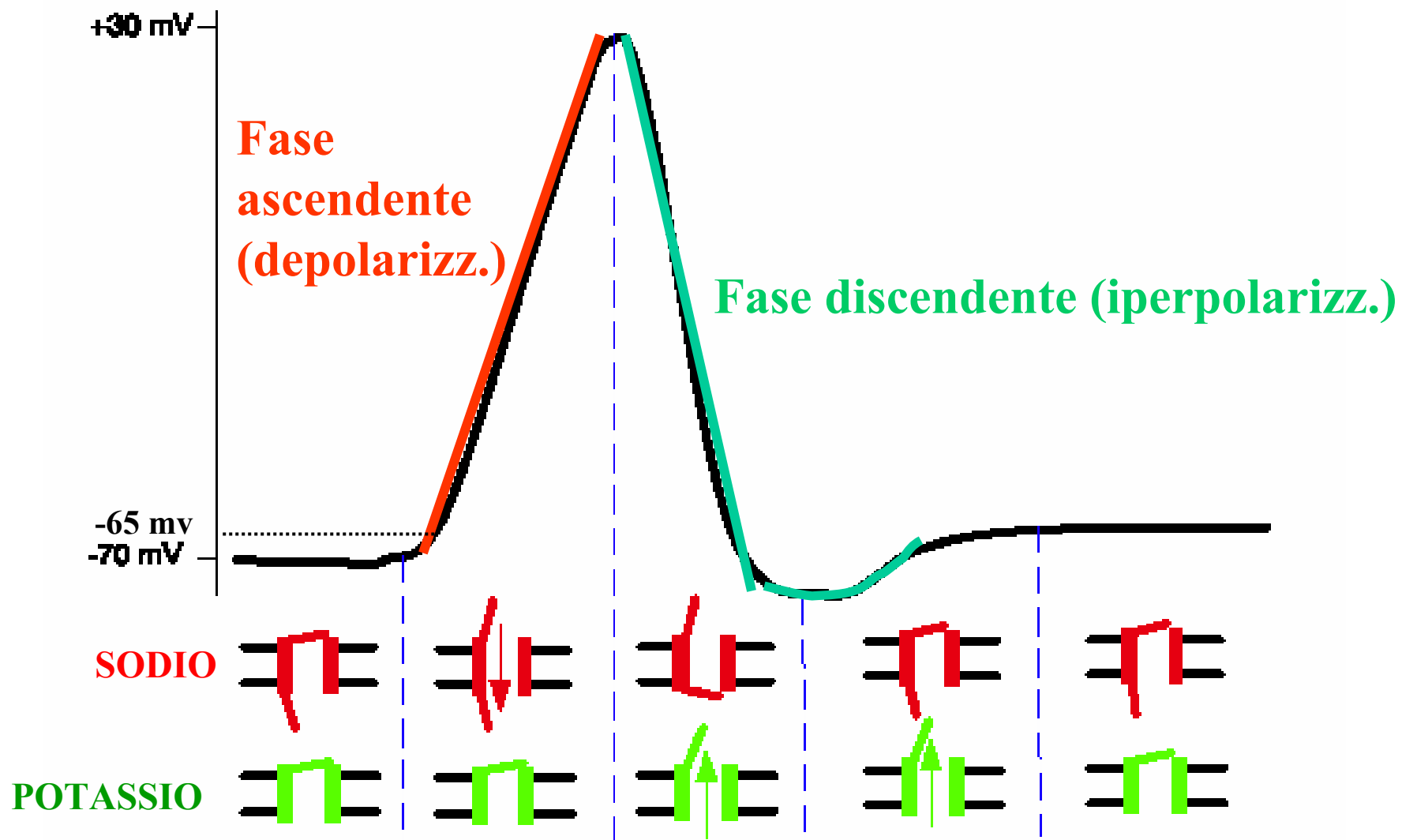


# FASE ASCENDENTE

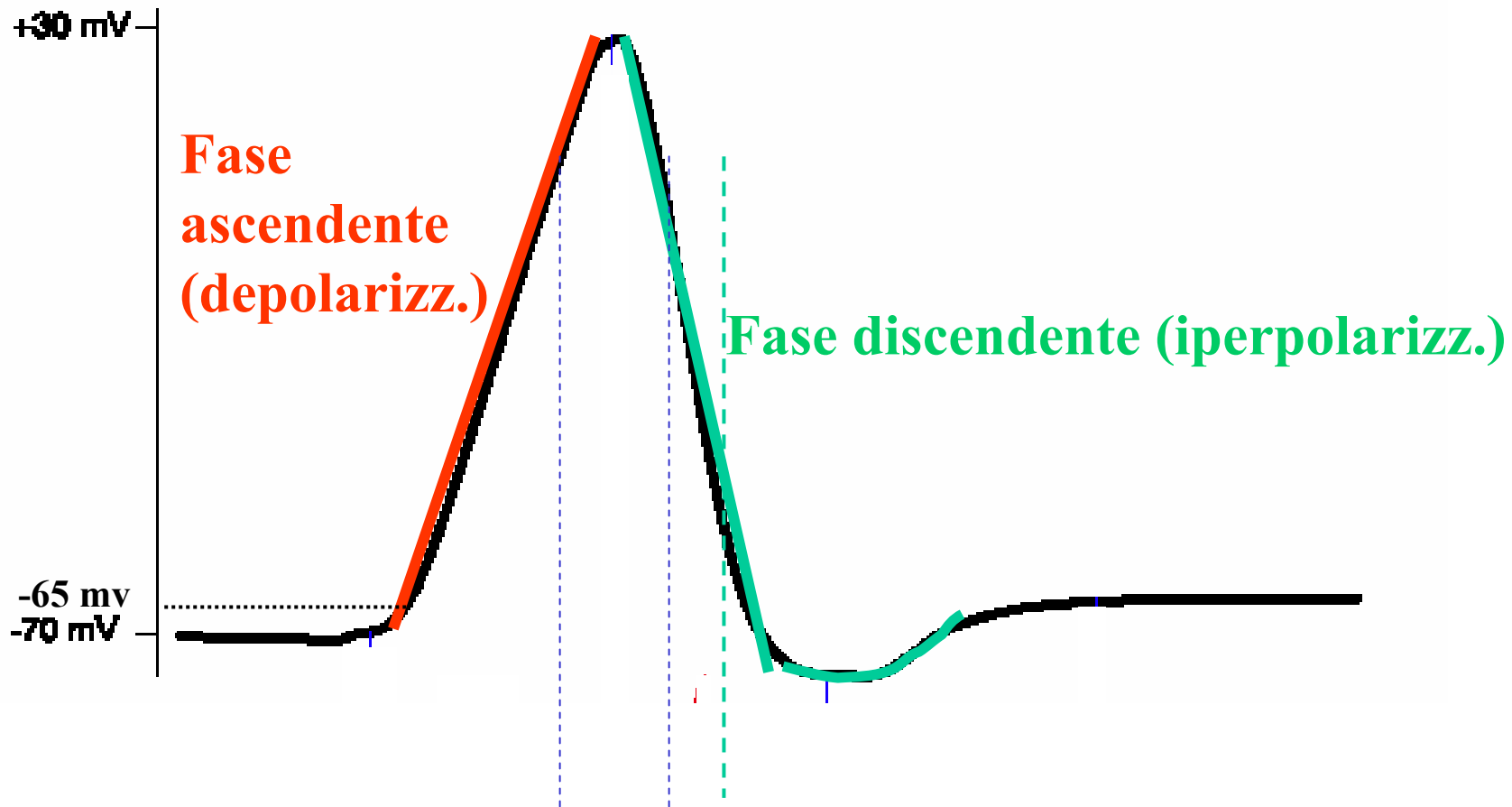


# FASE DISCENDENTE

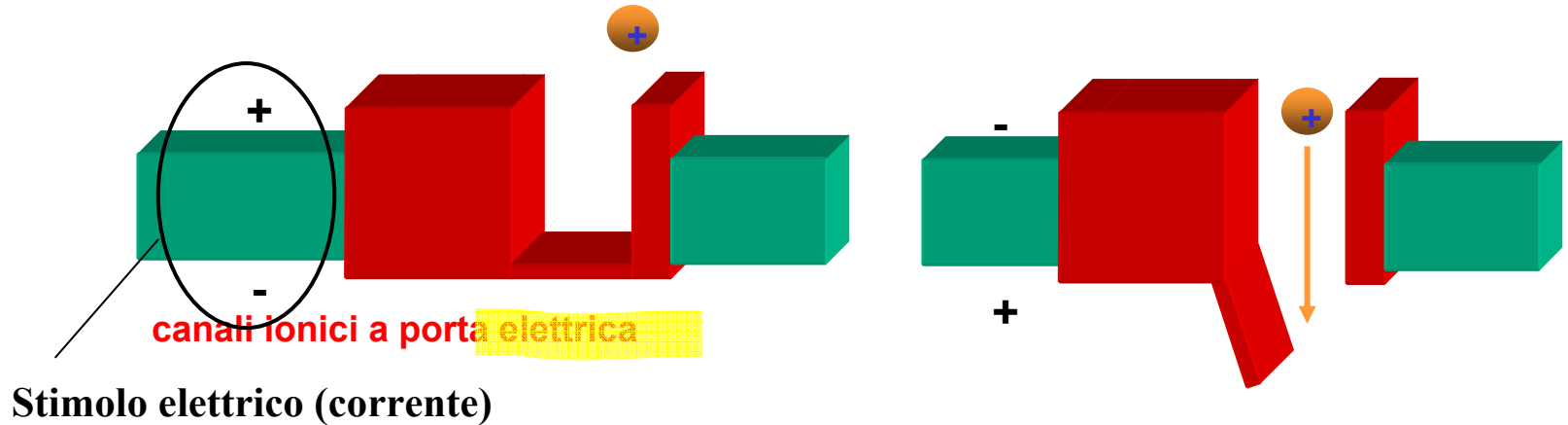




# PERIODI REFRAATTARI



- I canali ionici per il sodio ( $\text{Na}^+$ ) e il potassio ( $\text{K}^+$ ) che si aprono/chiodono durante il potenziale d'azione sono a **PORTA ELETTRICA**: aperti solo da stimoli di natura elettrica



