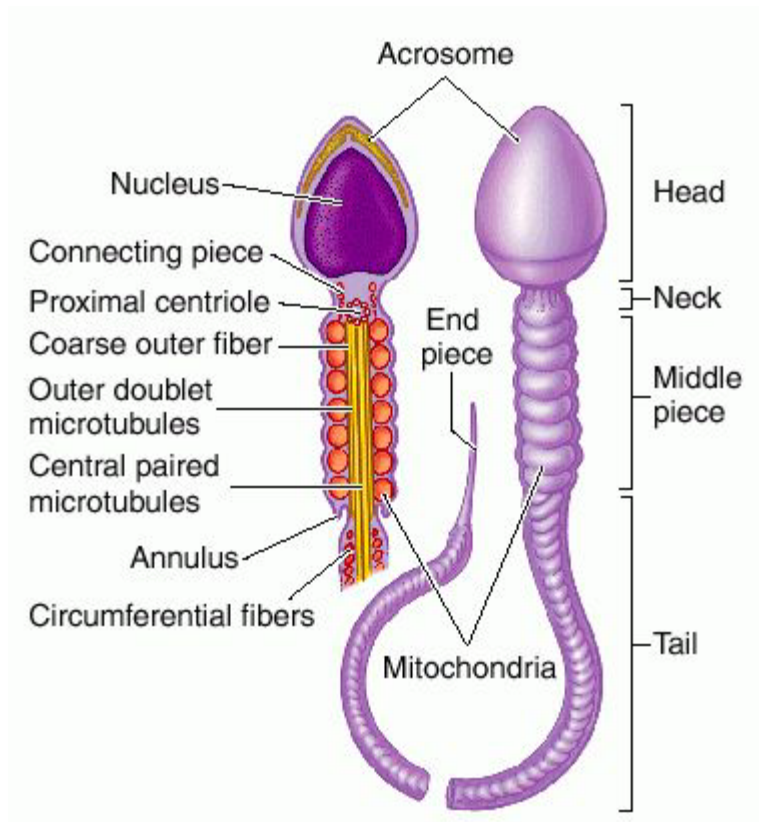


- Quiescent
- Not capable of fertilization

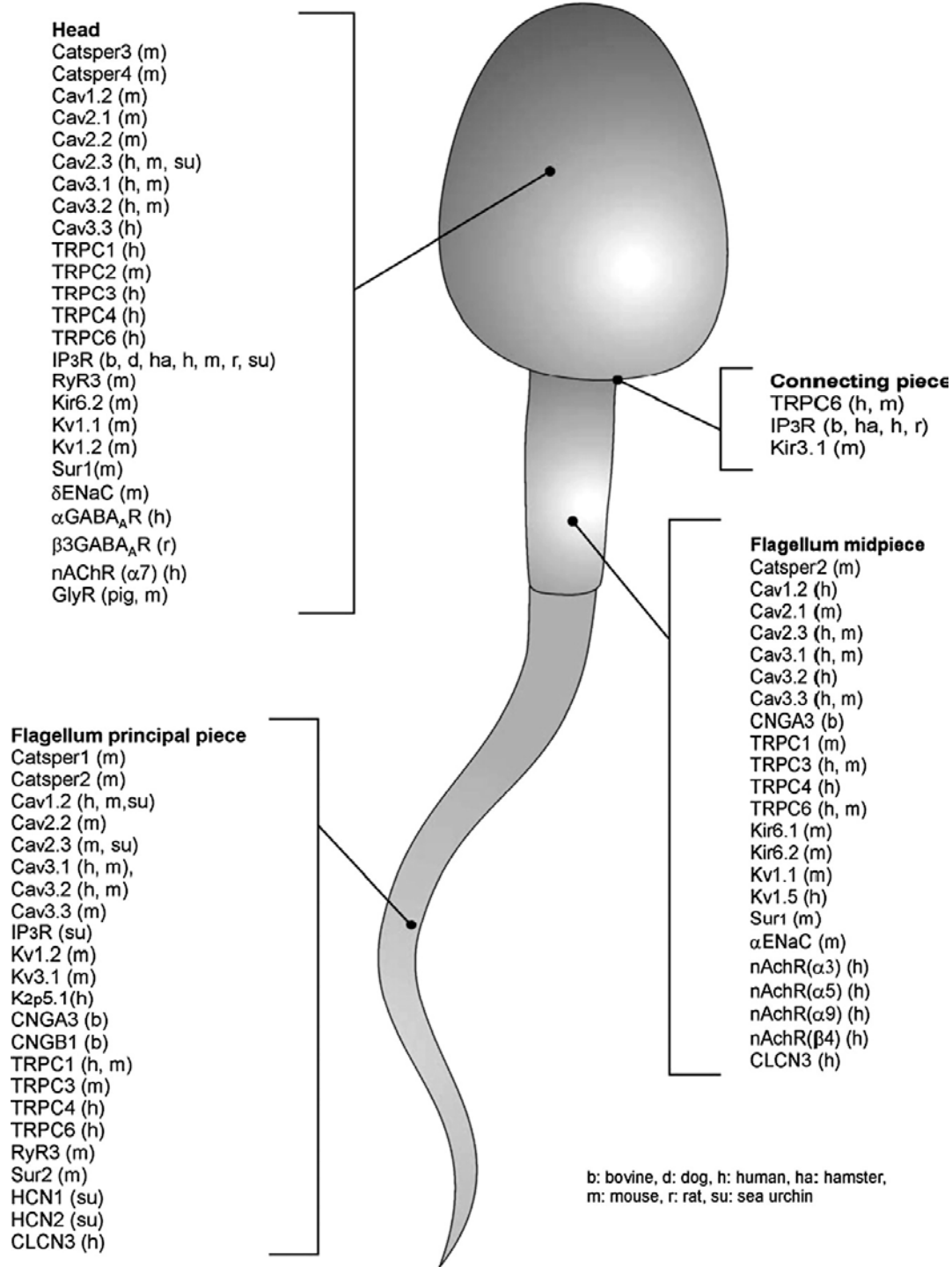


microM
5
5-7
40-50

Speed 100 microm/s

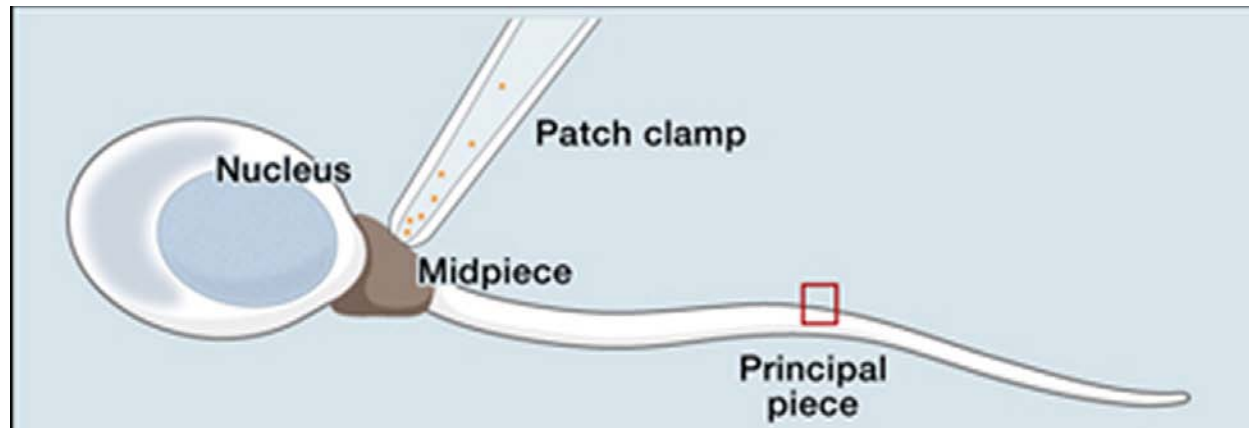
Capacitation – step in the maturation of mammalian spermatozoa and is required to render them competent to fertilize an oocyte. Typically occurs after ejaculation, in the female reproductive tract

- **destabilisation of the acrosomal sperm head membrane (cholesterol depletion, lipids reorganization)**
- **increased pH_i**
- **increased permeability to Ca^{2+}**
- **increased intracellular cAMP**
- **increase in motility (Hyperactivation)**
- **Hyperpolarization of the sperm plasma membrane (from -30 to -60mV)**

