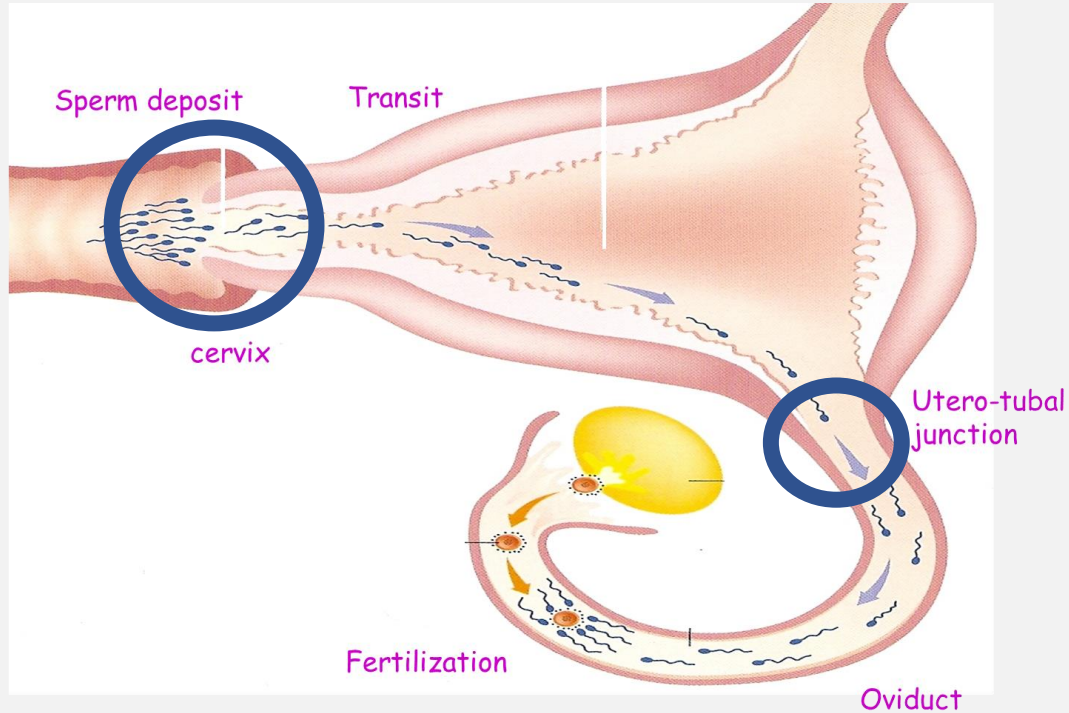




## **Exploration fonctionnelle du transit des spermatozoïdes dans le tractus génital femelle**

Xavier Druart , INRAE PRC PIXANIM

# Le transit des spermatozoïdes chez les mammifères



## Sélection des spermatozoïdes

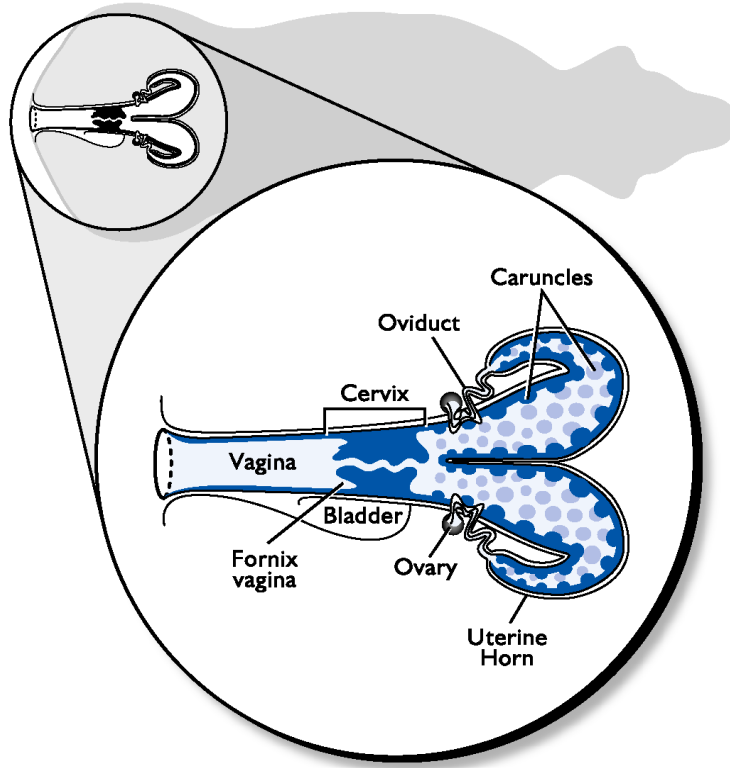
### Cervix :

- Mobilité
- Morphologie

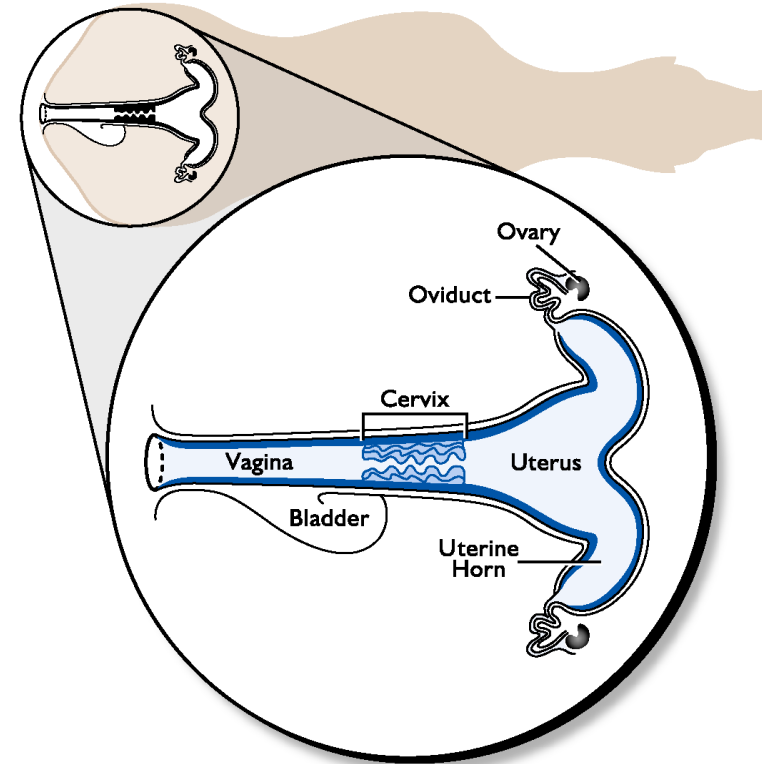
### Jonction Utéro-tubaire

- Mobilité
- Protéines de surface (ADAM) (souris)

Réussite de la fécondation dépend du transit adéquat des spermatozoïdes pour la rencontre spermatozoïdes / ovocyte