• **DEPOLARIZZAZIONE**: avvicina alla soglia per il pot. d'azione:  
“ECCITAZIONE”

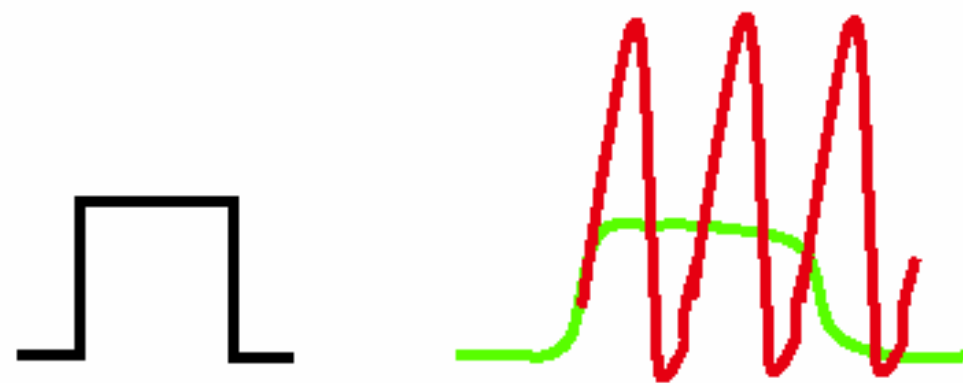
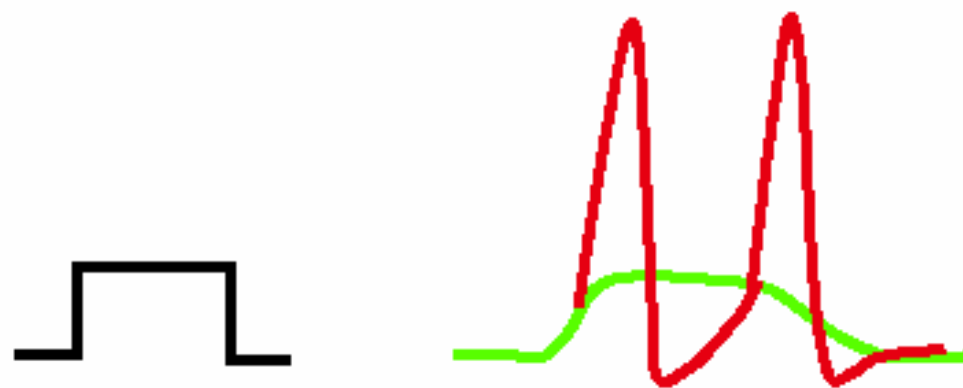
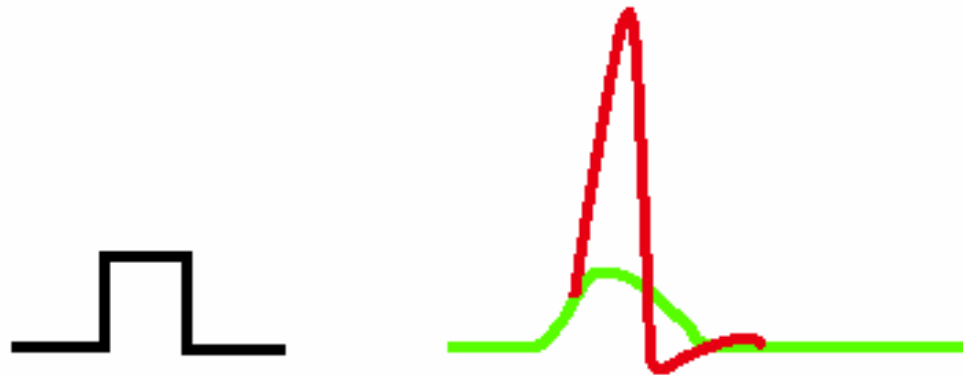
**IPERPOLARIZZAZIONE**: allontana dalla soglia per il pot.d'azione  
“INIBIZIONE”

# Potenziale d'azione

- I canali ionici sono a **porta elettrica**: SOLO stimoli di **natura elettrica** attivano il **potenziale d'azione**
- Soglia: “**nulla**”
- Ha sempre ampiezza MASSIMA (tutti i canali per il  $\text{Na}^+$  sono aperti): “**Tutto**”
- Va da circa  $-70\text{mV}$  fino a  $+30\text{ mV}$  (NON  $+55\text{ mV}!!!$ ): ha ampiezza di circa  $100\text{ mV}$
- Sempre ampiezza massima:  
**Ampiezza NON può variare** (costante)

**Non si può sommare** con altri potenziali d'azione

Ampiezza NON cambia con la distanza: usato per portare informazioni (con **codice di frequenza**)



— stimolo  
— depolarizzazione  
— potenziale d'azione

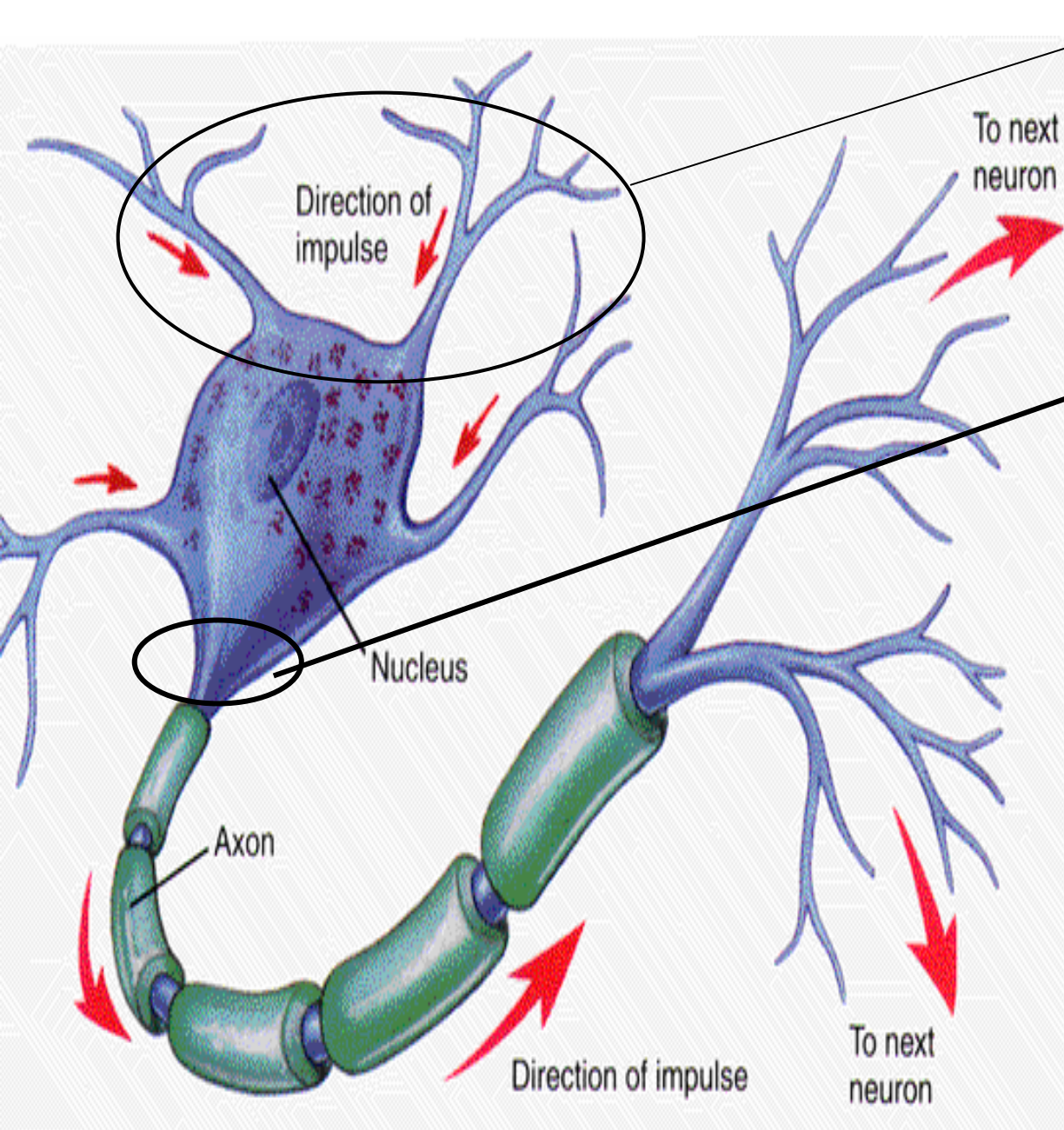
## **Potenziali locali (elettrotonici)**

- **Passivi**
- **Condotti solo per pochi mm**
- **Ampiezza variabile**
- **Decremento con la distanza**
- **Sommabili**

## **Potenziali d'azione**

- **Attivi**
- **Condotti per lunghe distanze**
- **Ampiezza costante**
- **Non c'è decremento**
- **Non sommabili**