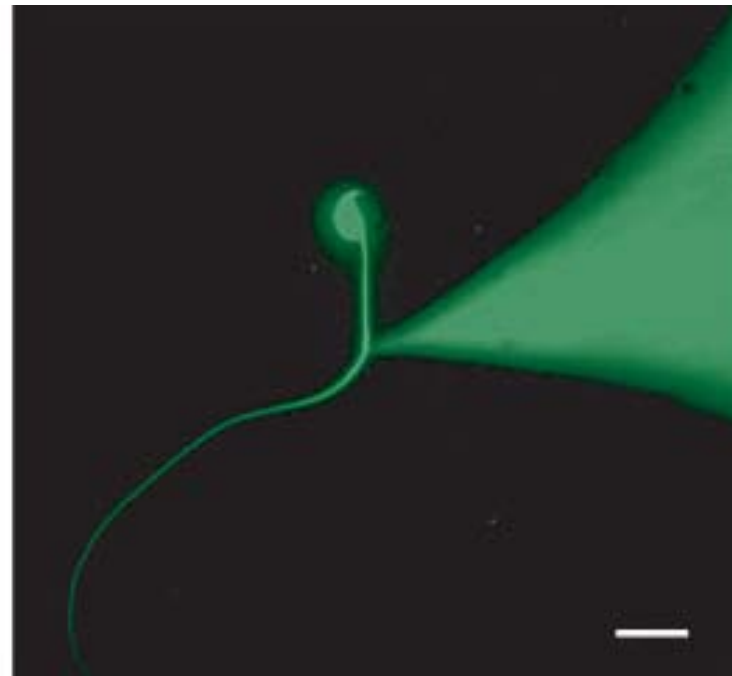


Whole-cell patch-clamp measurements of spermatozoa

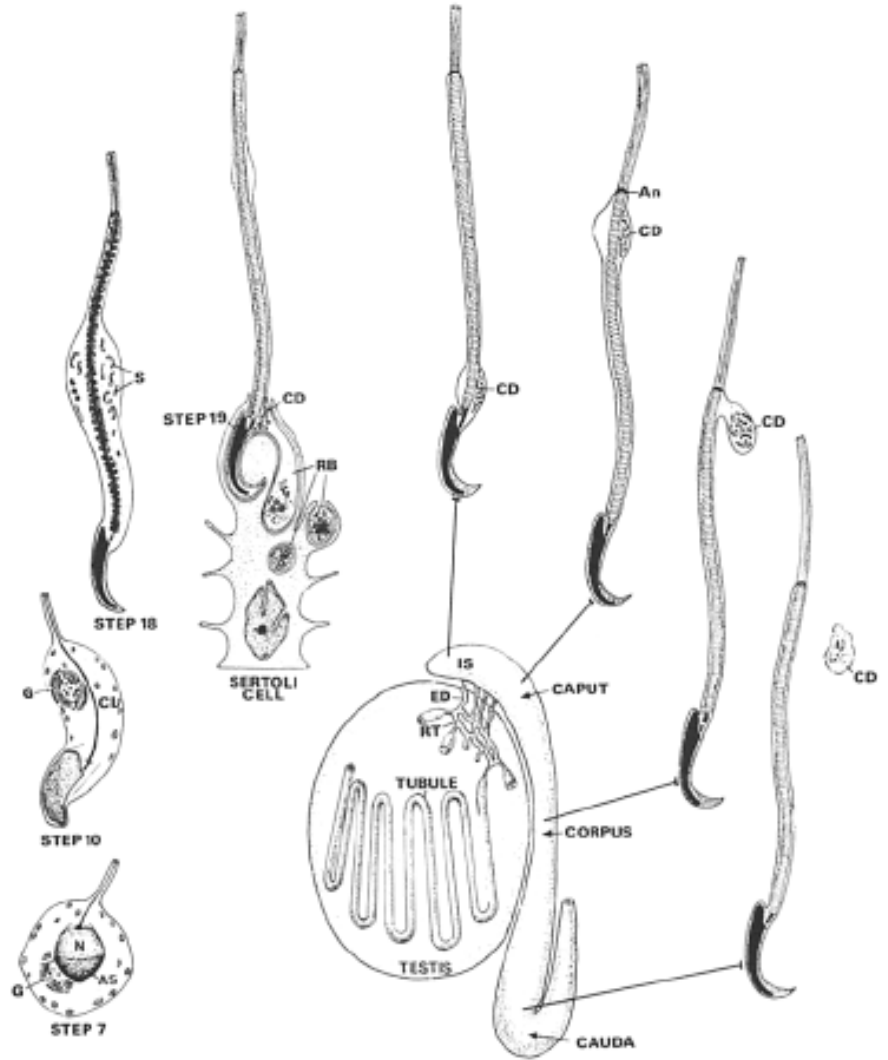
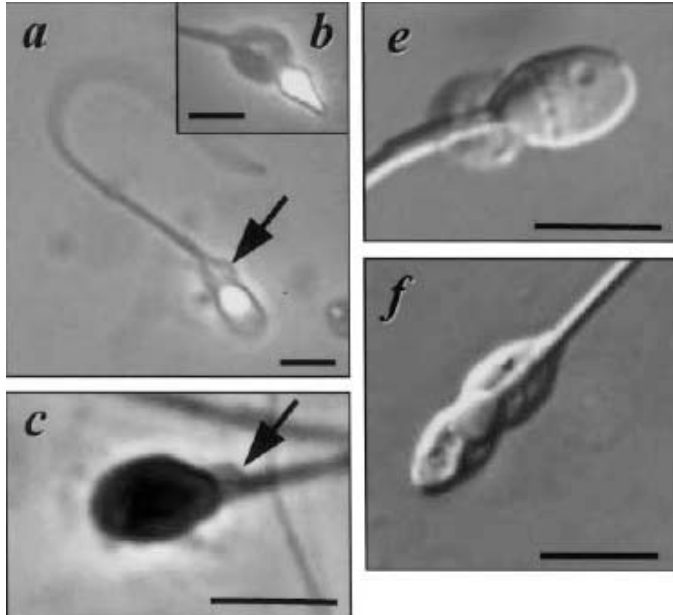
Yuriy Kirichok, Betsy Navarro & David E. Clapham



$C_{\text{mouse}} = 2.5 \text{ pF}$
 $R_{\text{pip}} = 3\text{-}11 \text{ M}\Omega$
 $R_a = 25\text{-}80 \text{ M}\Omega$



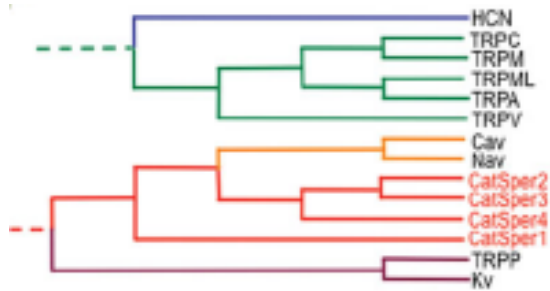
Cytoplasmic droplets



-increased permeability to Ca²⁺ ??????