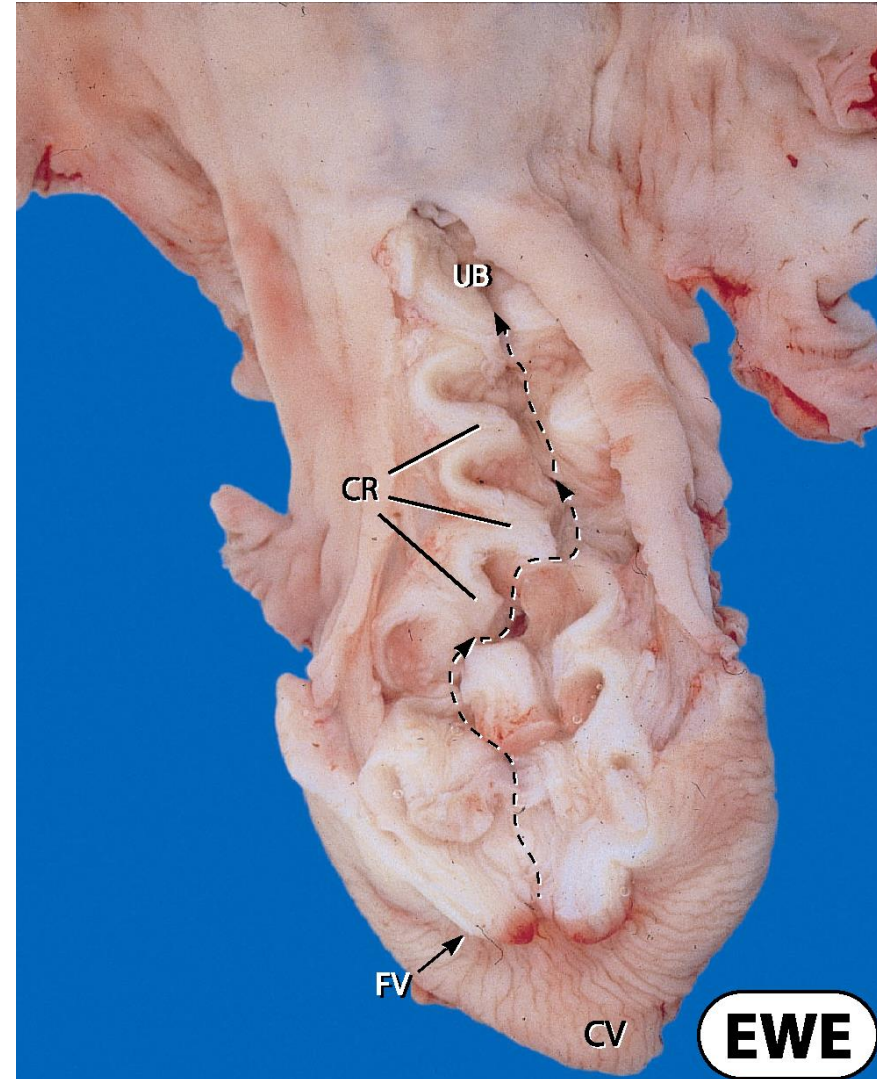
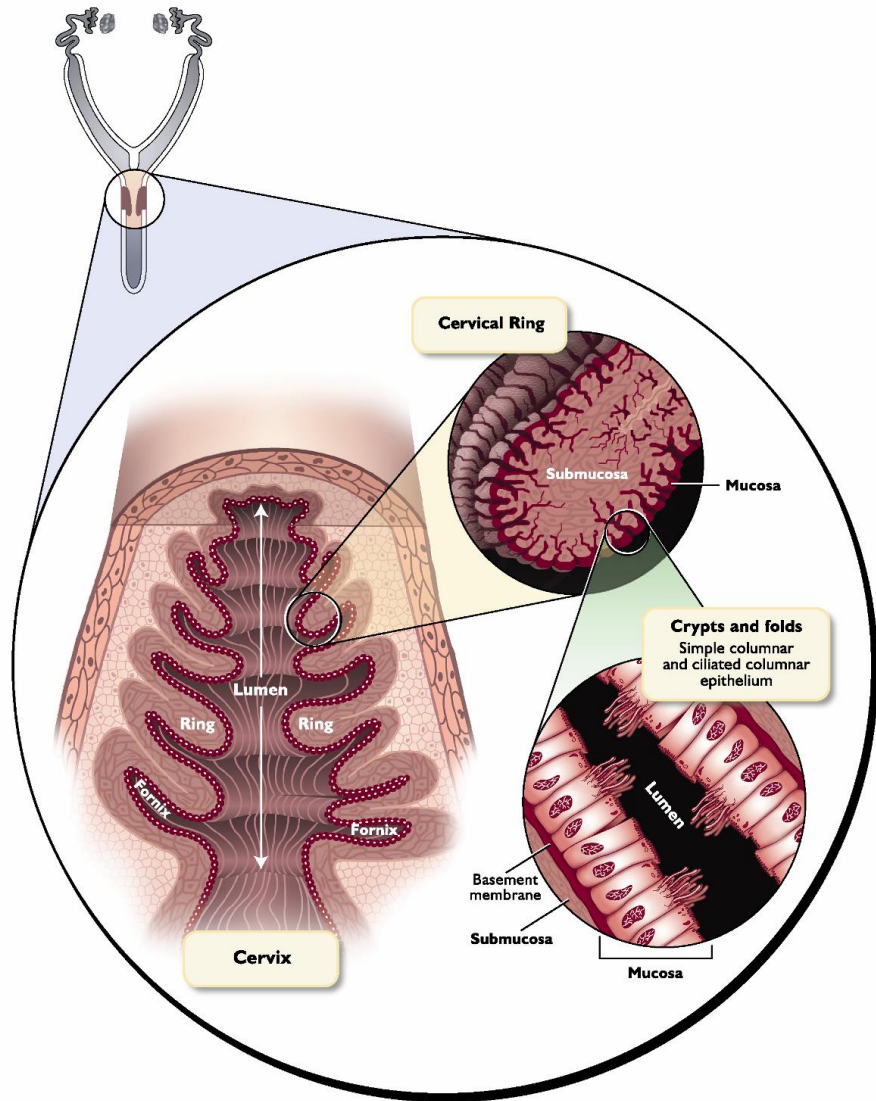