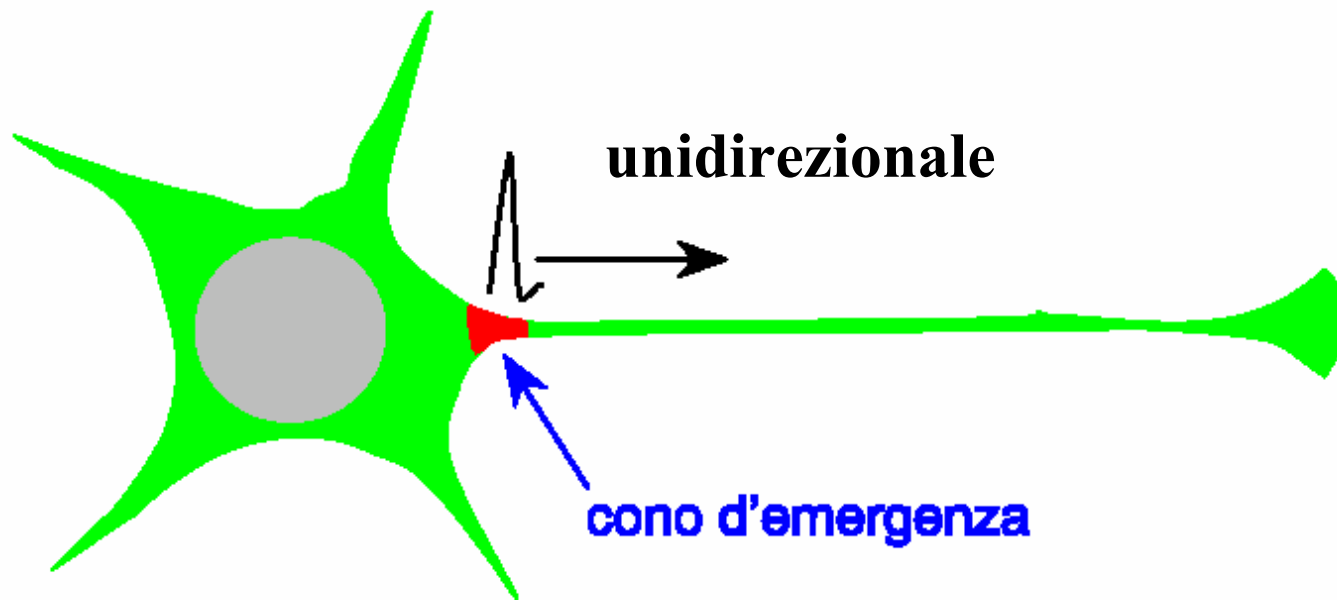




## Potenziali locali

**“Cono d’emergenza”:**  
Numerosi canali per il  $\text{Na}^+$ : soglia più bassa per il potenziale d’azione

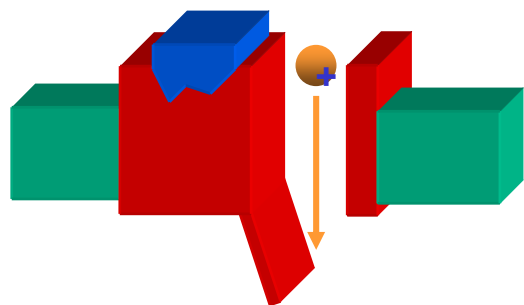
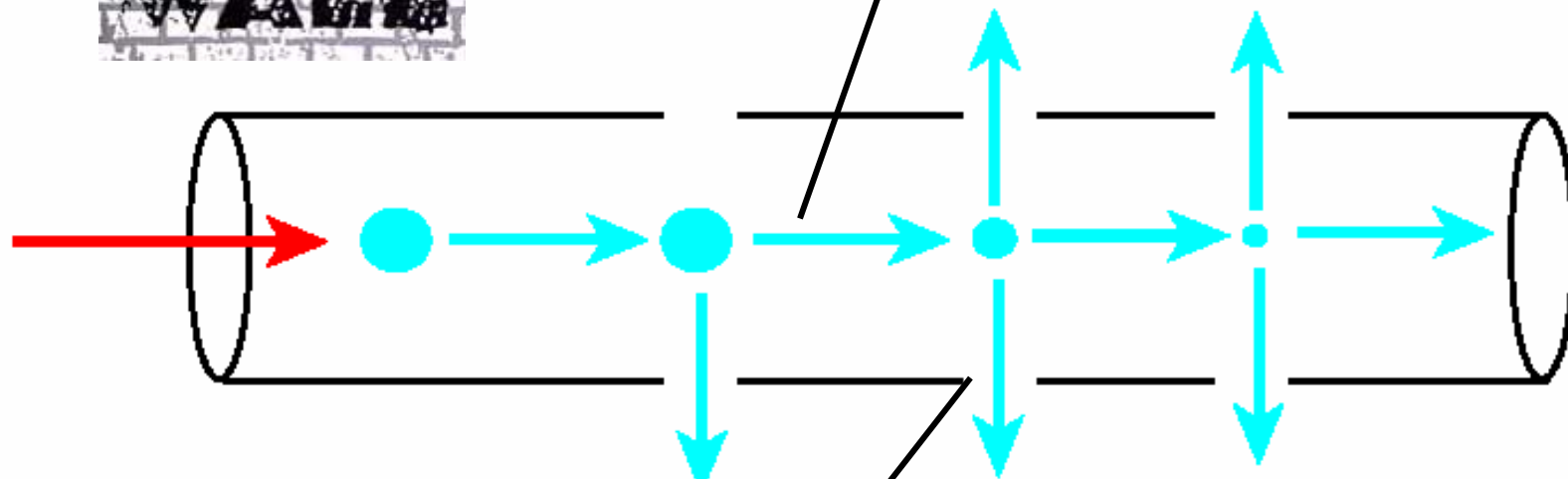
**Convergenza segnali:**  
Sommazione dei pot. locali:  
innescò del potenziale d’azione