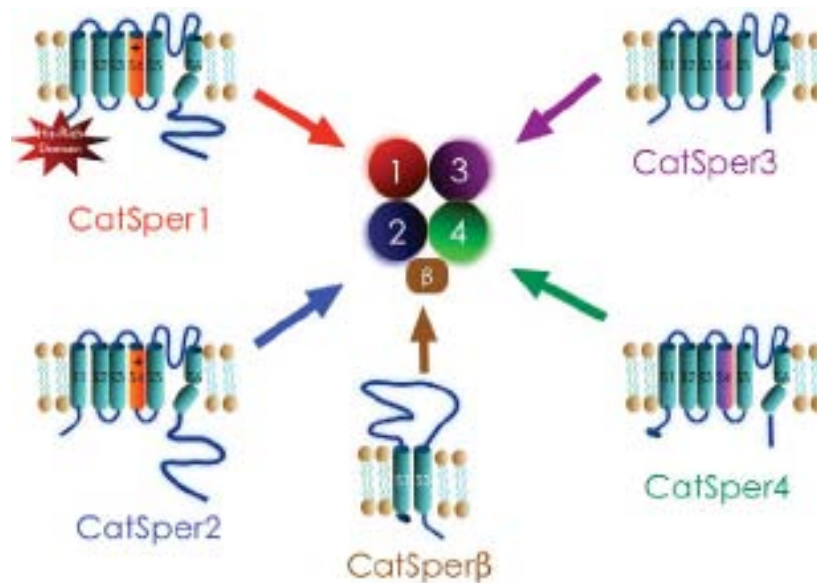
mouse

CatSper – Ca-selective channel

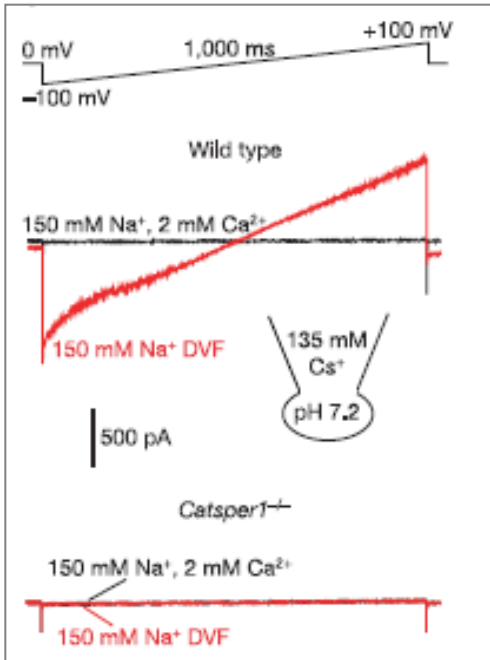


Expression:

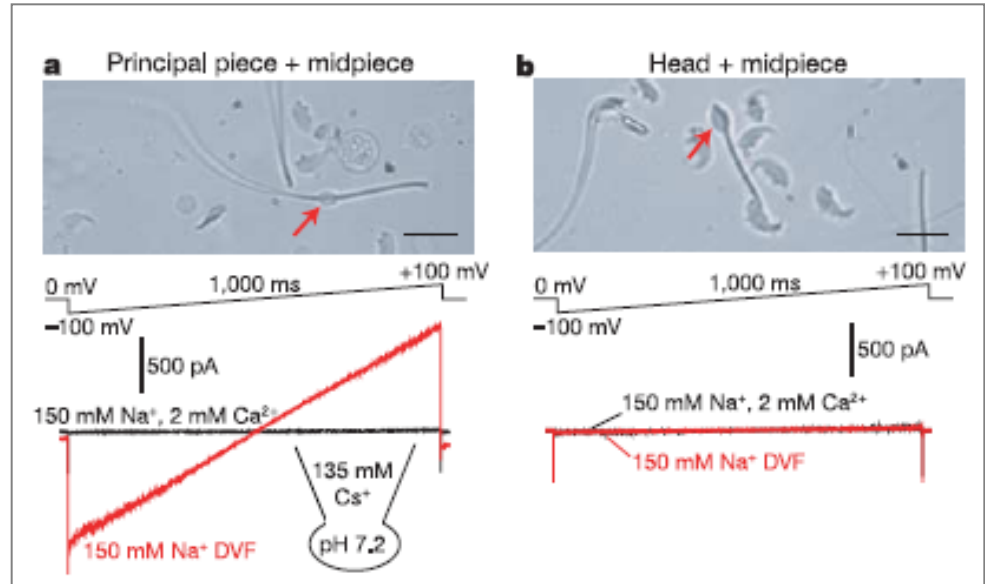
Testis,
Principal piece of sperm



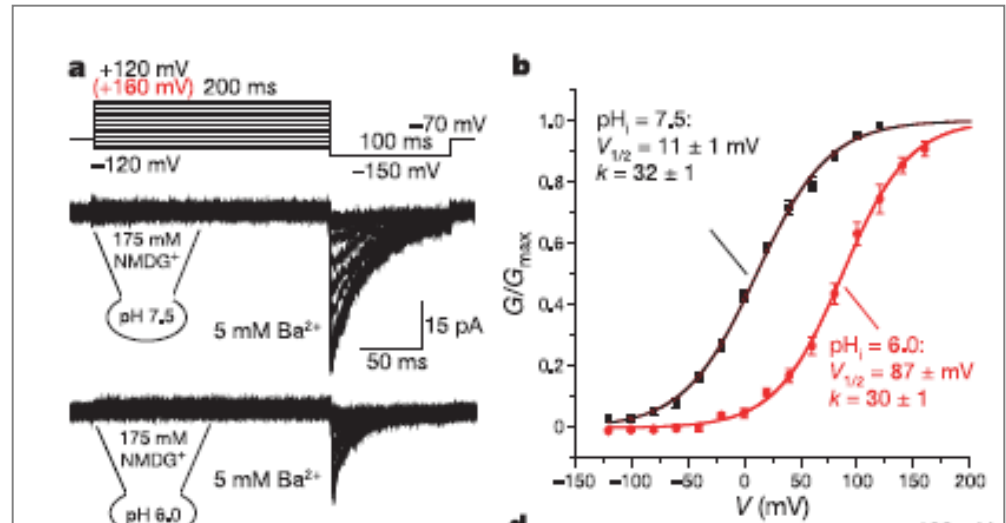
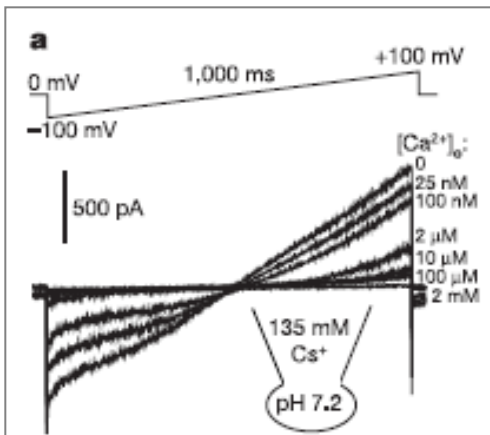
Ca-selectivity



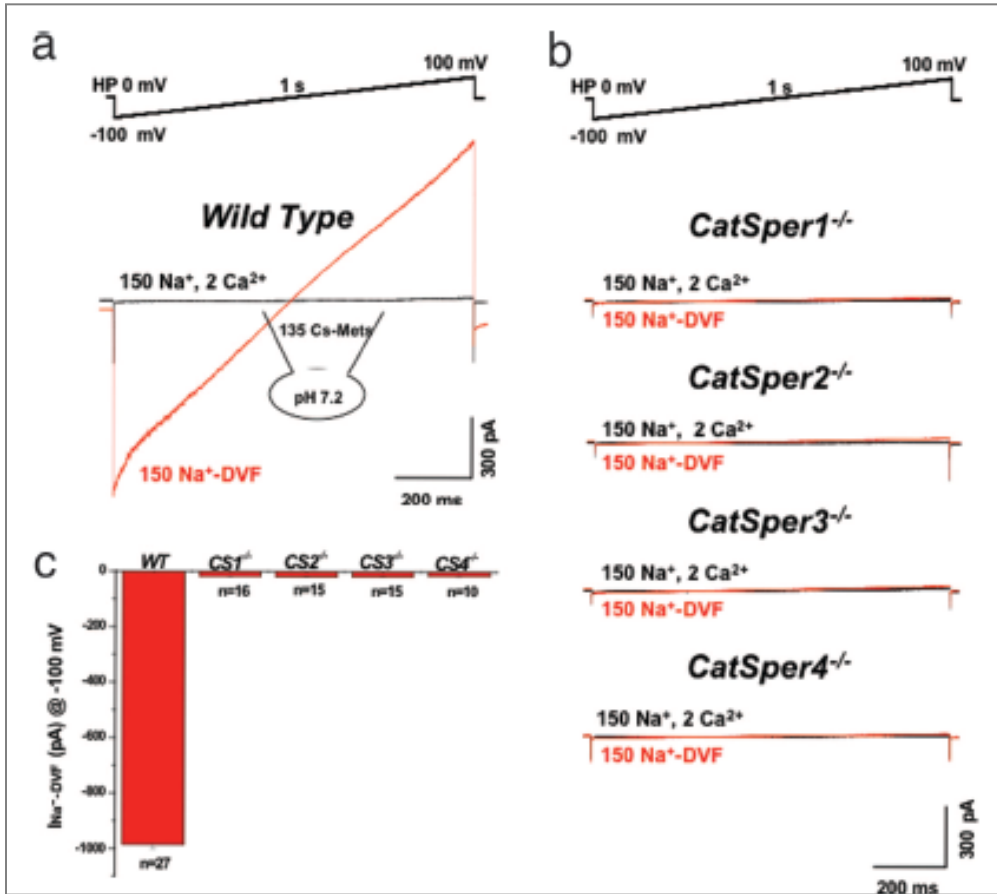
Expression in the principal piece



pH and voltage dependence



ICatSper is absent in CatSper^{-/-}



CaV1.3, CaV2.2, CaV2.3,
CaV3.1, CaV3.2,
TRPC2, CNGA3 - null

Normal fertility

CatSper-null



Infertility

Acrosomal Reaction



Spermatogenesis



Hyperactivated motility



Hyperpolarization of the sperm plasma membrane (from -30 to -60mV) ??????????