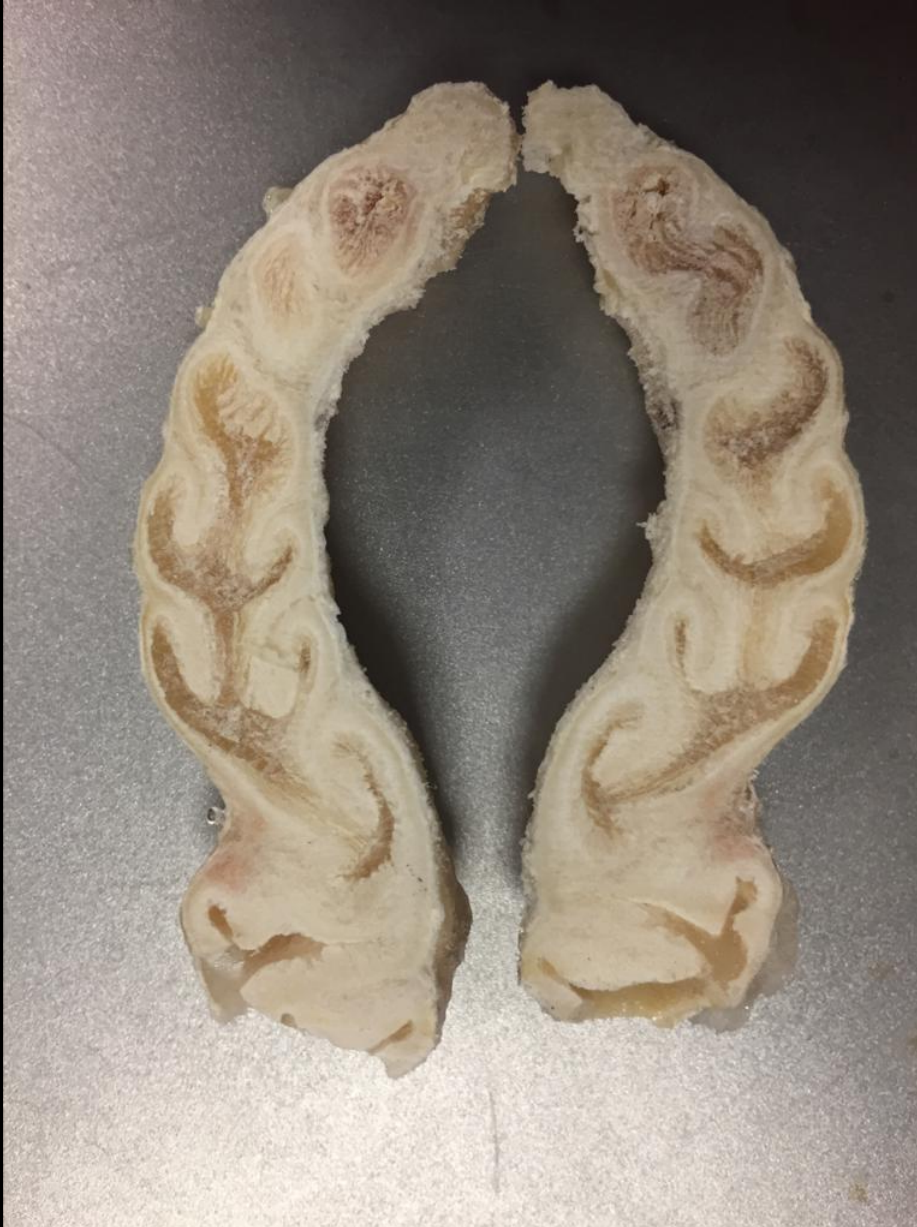
- Dépôt de la semence dans **le vagin**
- Sélection des spermatozoïdes par **le col de l'utérus**
- Rôle potentiel du plasma séminal dans le transit à travers le col



- Dépôt de la semence dans **l'utérus**
- Sélection des spermatozoïdes par **la jonction utéro-tubaire**
- Inflammation de l'endomètre induite par le plasma séminal

# Morphologie du col de l'utérus chez la brebis

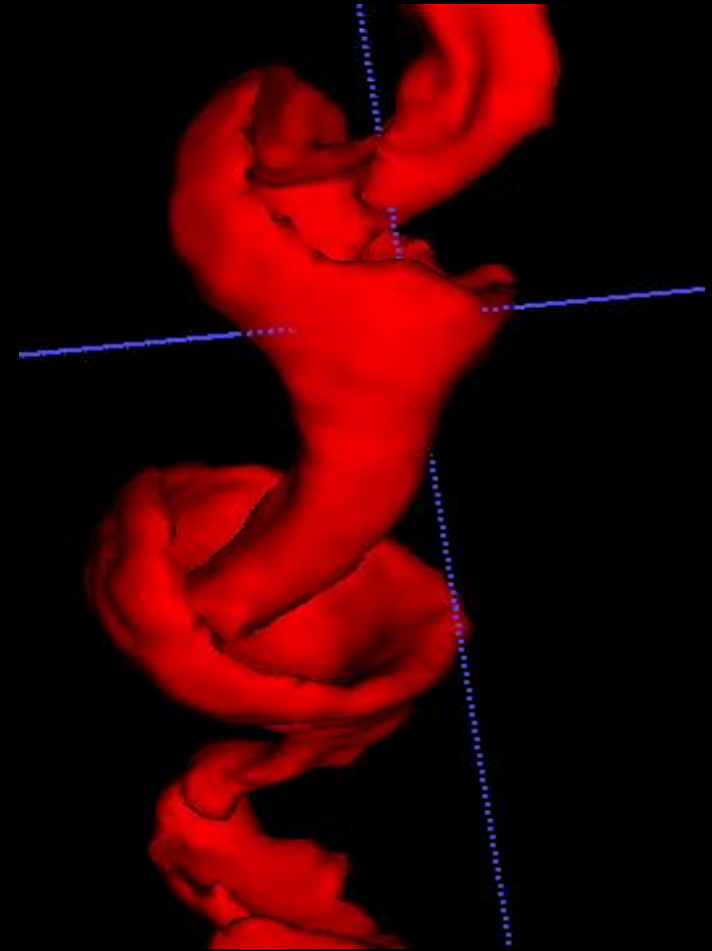
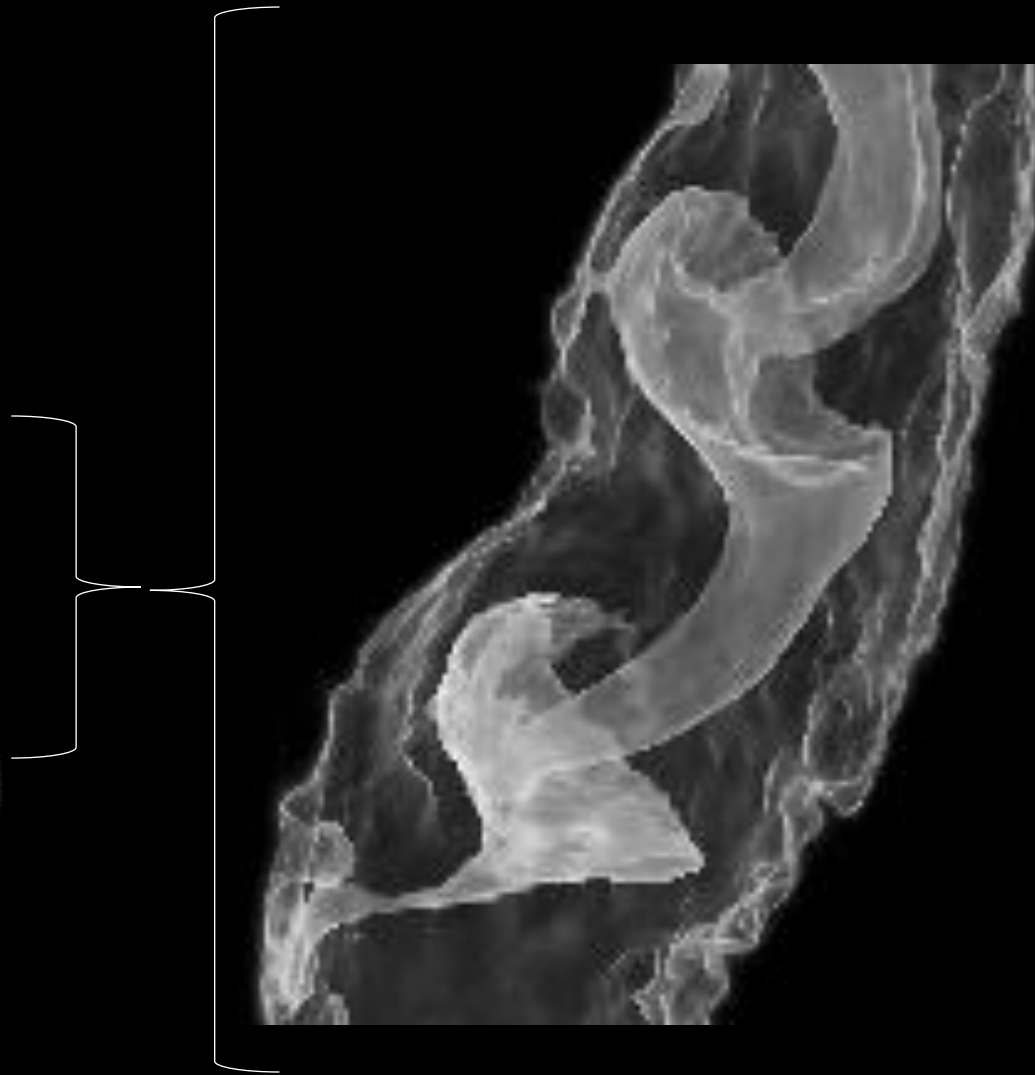