# Conduzione segnali elettrici

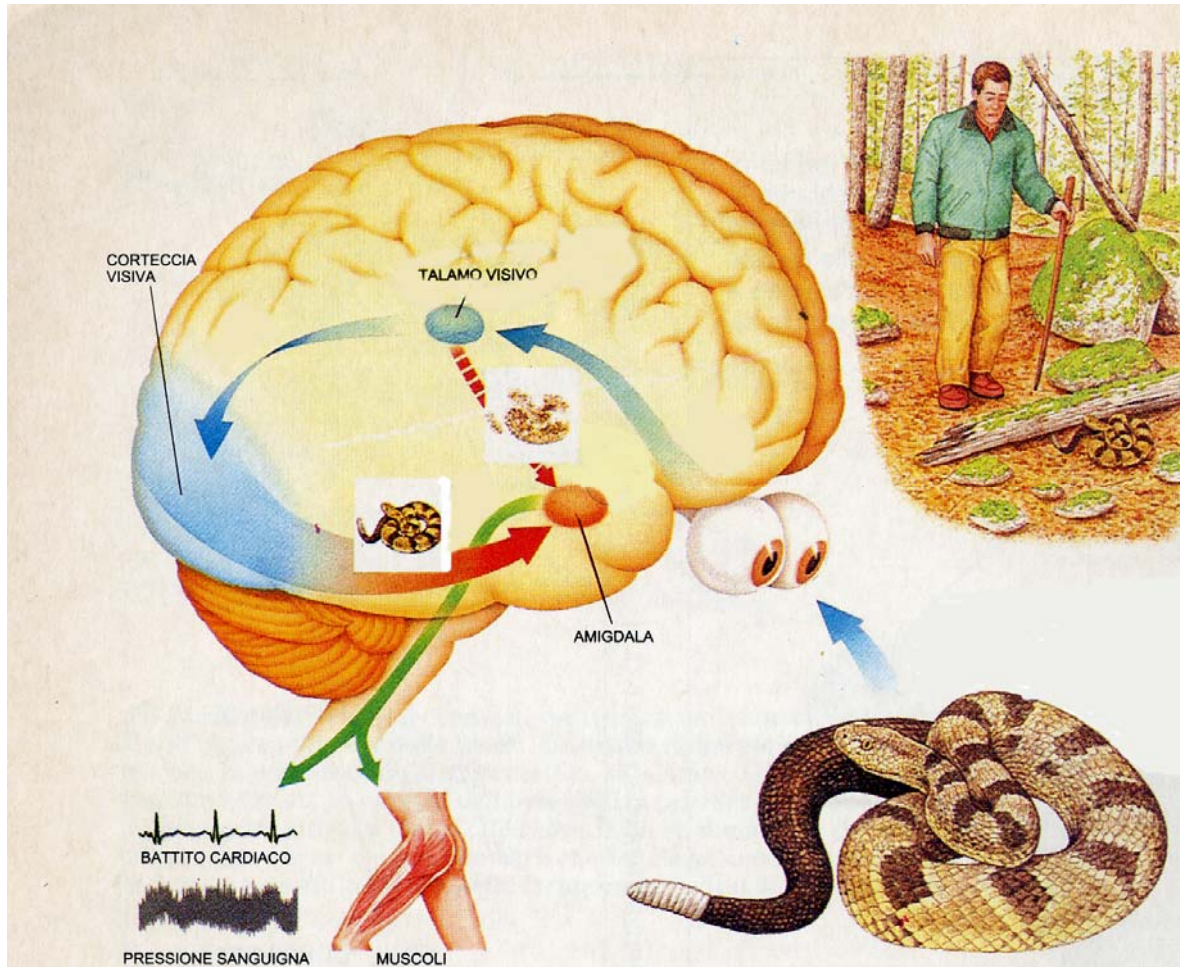


**Citoplasma: Resistenza interna ( $R_i$ )**

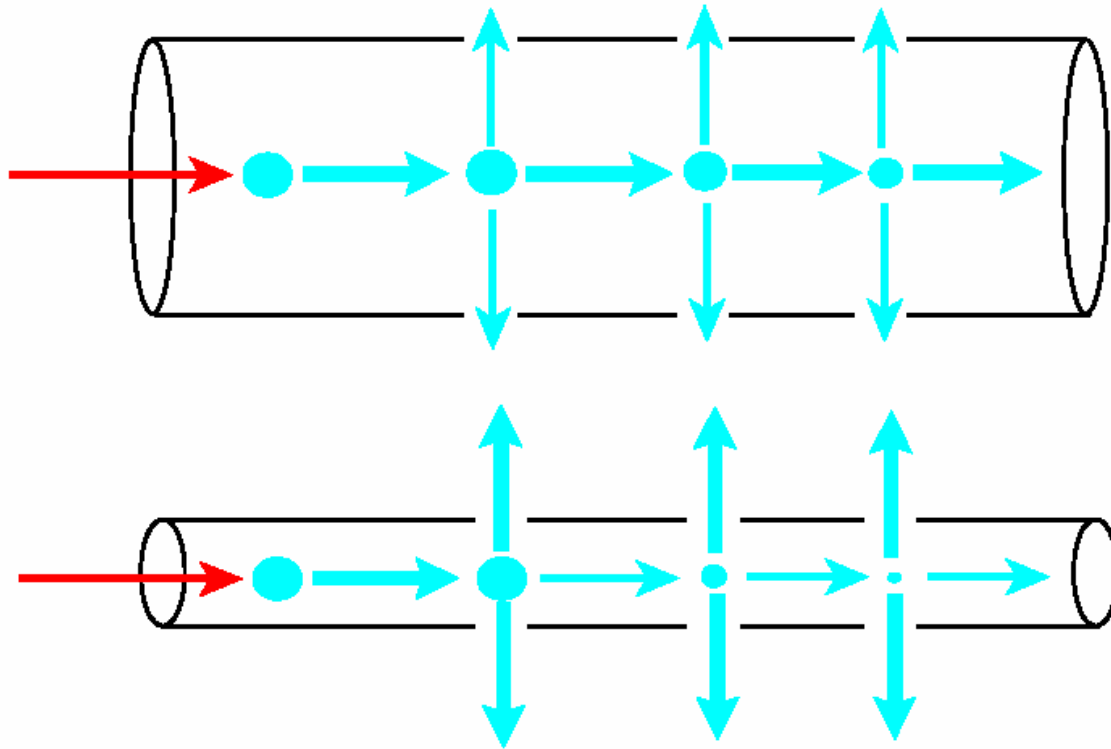


**Resistenza di membrana ( $R_m$ )**

# Aumentare velocità conduzione:

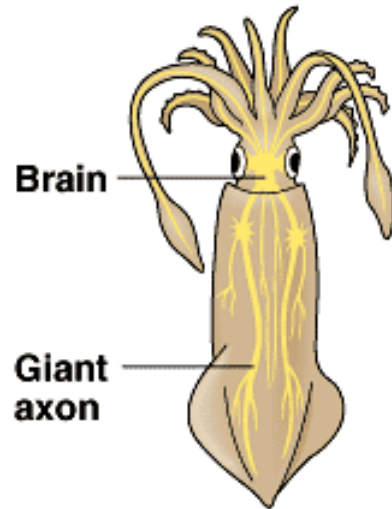


# 1) Diminuzione $R_i$ : aumento Diametro

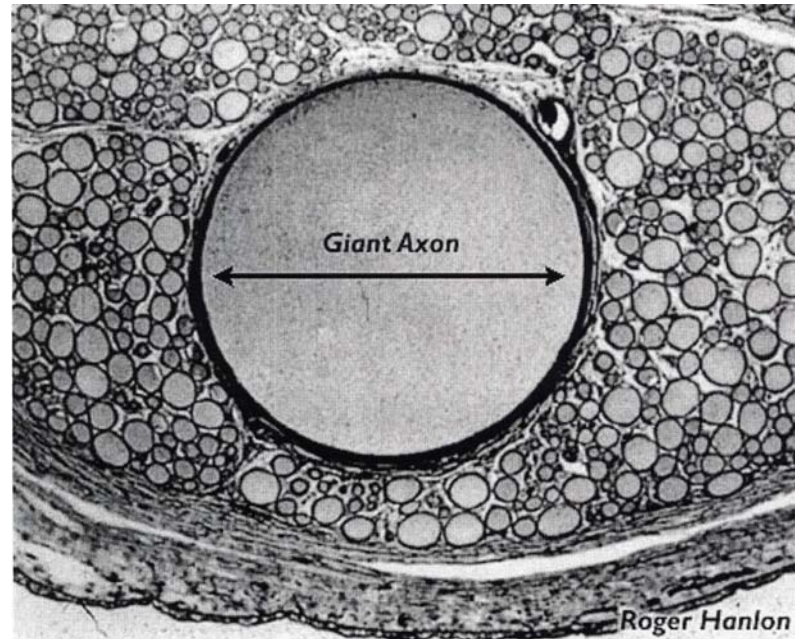




## In Invertebrati:

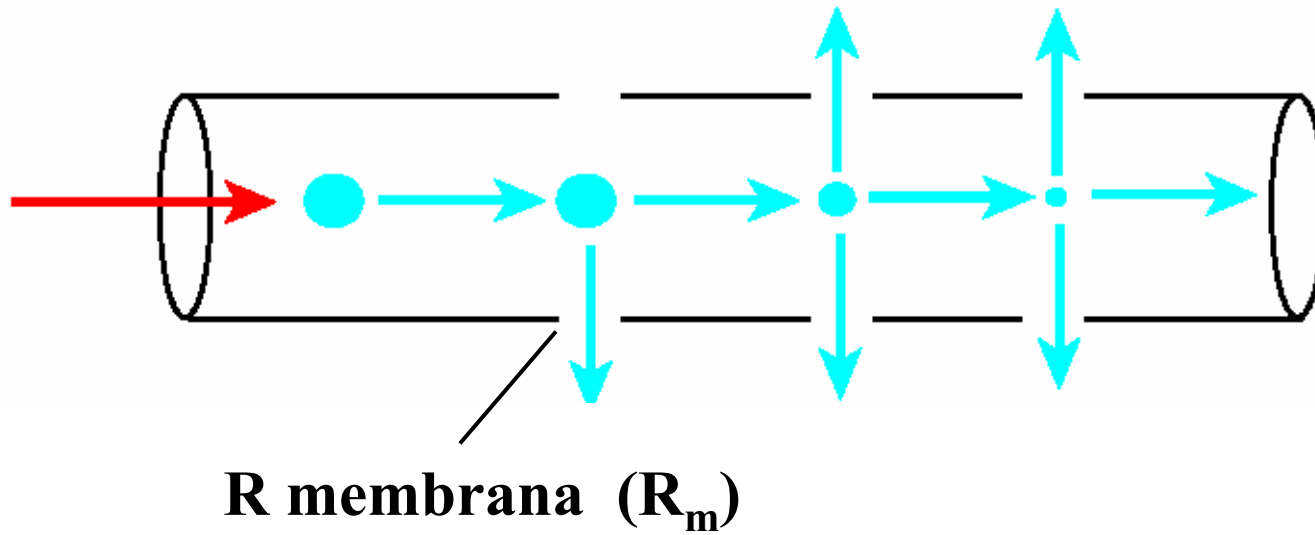


(g) Squid (mollusk)



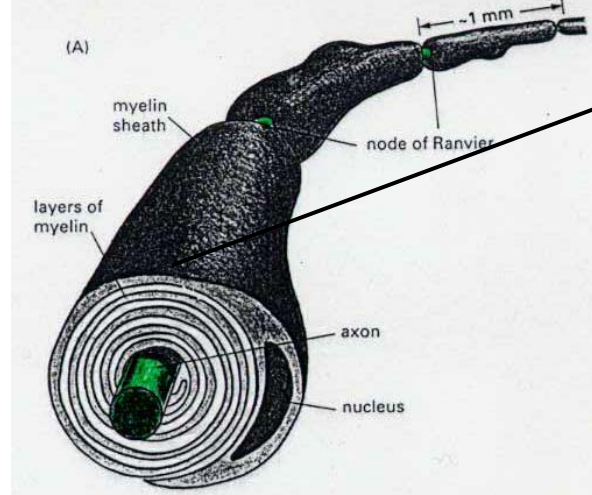
**Svantaggio: aumento massa corporea!!!!**

2)  $R_m$ :



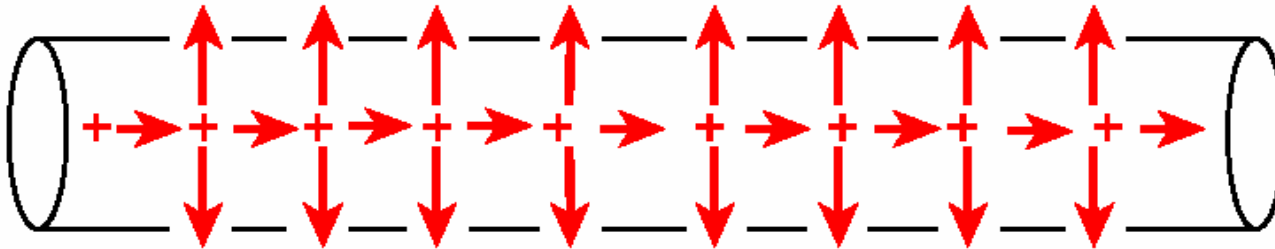
?