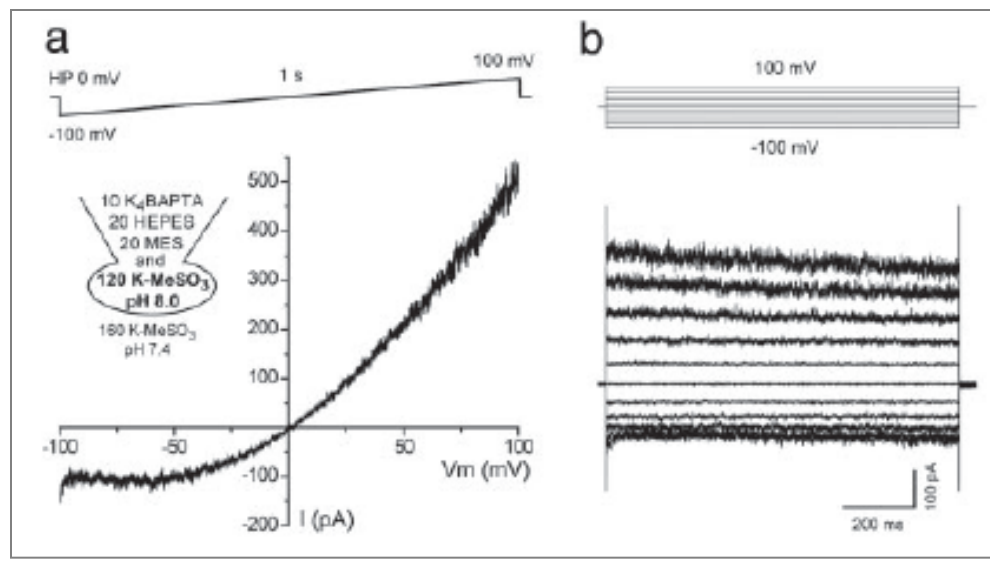
KSper – K channel, that controls sperm membrane potential

mouse

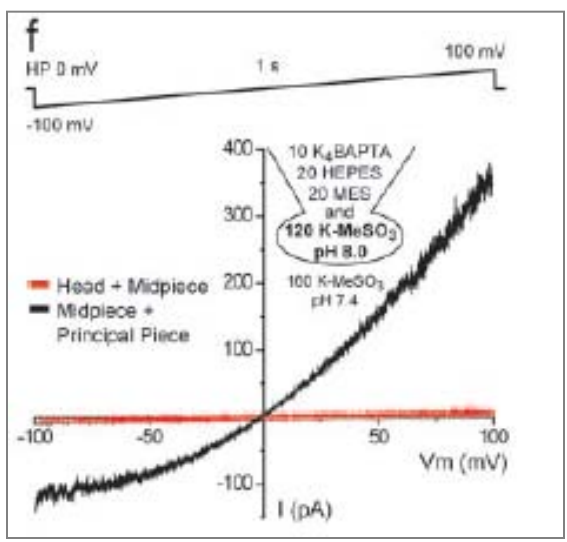
Possible candidate – *mSlo3 (testis specific)*

Expression:

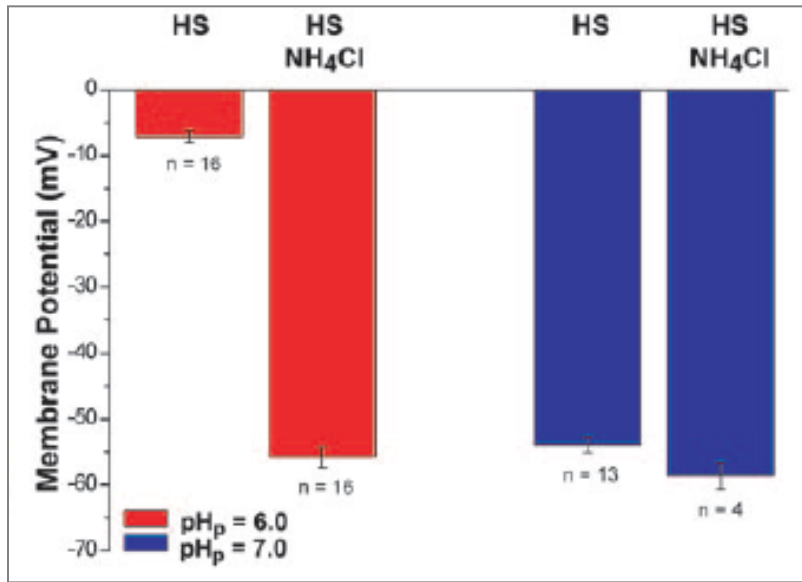
Testis,
Principal piece of sperm



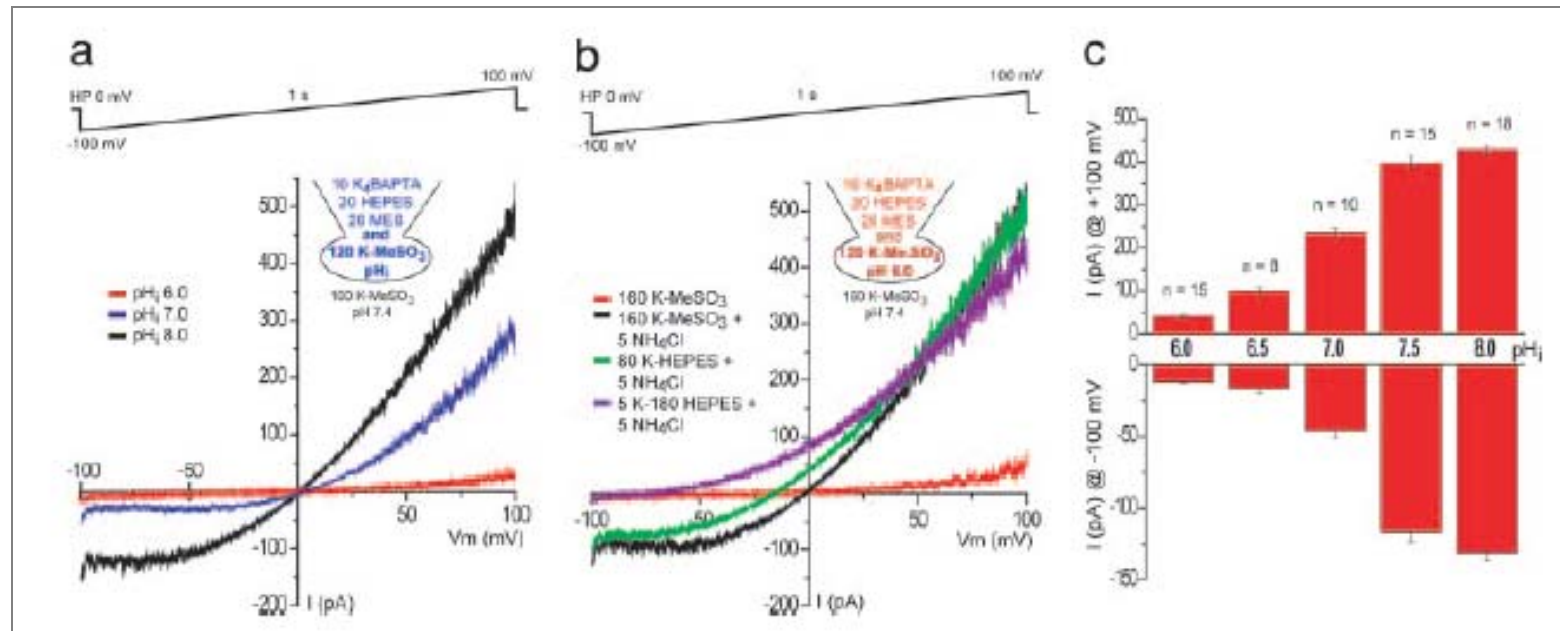
Expression in the principal piece



pHi controls sperm resting Vm



Intra alkalinization potentiates I_KSper



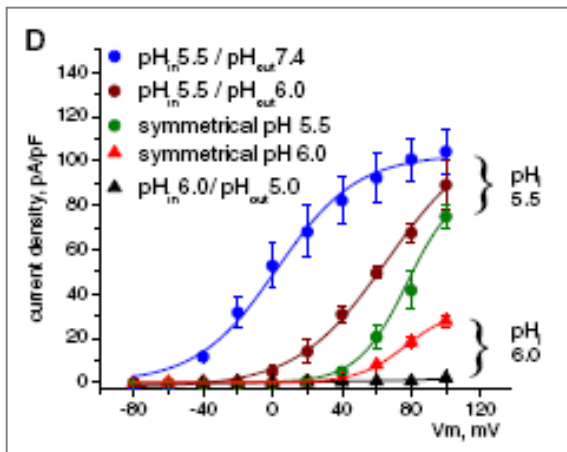
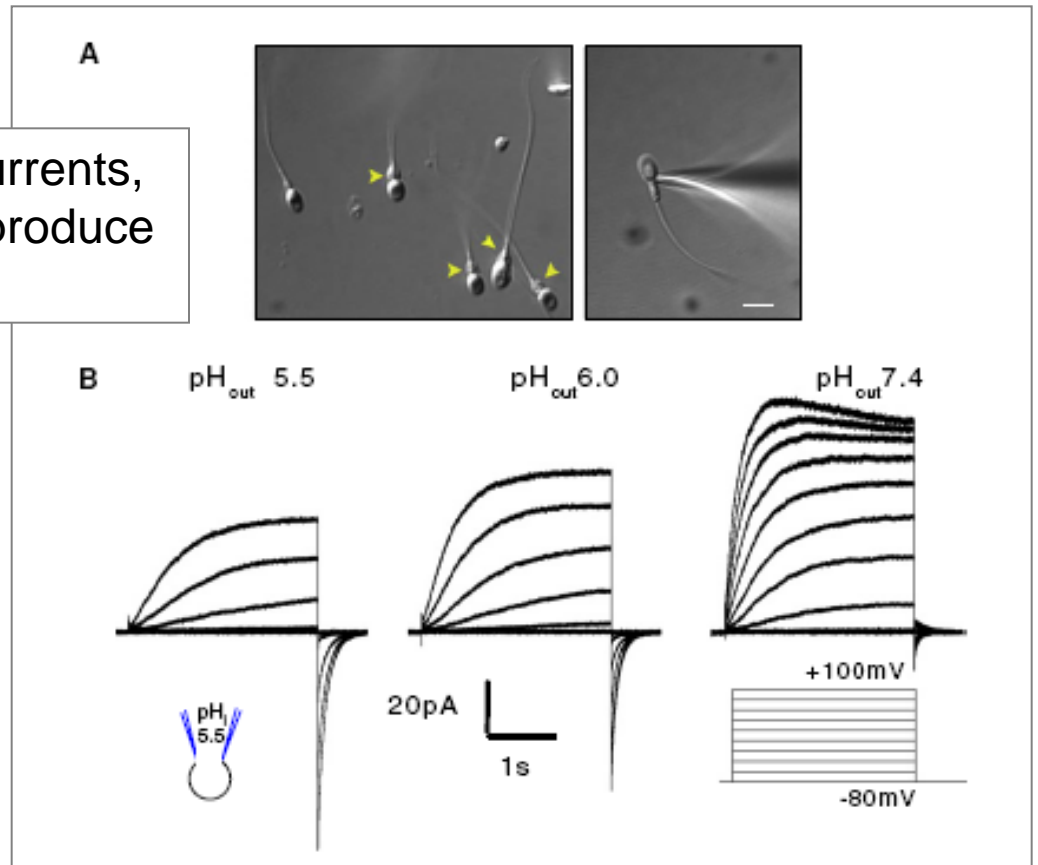
increased pHi ??????????

human

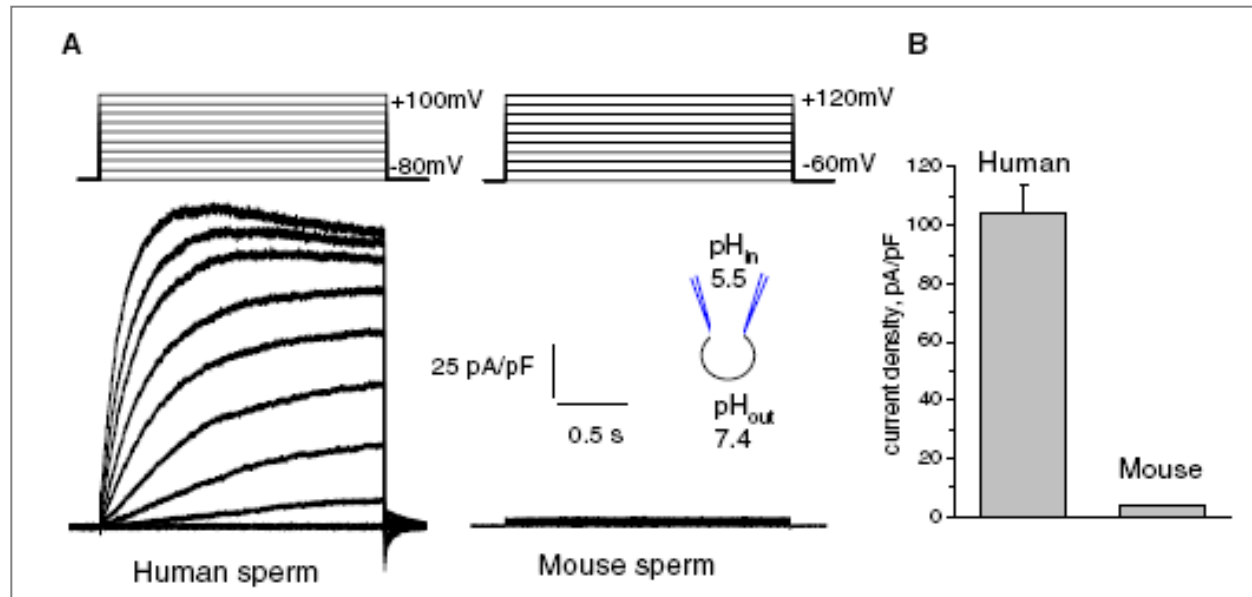
$C_{human} = 0,9 \text{ pF}$

- Na^+/H^+ exchanger
- **HSper = Hv1**

Conducts only outward proton currents,
Thus is specifically designed to produce
intracellular alkalinization