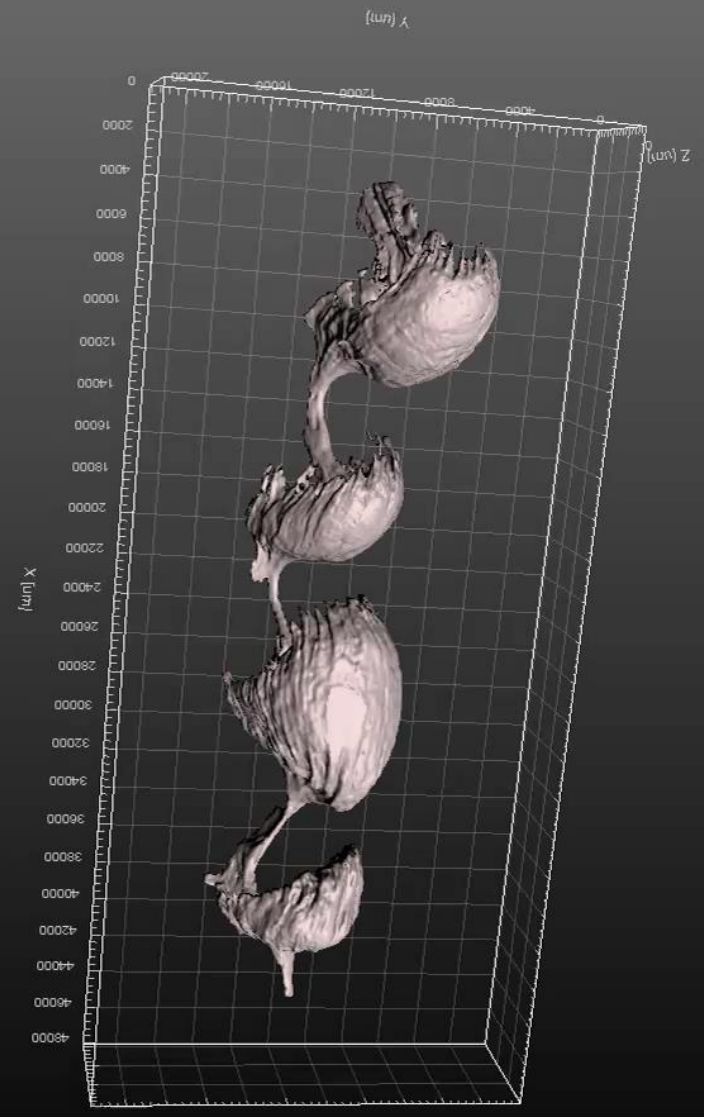
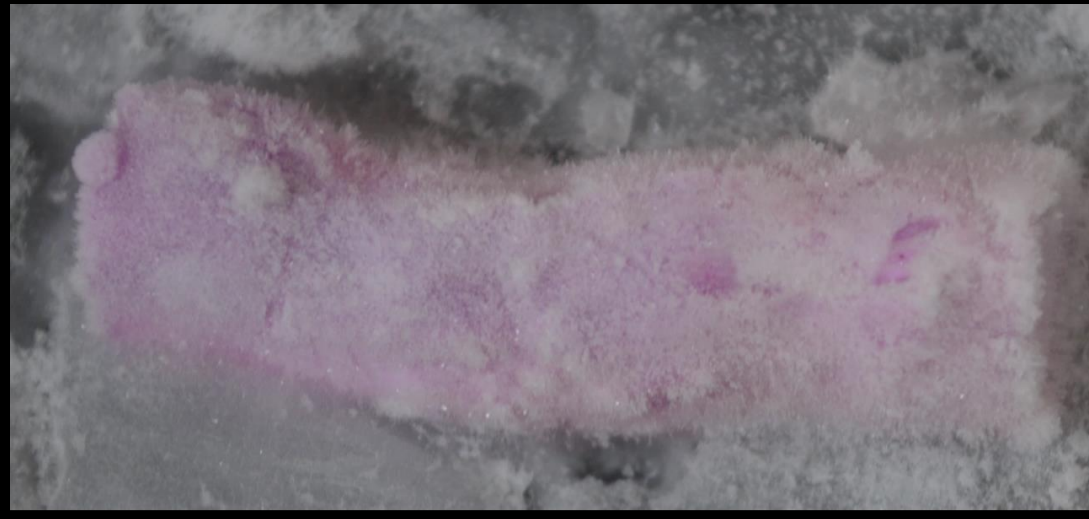
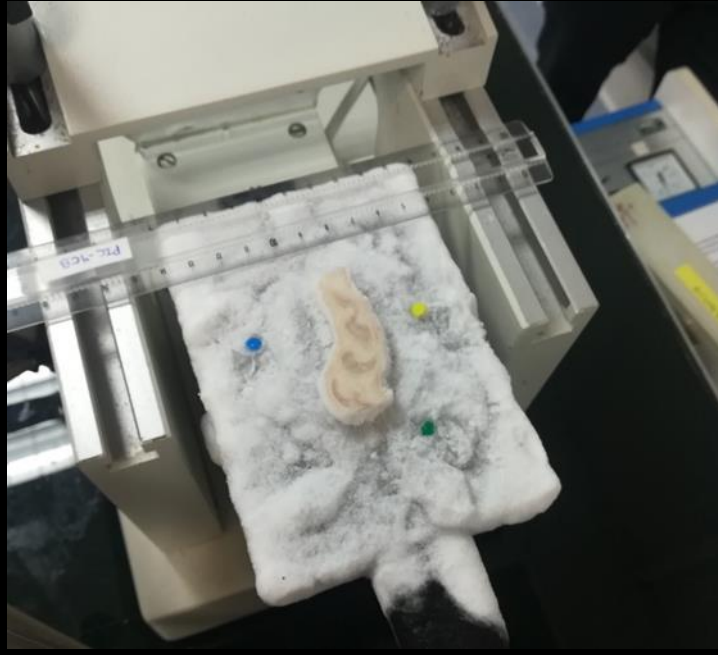