**guaina isolante:**

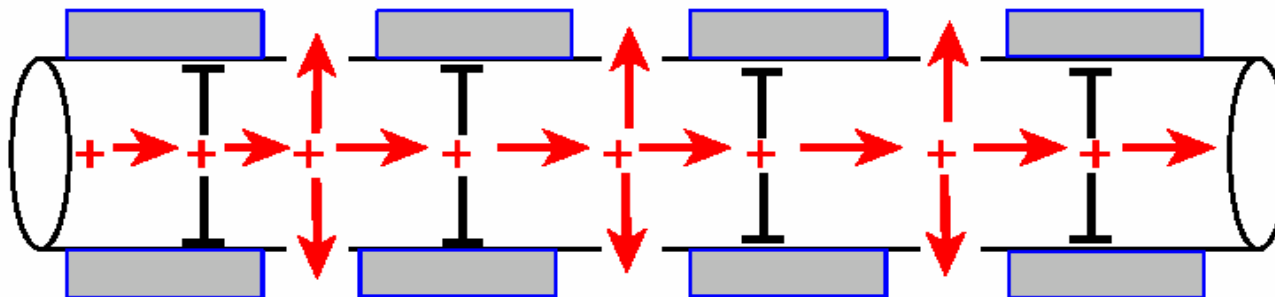


**Guaina mielinica**

**assone amielinico**

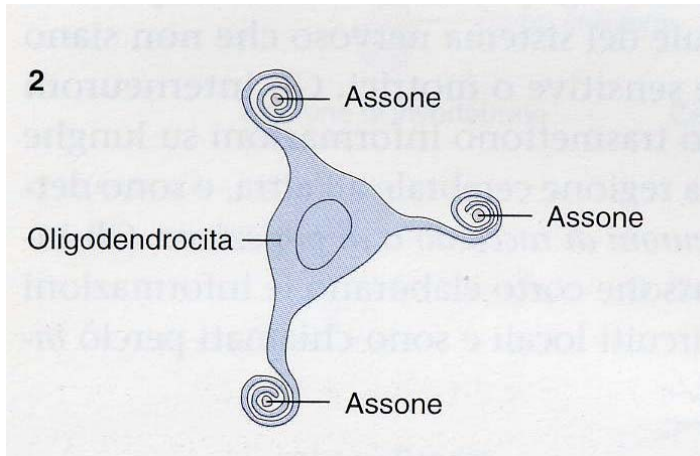


**assone mielinico**

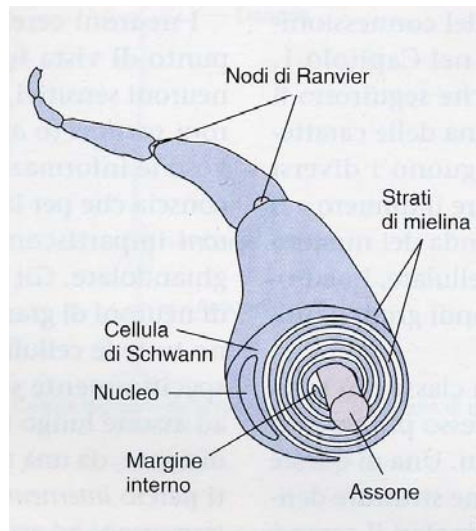


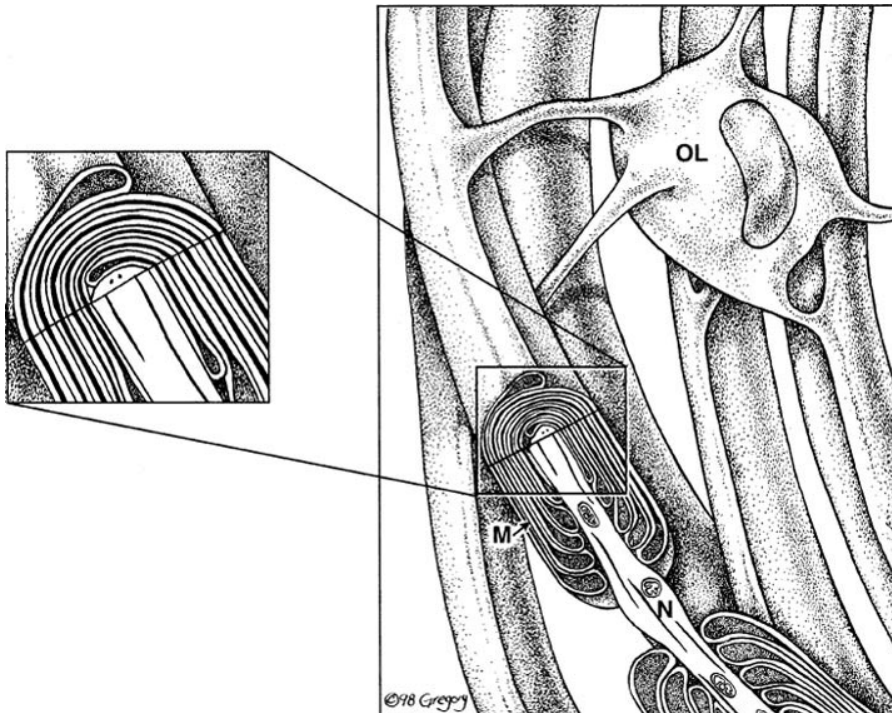
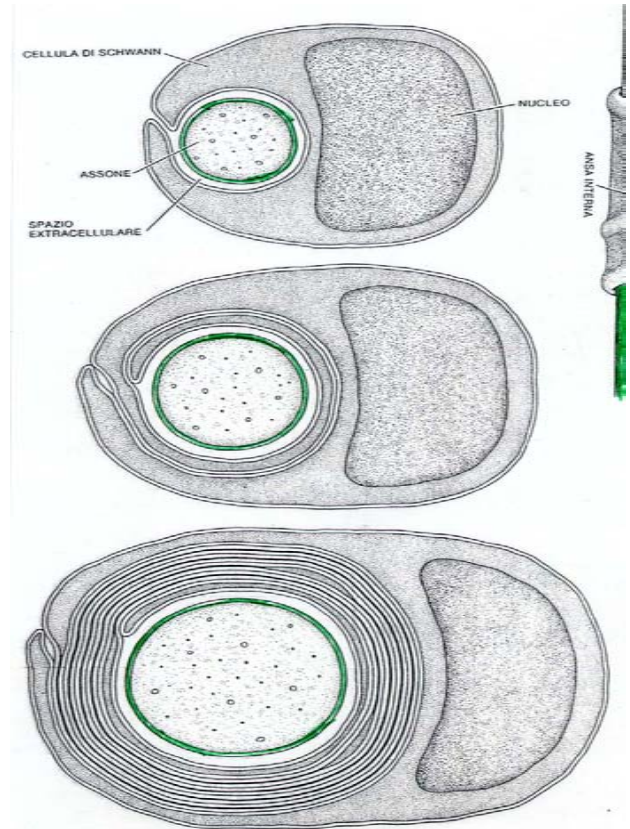
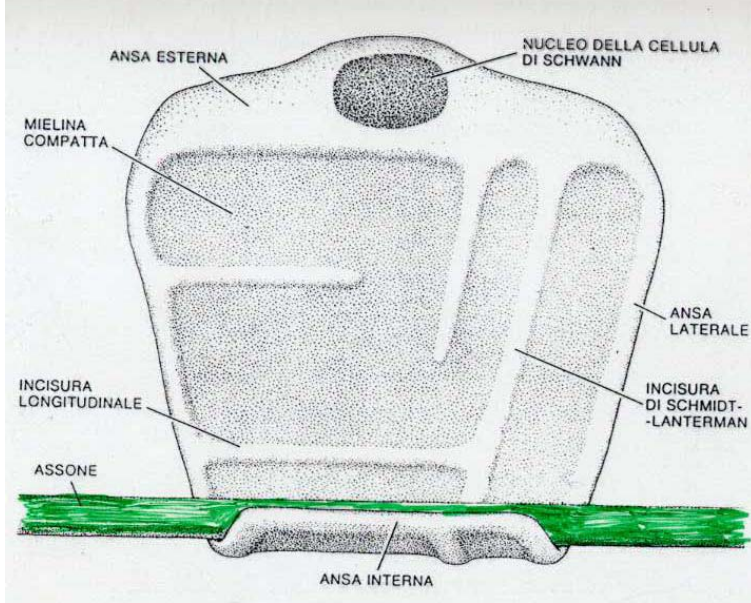