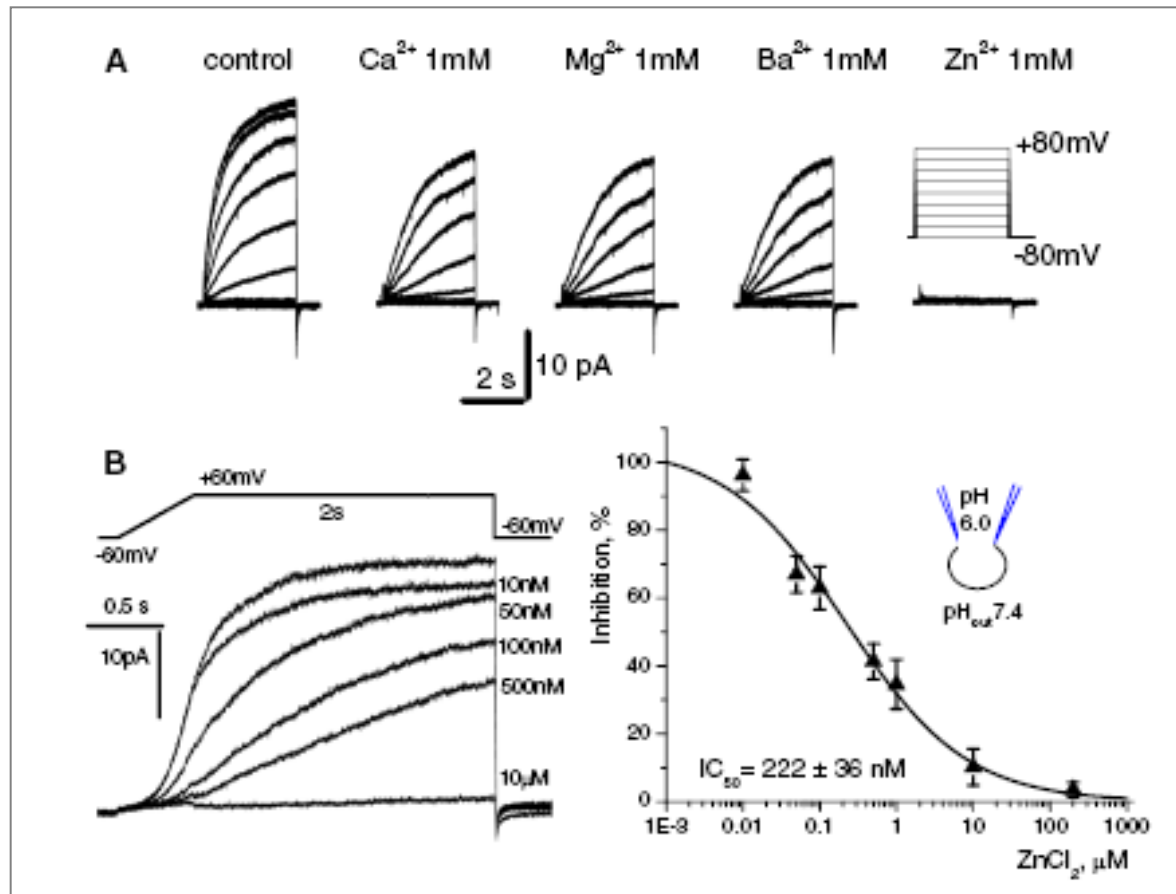
Mechanisms that control sperm pHi are different in mouse and humans



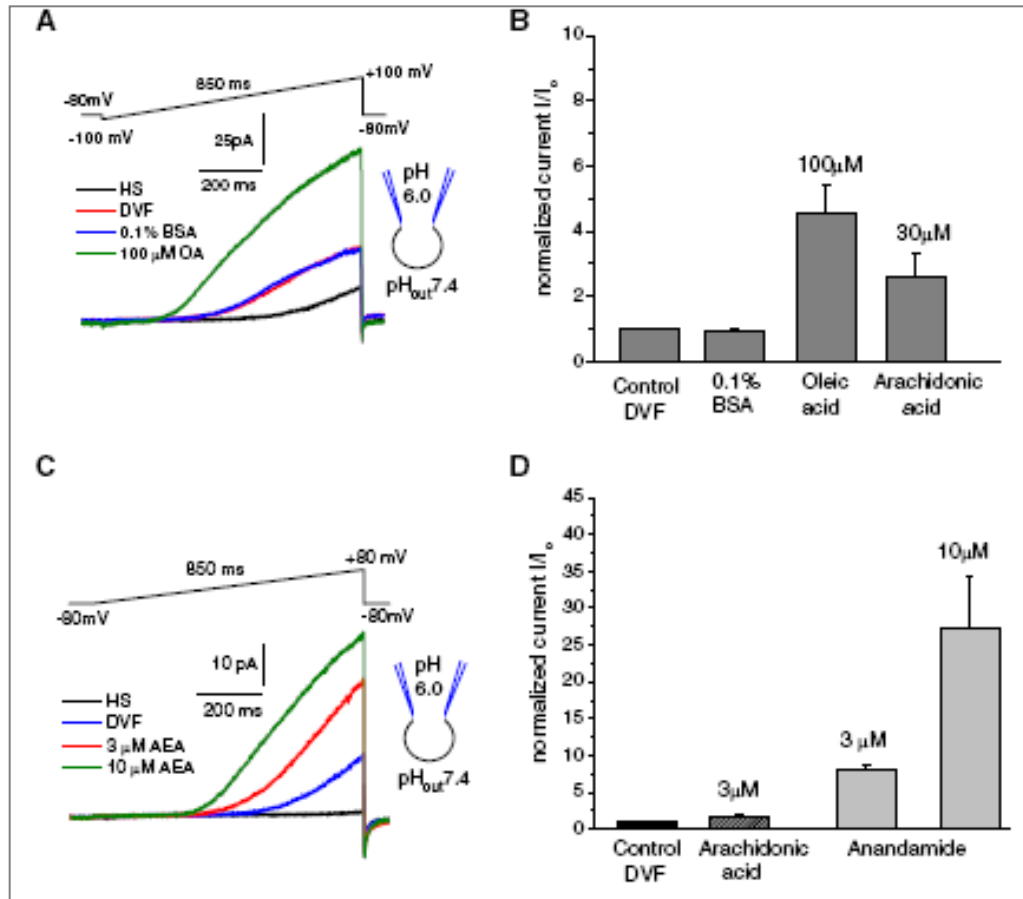
???? Sperms are in different physiological states!!!!

Cannot make firm conclusions.