## Morphologie du col de l'utérus chez la brebis

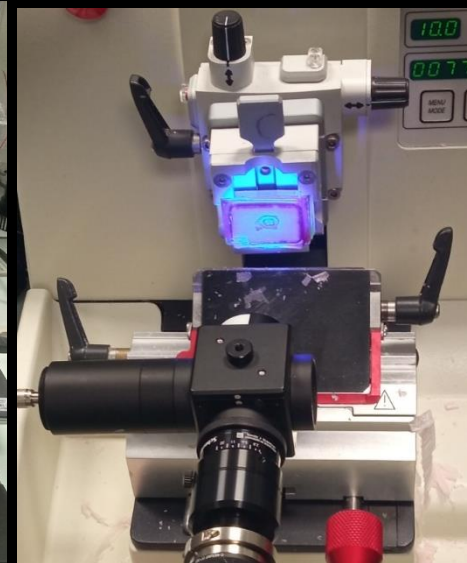
Karine Reynaud

# Imagerie IRM du cervix de brebis

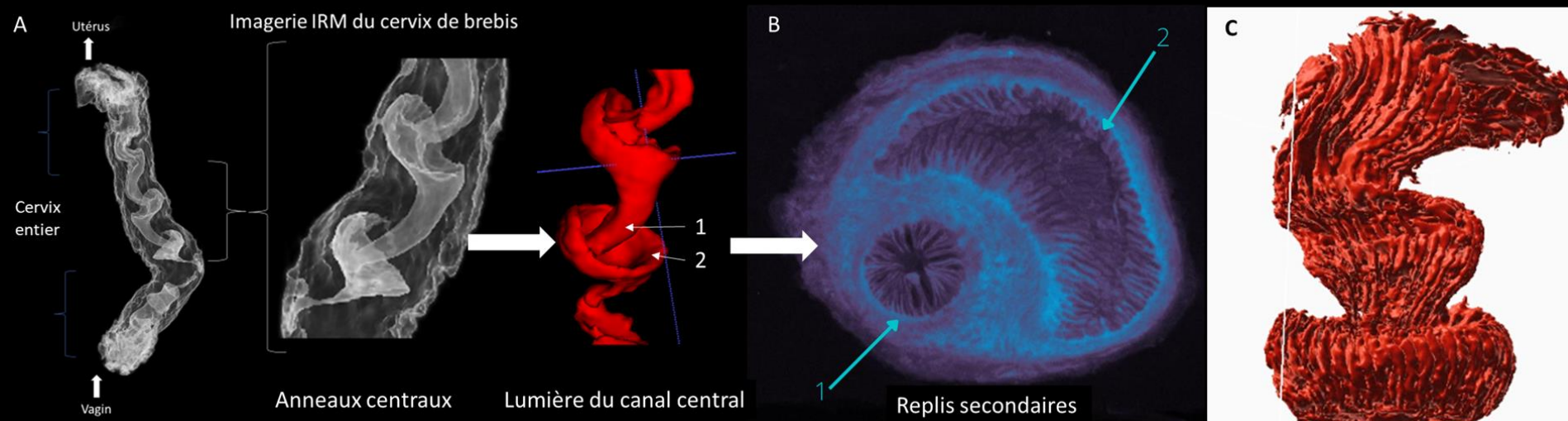




# Kratoscope pour reconstruction 3D de type Blockface

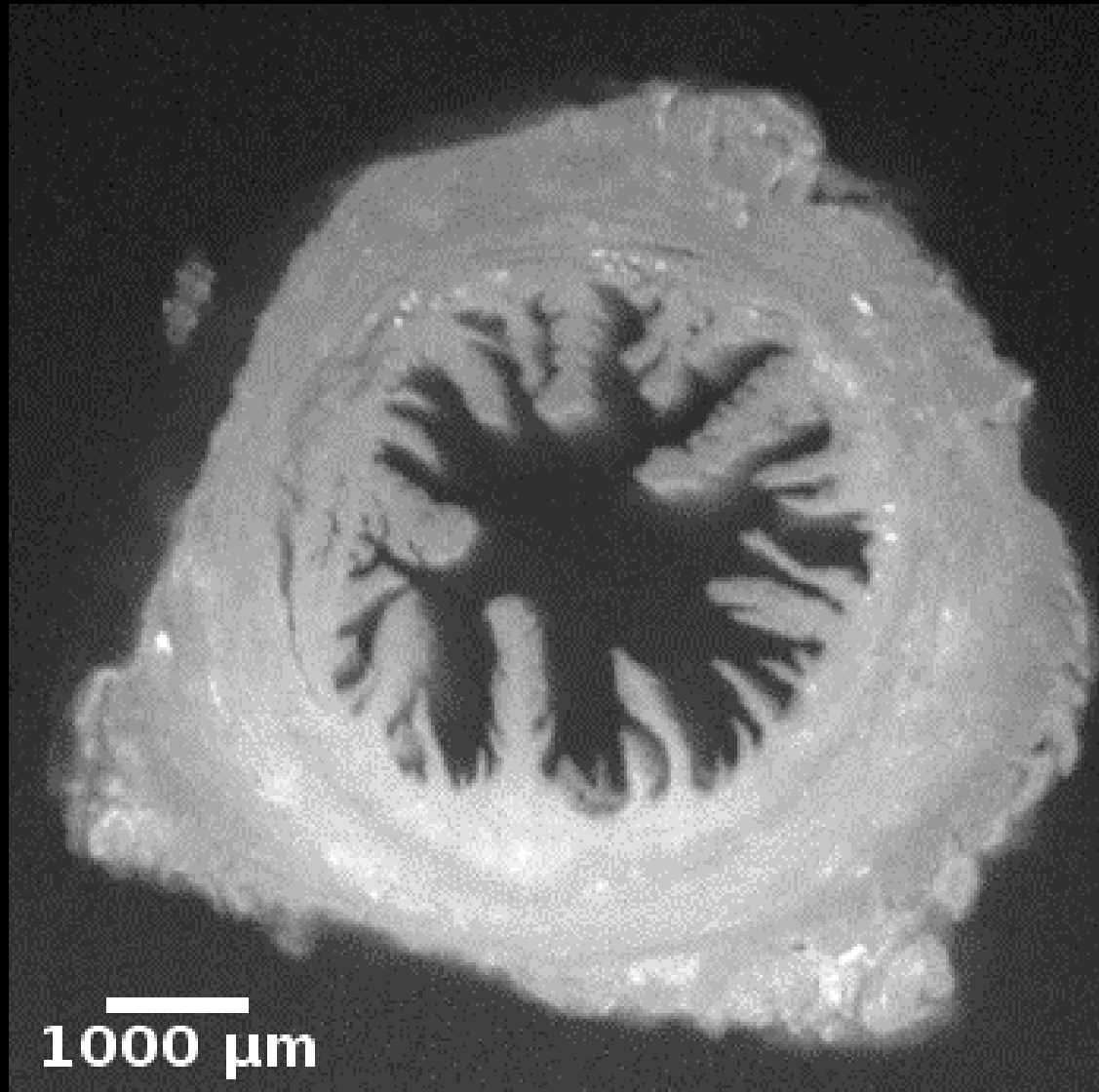


Kaer Labs  
Nantes





# Imagerie de cervix par Kratoscope



Col d'utérus de brebis  
coupes de 10 microns

# KRATOS-COPE



## KRATOS ANATOMY OF A CHARACTER

The life of Kratos is filled with tragedy and triumph, and he has the scars and spoils to prove it. As players take control of the Ghost of Sparta in God of War III, they will notice that he bears the marks of his past, including the legendary artifacts and wounds that he has collected along the way.