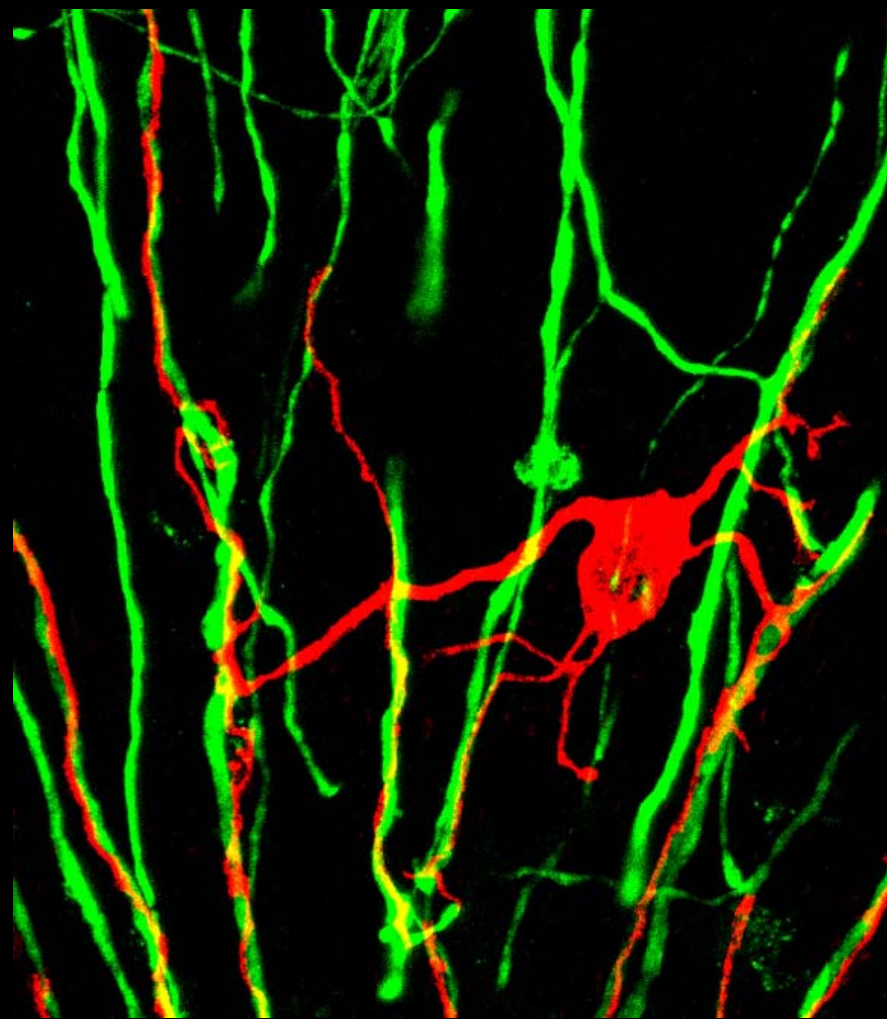
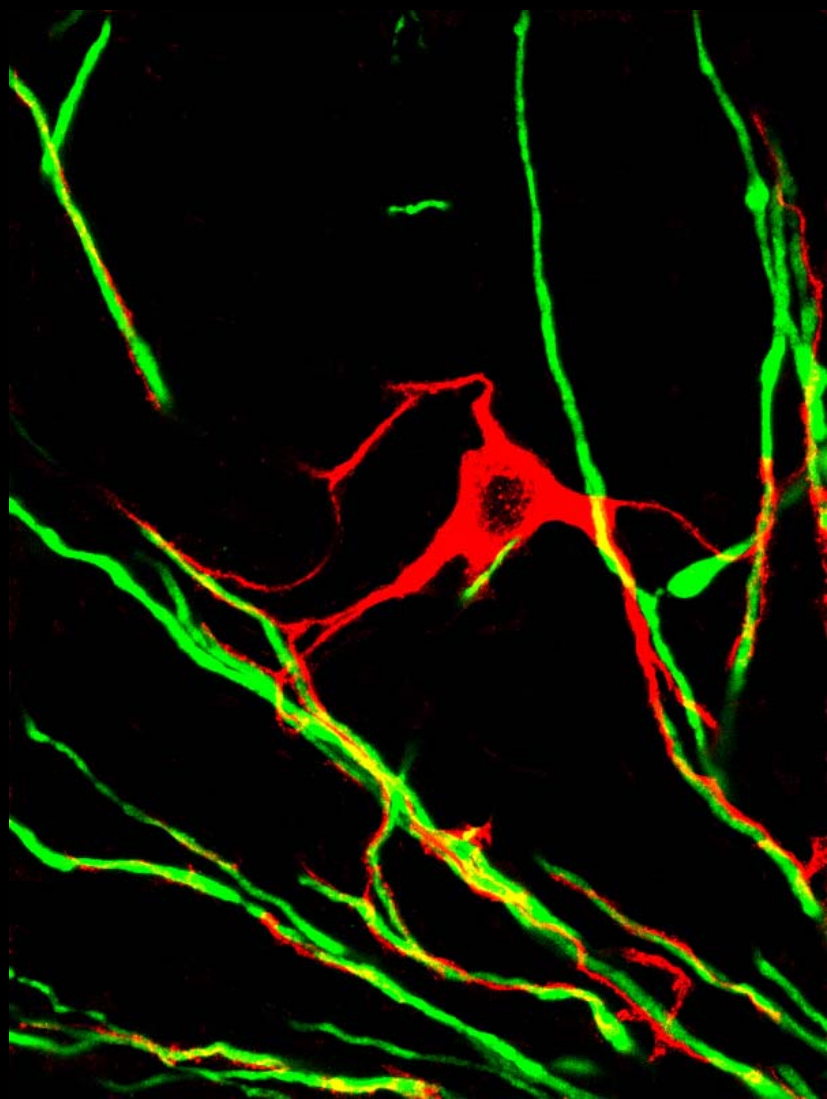
# Oligodendrociti: in SNC, più assoni



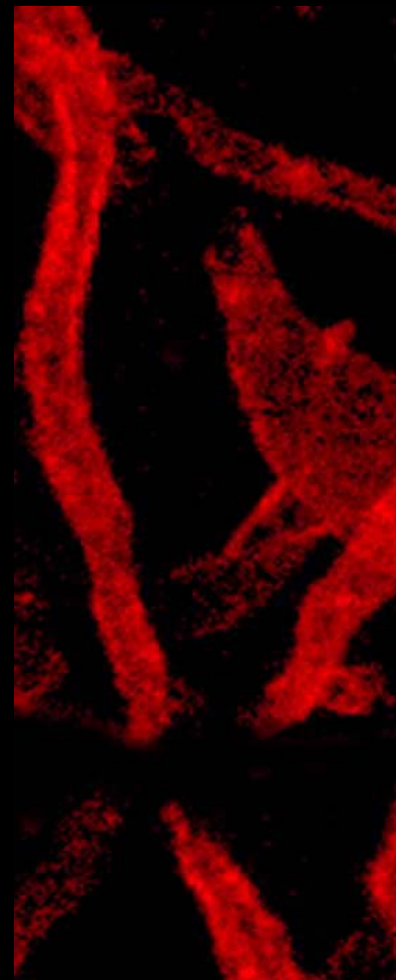
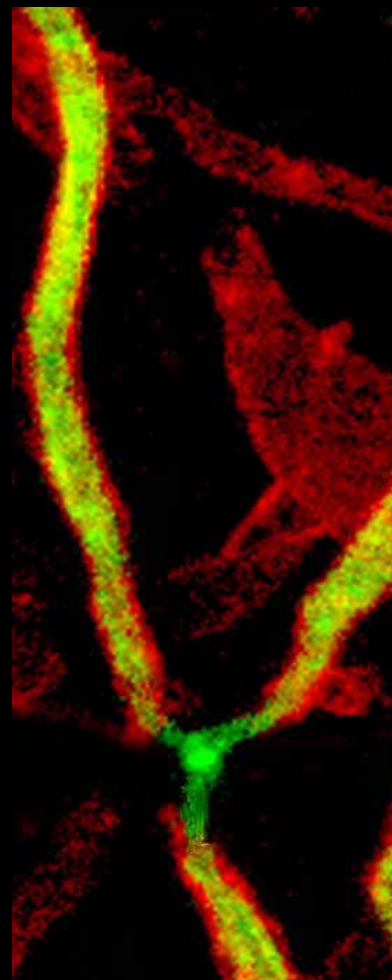
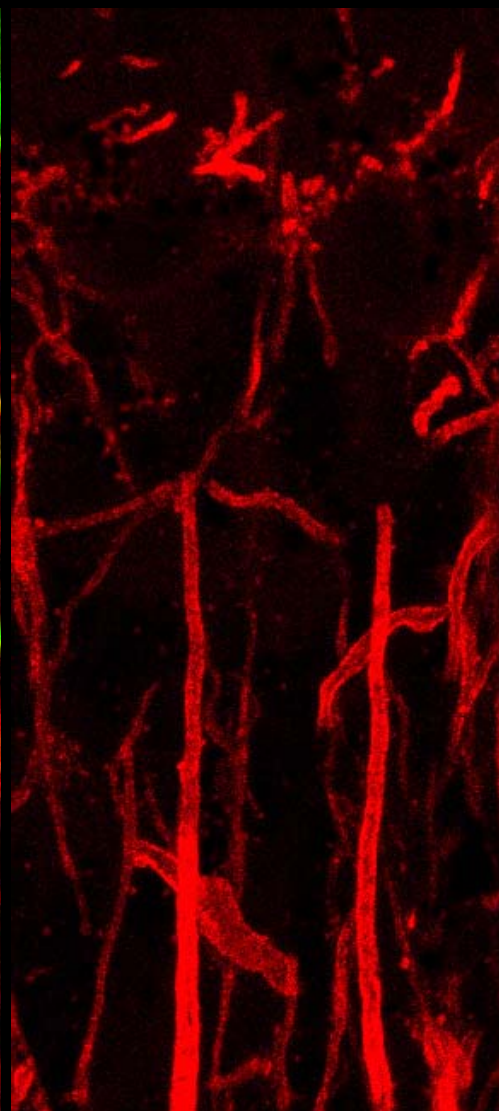
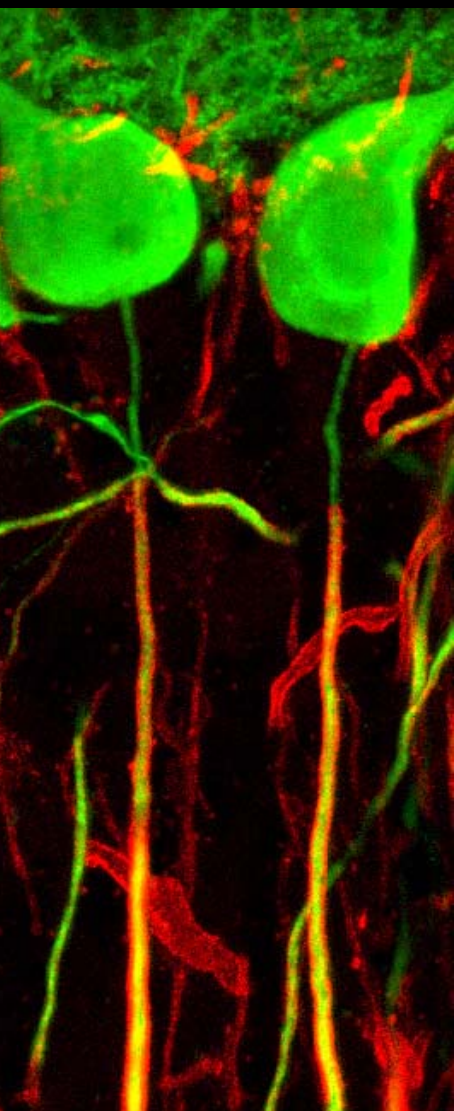
# Cellule di Schwann: in SNP, un solo assone