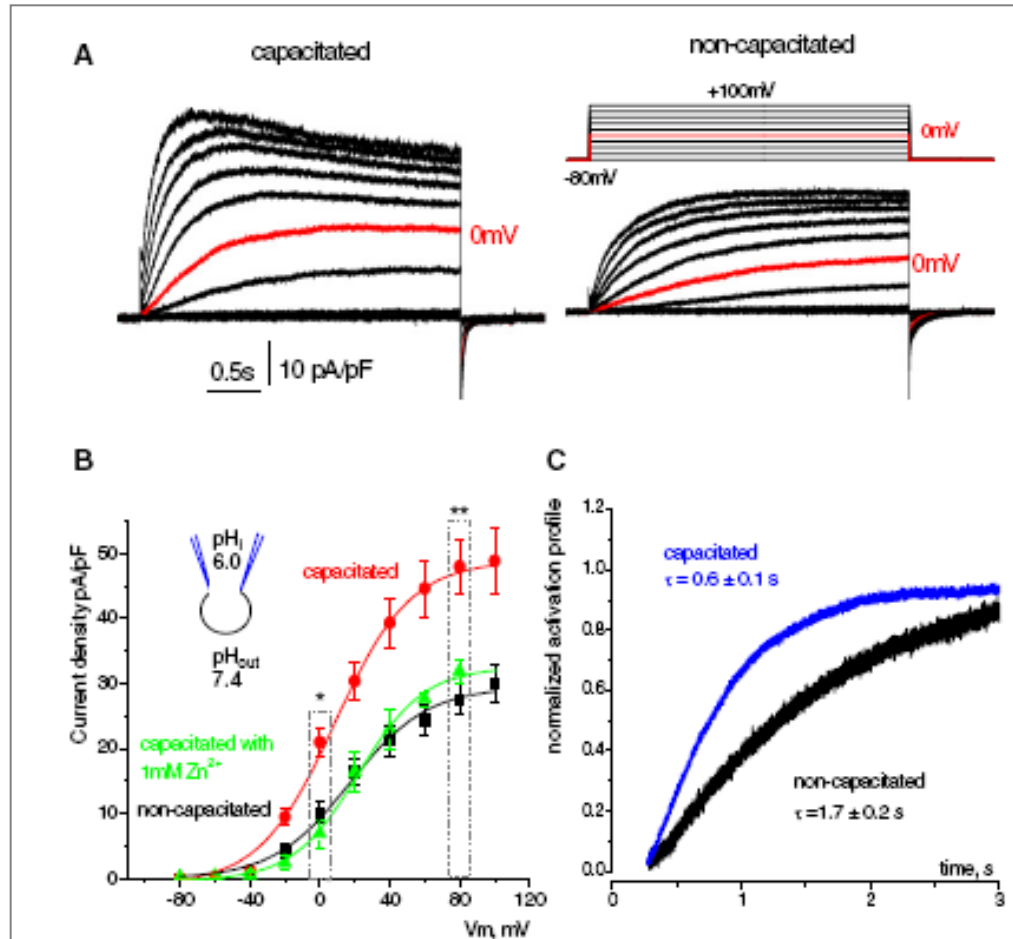
Hv1 is inhibited by Zn

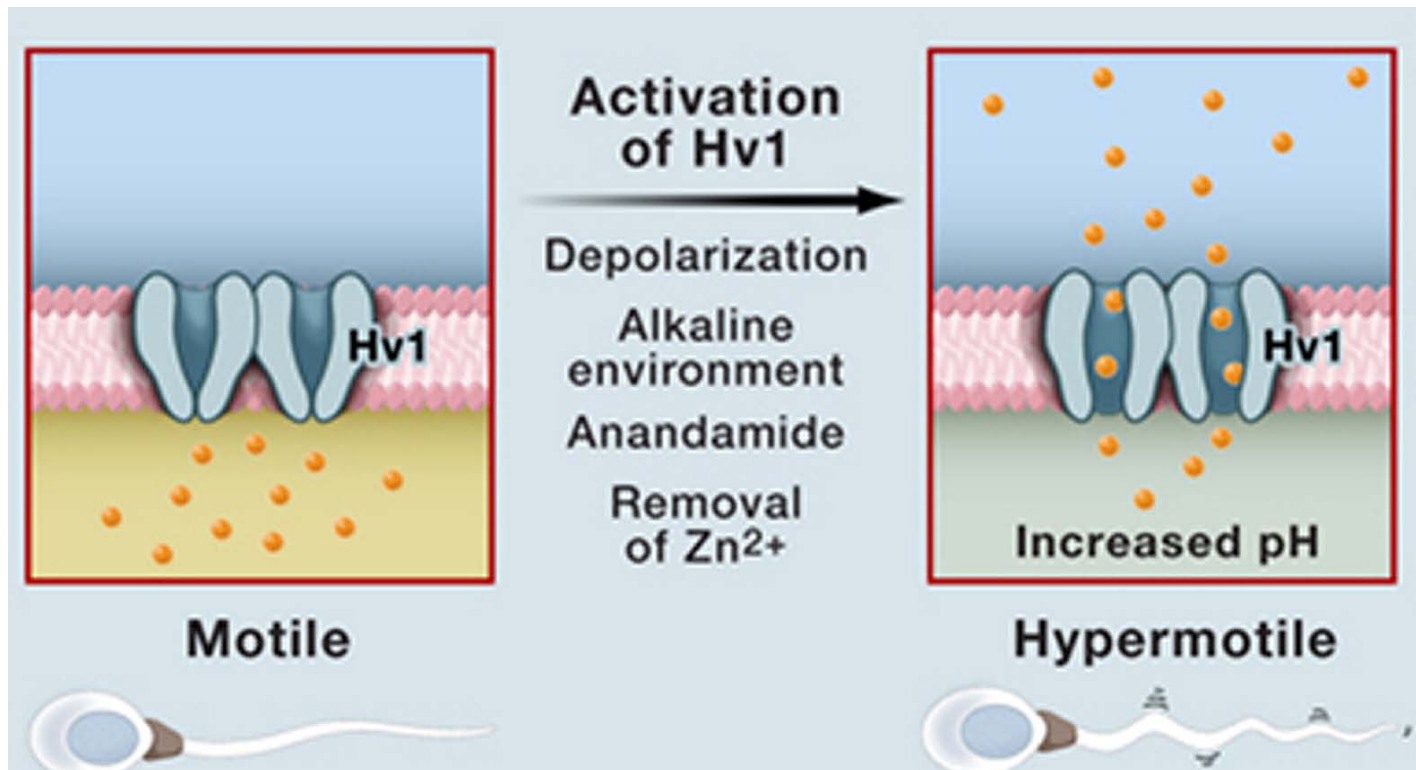


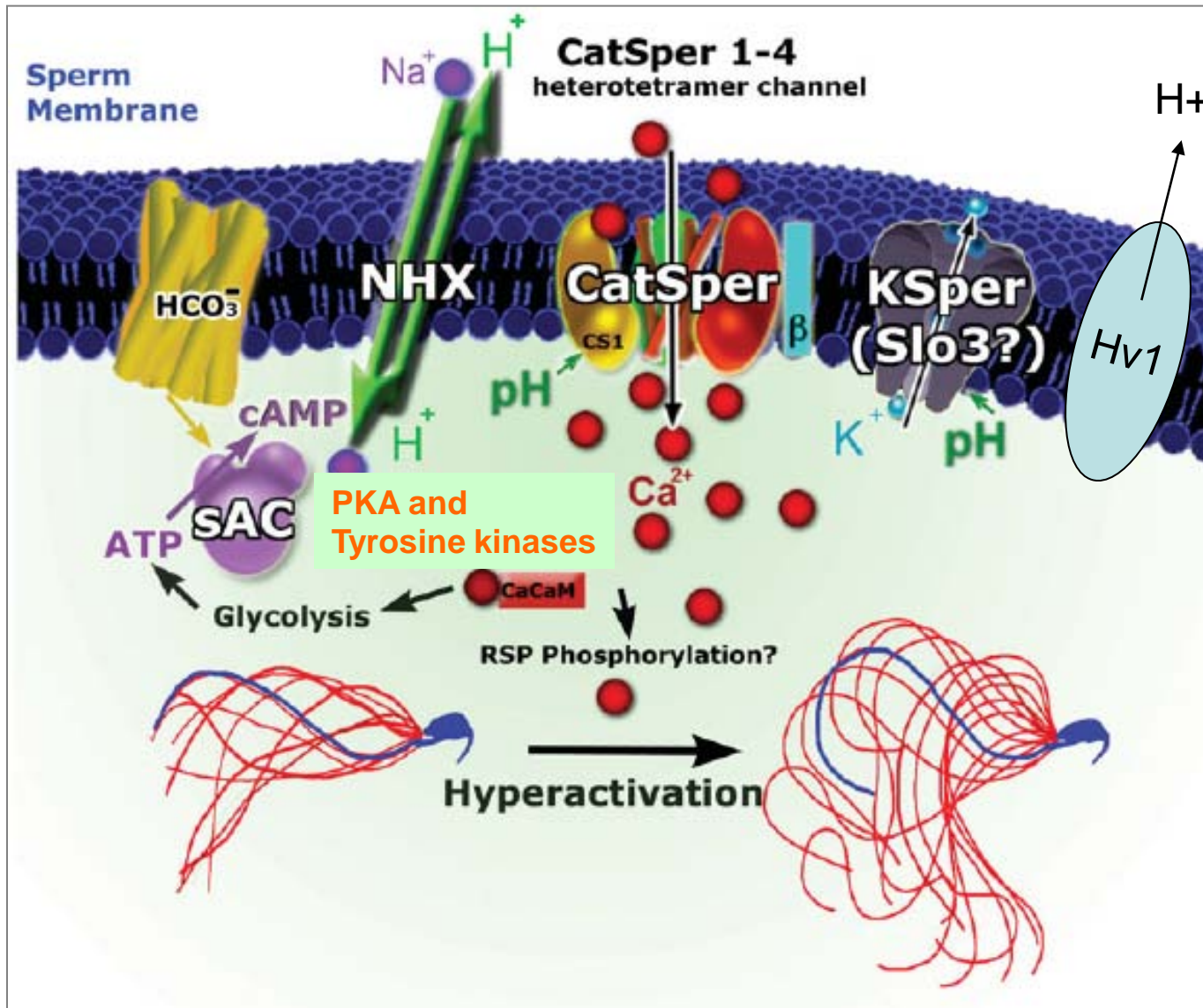
Hv1 is potentiated by Fatty Acids and anandamide