### GOLDEN FLEECE

Retrieved in the Bog of the Forgotten during the events of God of War II, this legendary piece of armor is nearly impenetrable, granting Kratos the ability to reflect projectiles and parry attacks.

### ASH

After slaughtering his own family, the ashes of his deceased loved ones were permanently fused to Kratos' skin – a constant reminder of his terrible mistake. Their pallid hue is the source of Kratos' other moniker, the Ghost of Sparta.

### SCAR

This long, jagged scar was created when Zeus impaled Kratos with the Blade of Olympus at the beginning of God of War II. The wound reminds Kratos of the treachery of Zeus – who also happens to be his father.

### CHAINS

Thick chains permanently attached to his forearms allow Kratos to swing his blades at distant enemies, making him a threat at any range. The chains also grant him added mobility, since he uses them to swing across gaps.

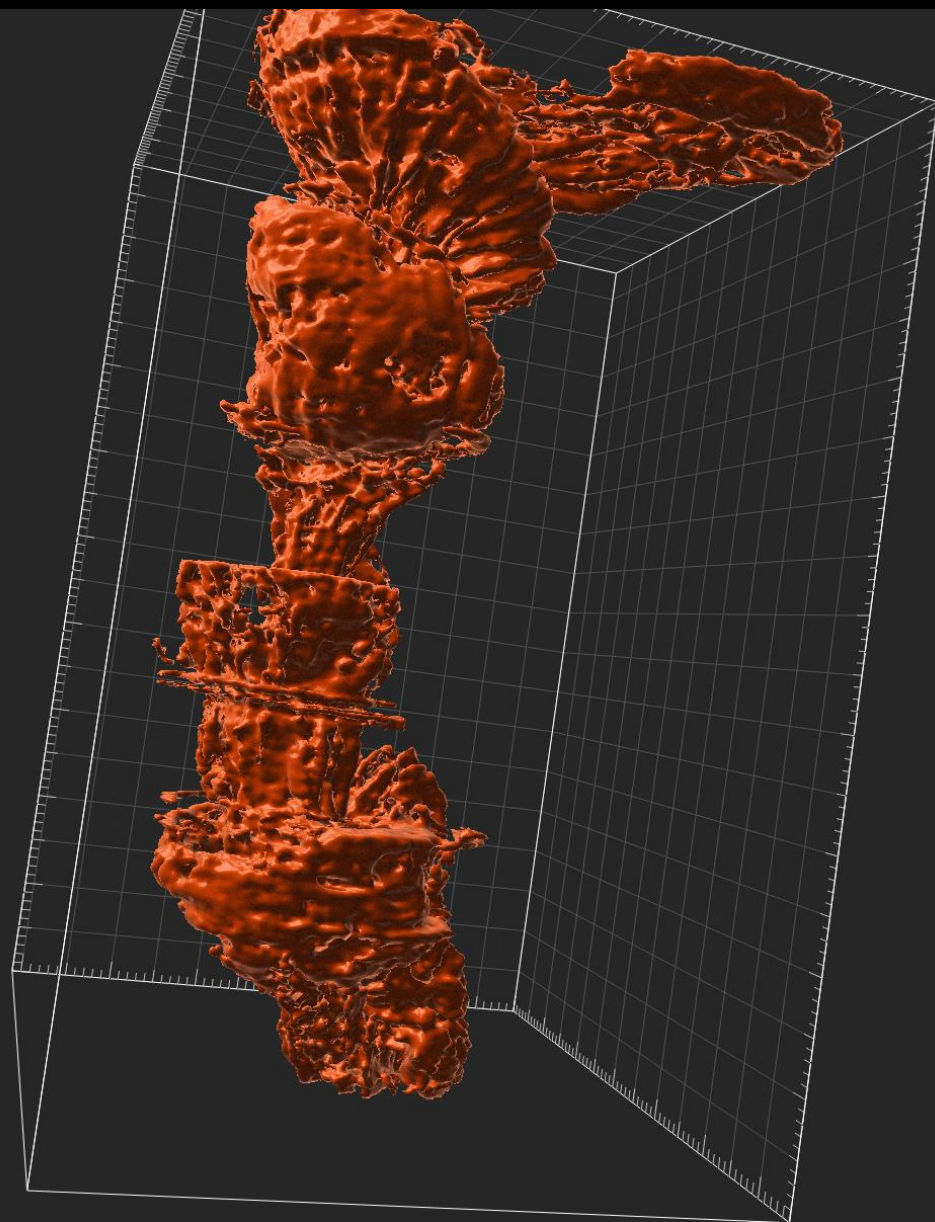
### BLADES

As Kratos' signature weapon, these chain blades cut a fiery swath through his foes. In the original game, they were called the Blades of Chaos. In God of War II, they were upgraded to the Blades of Athena. The trend continues in God of War III, with Kratos receiving yet another improvement to his favored implements of destruction.