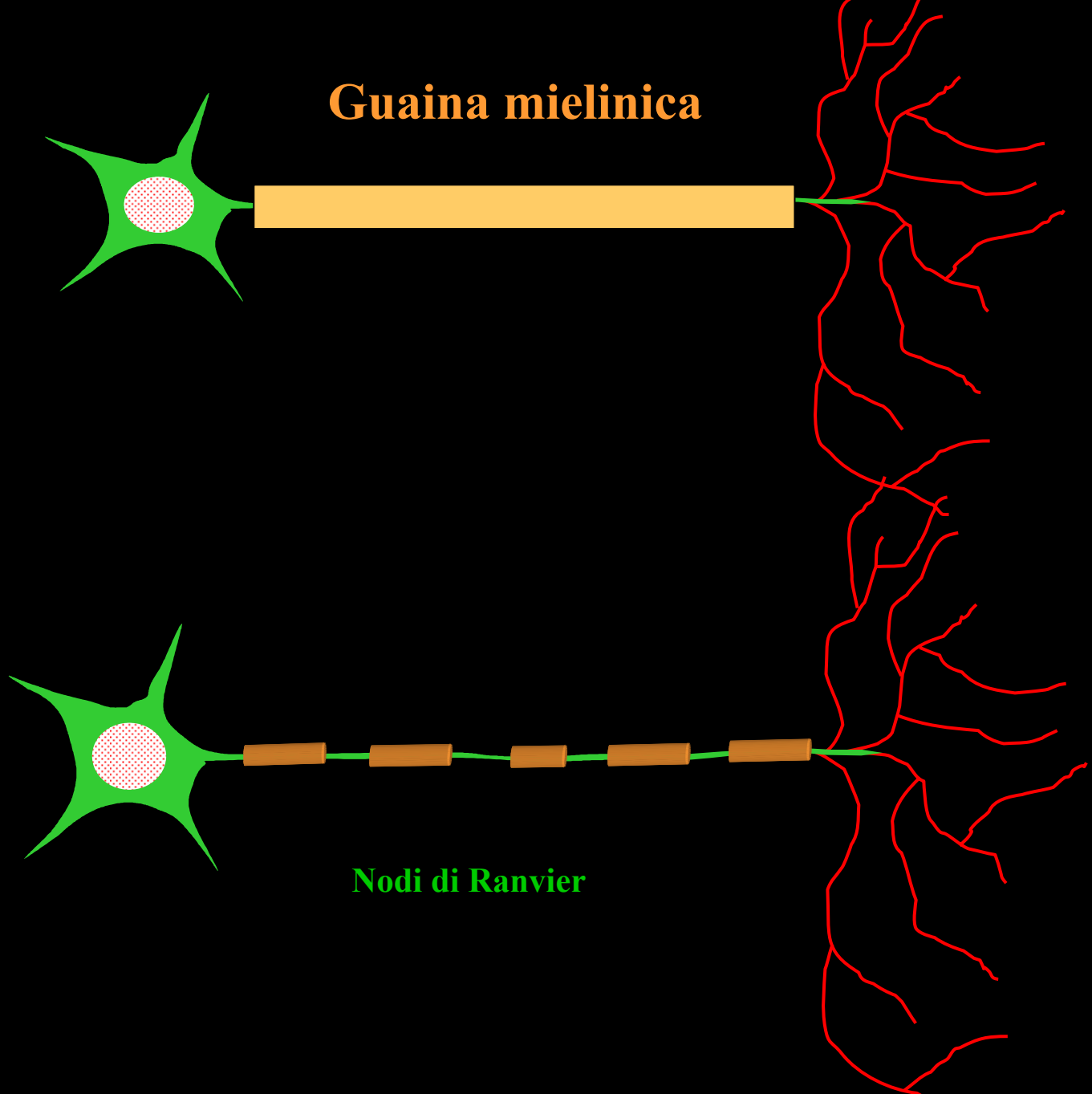


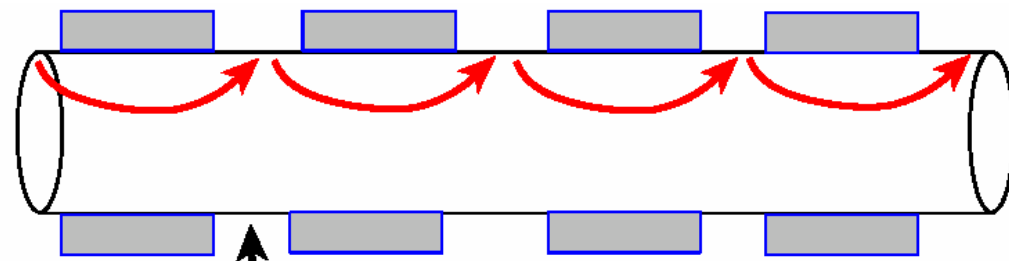
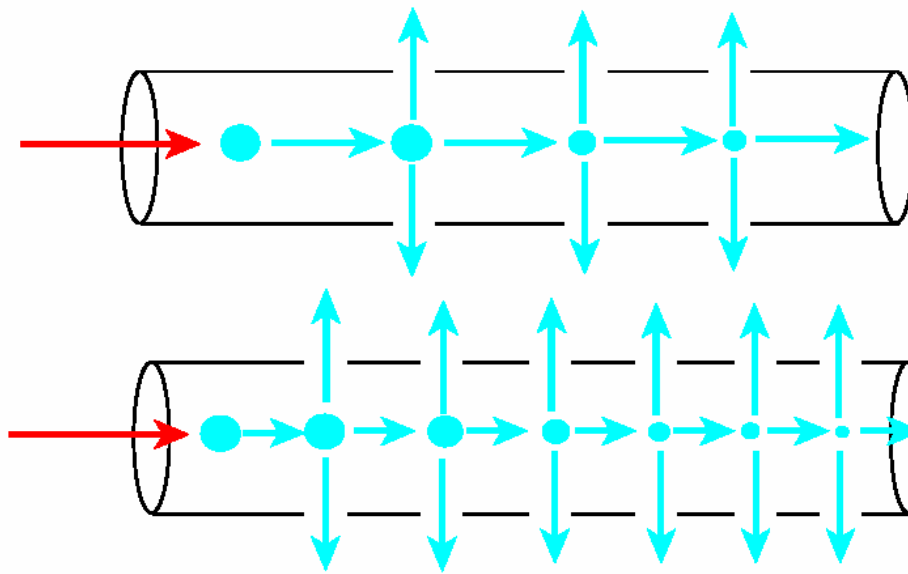