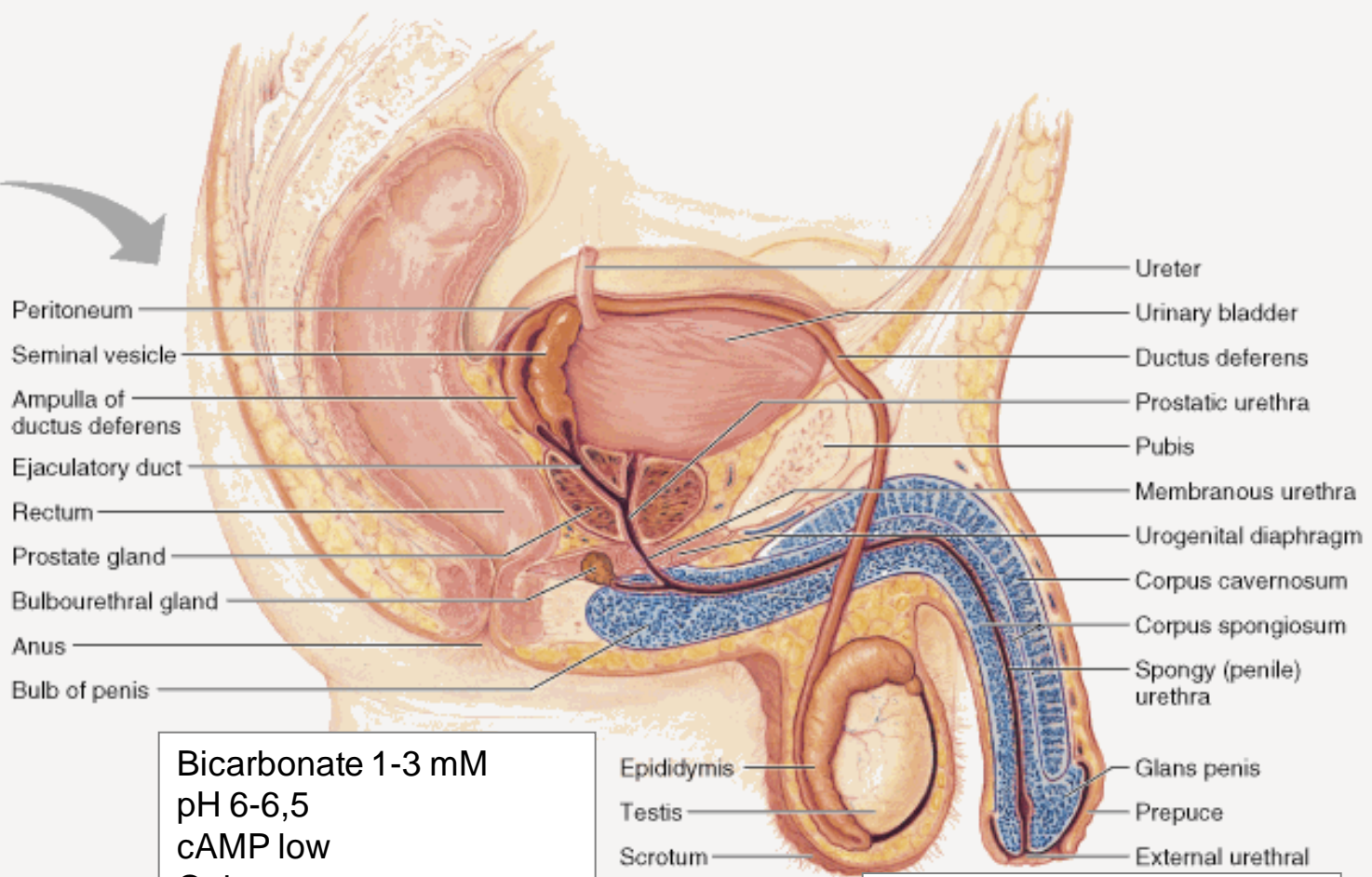


Hv1 currents are enhanced in capacitated sperm









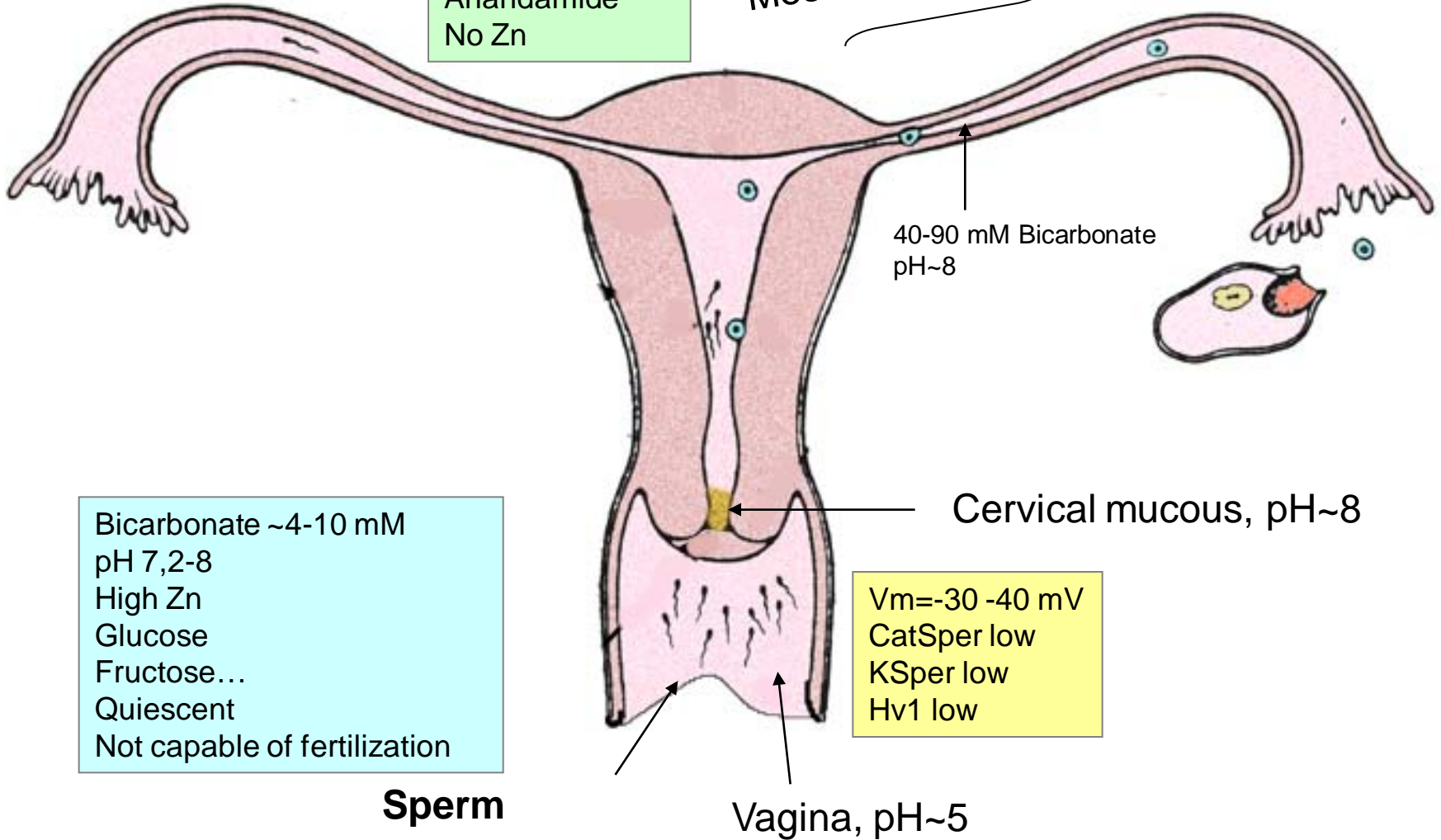
Bicarbonate 1-3 mM
pH 6-6,5
cAMP low
Quiescent
Not capable of fertilization

Bicarbonate ~4-10 mM
pH 7,2-8
High Zn
Glucose
Fructose...
Quiescent
Not capable of fertilization

Vm=-60 mV
CatSper high
KSper high
Hv1 high
cAMP high
Anandamide
No Zn

?

Most capacitation occurs HERE



40-90 mM Bicarbonate
pH~8

Cervical mucous, pH~8

Vm=-30 -40 mV
CatSper low
KSper low
Hv1 low

Bicarbonate ~4-10 mM
pH 7,2-8
High Zn
Glucose
Fructose...
Quiescent
Not capable of fertilization

Sperm

Vagina, pH~5