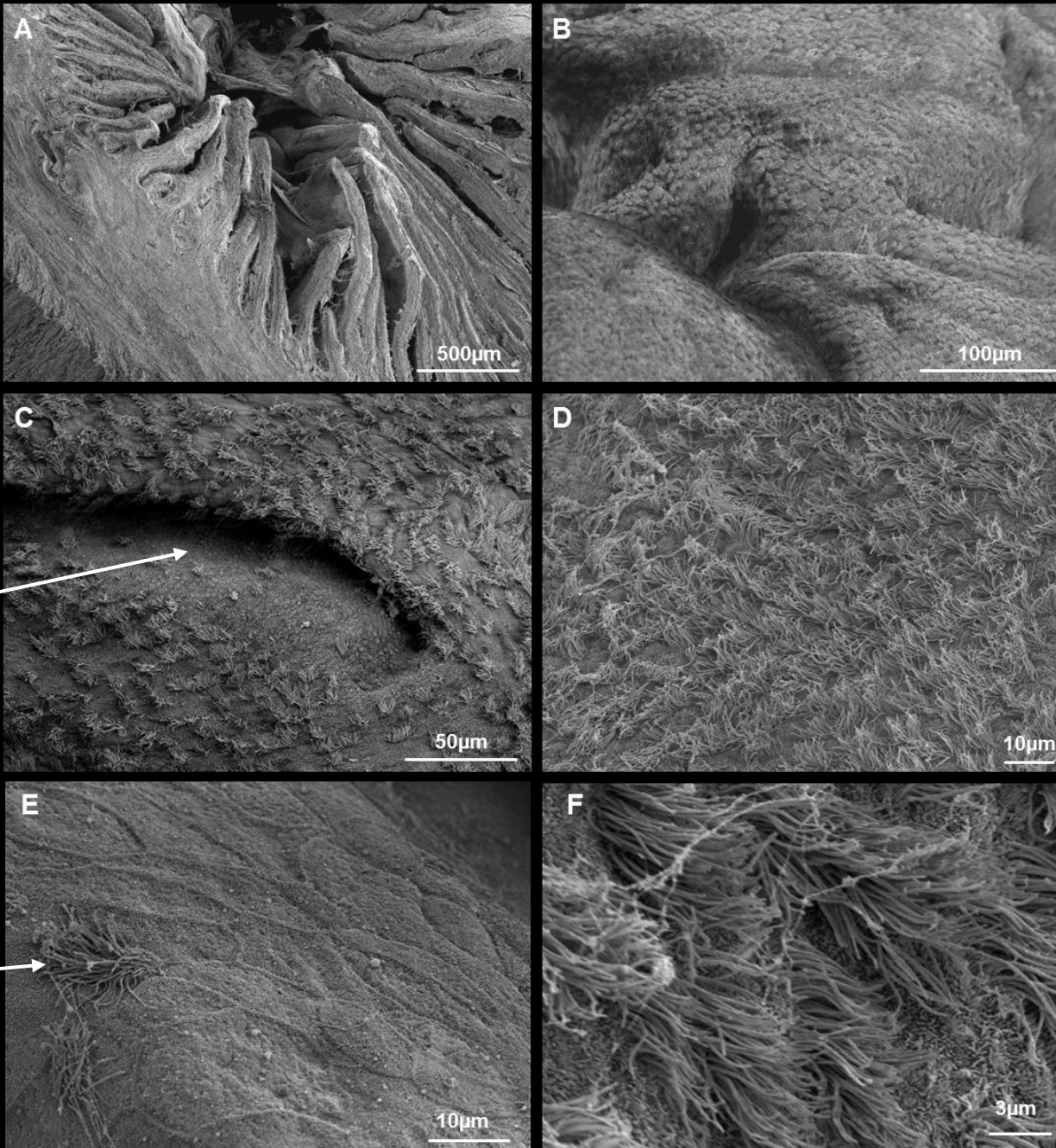
### SANDALS

These epic pieces of footwear protect Kratos' mighty arches from the perils of small, sharp rocks and brambles.

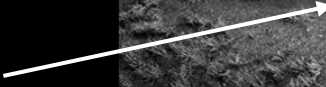




50  $\mu\text{m}$



crypts



Ciliated epithelial cells



## Scanning electron microscopy of the sheep cervix

REPRODUCTION  
REVIEW

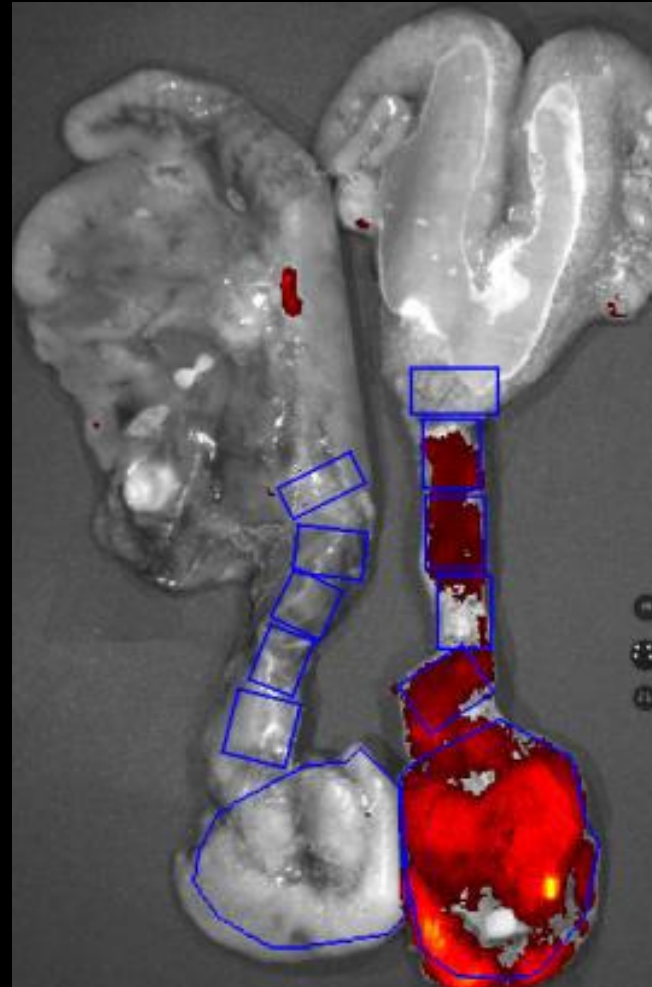
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The biological mechanisms regulating sperm selection by the ovine cervix

S Fair<sup>1</sup>, K G Meade<sup>2</sup>, K Reynaud<sup>3</sup>, X Druart<sup>3</sup> and S P de Graaf<sup>4</sup>