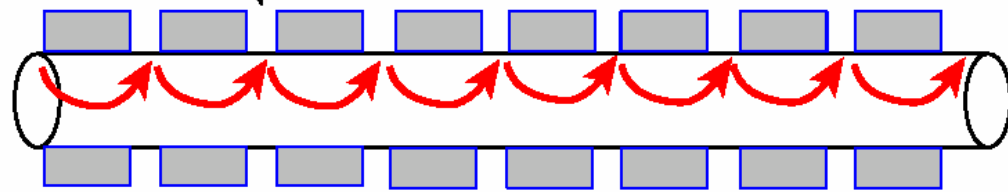






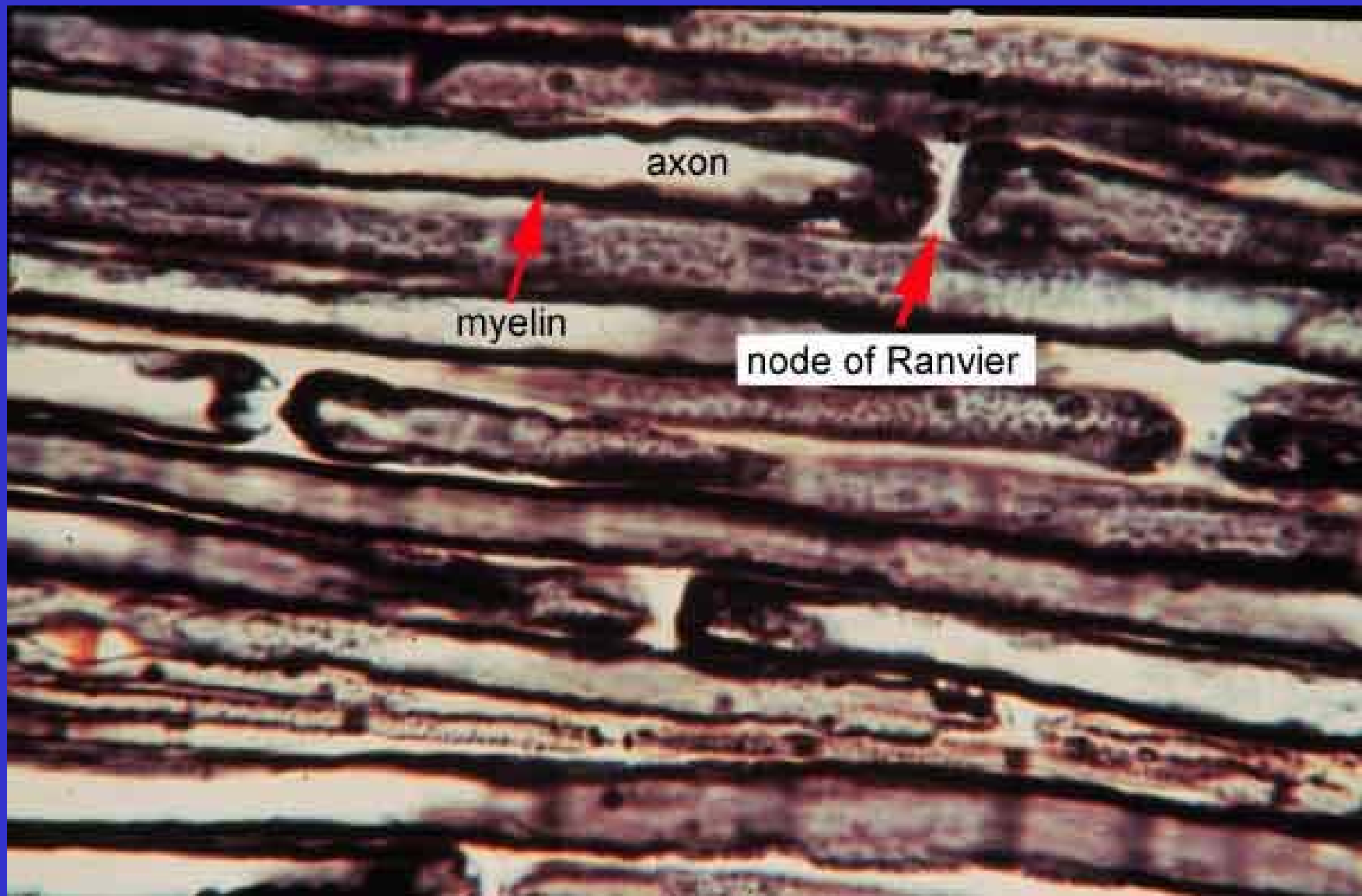
**adulto**

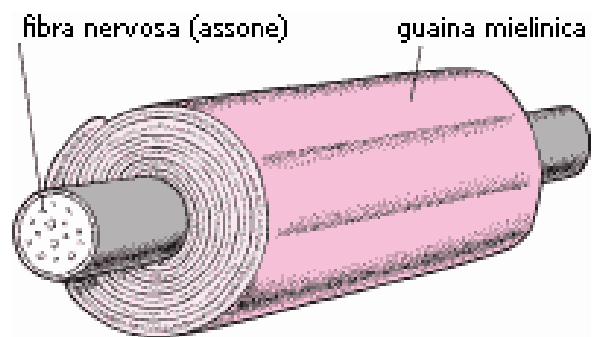
nodo di Ranvier



**bambino**

**“Conduzione saltatoria”**

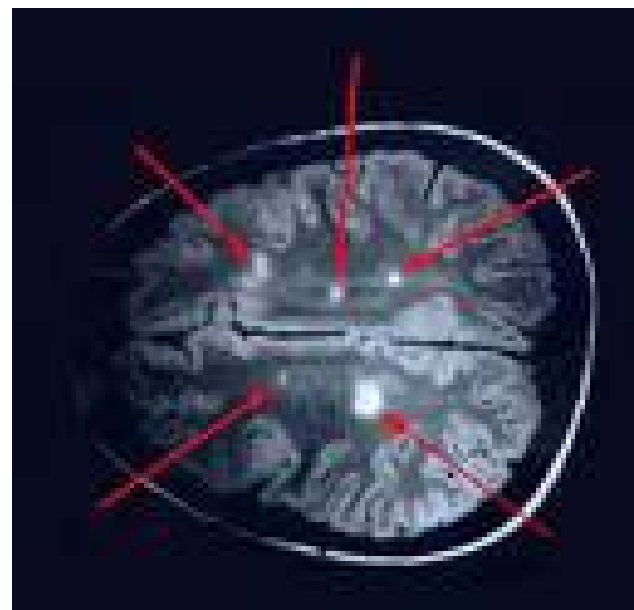




guaina mielinica normale

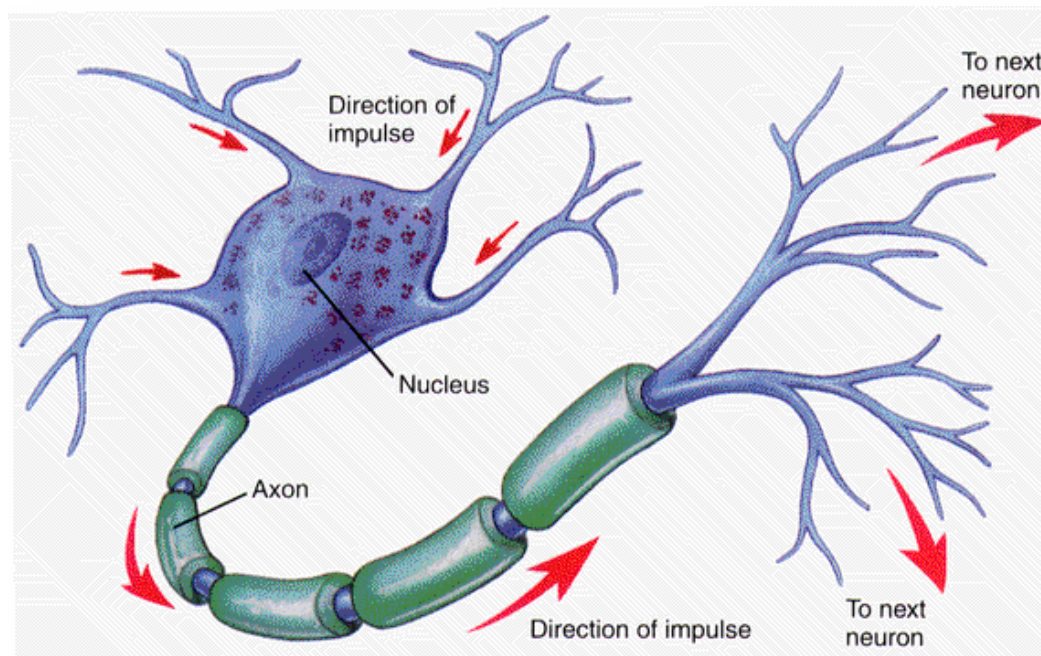
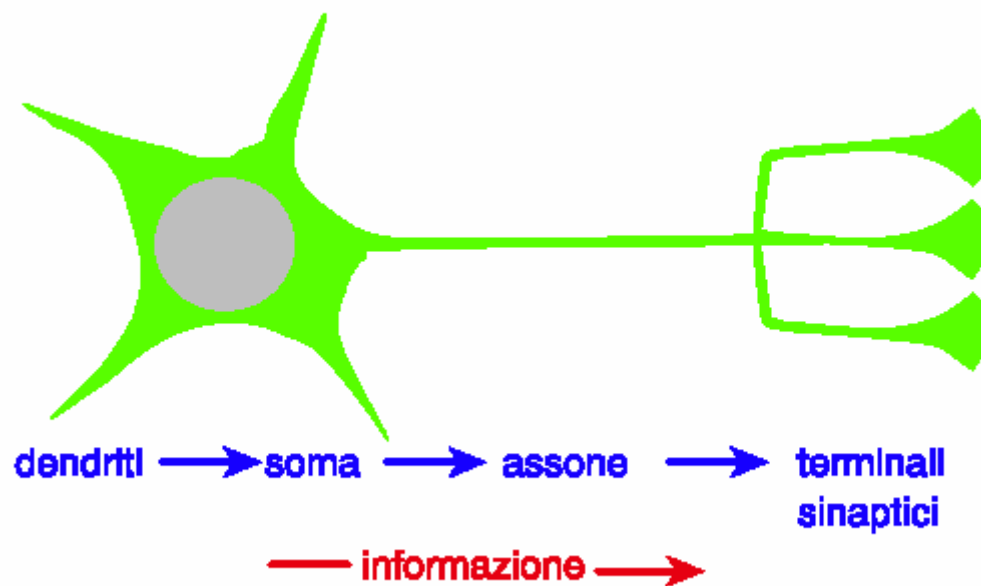


guaina mielinica lesionata





## principio della polarizzazione dinamica

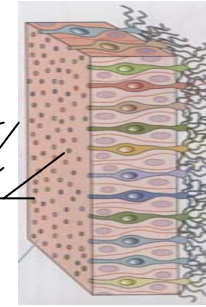


**Via sensoriale**

**STIMOLI  
SENSORIALI**  
(luce, suono, cibo...)

dendrite

assone



**Recettore: trasduzione:  
depolarizz/iperpolarizzazione**

**AREE SENSORIALI,  
ASSOCIATIVE,  
MOTORIE**

**Organi bersaglio:  
Muscoli, ghiandole:**

**RISPOSTE CORPOREE**