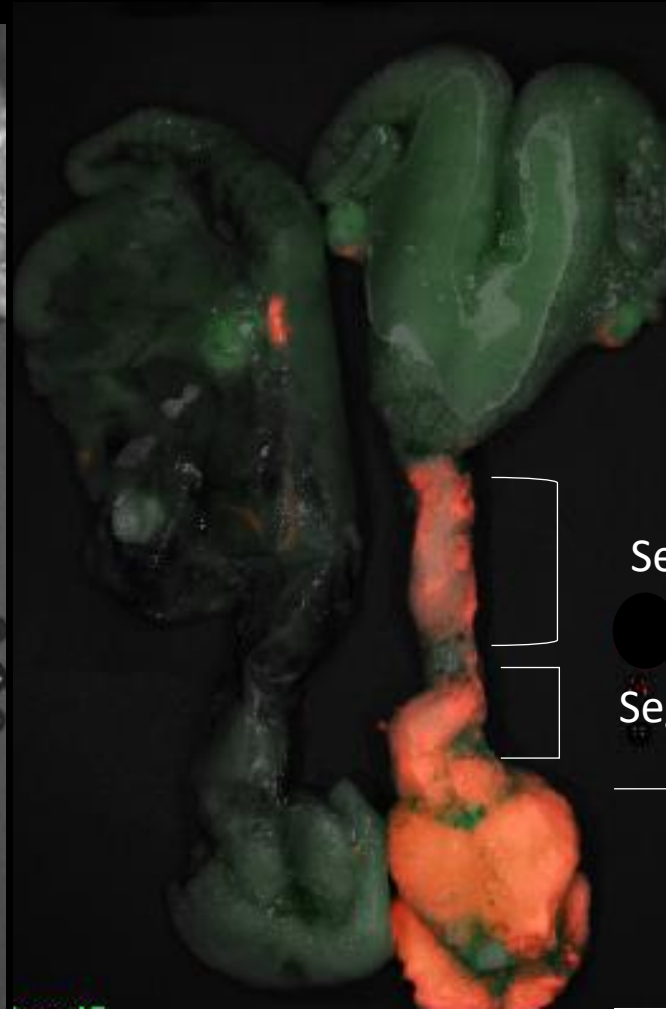
Karine Reynaud, ICF

# Sélection des spermatozoïdes par le cervix chez la brebis



Contrôle

4h après IA



Contrôle

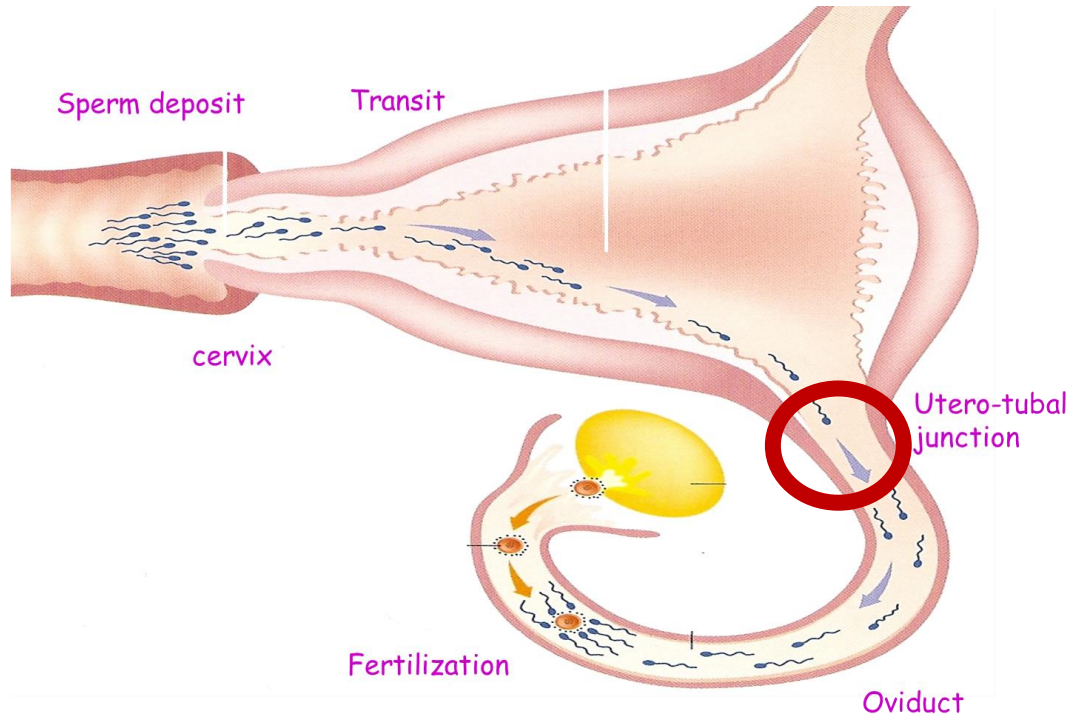
4h après IA

Segments médian + utérin

Segment vaginal

Vagin

# Le transit des spermatozoïdes chez les mammifères



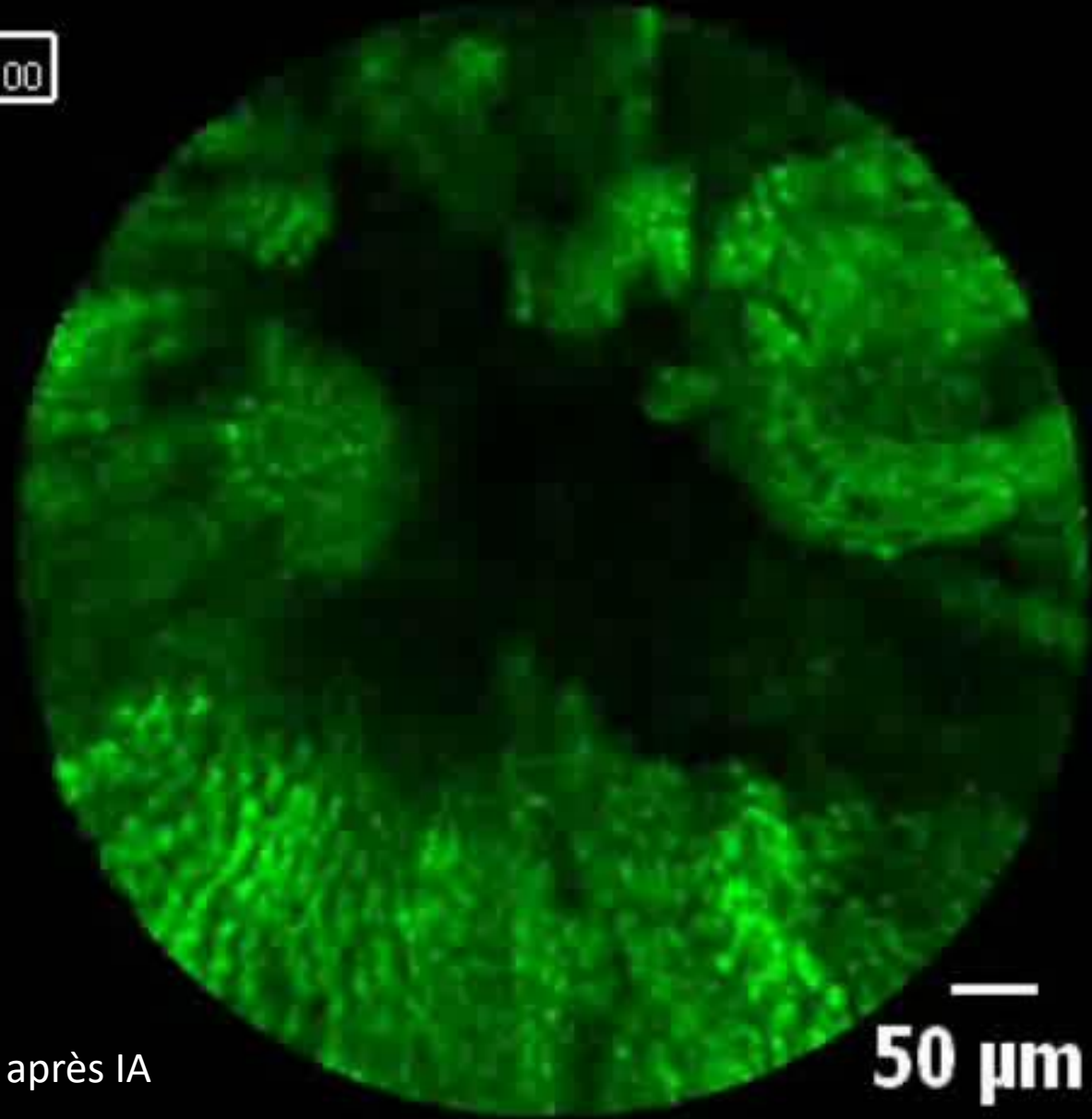
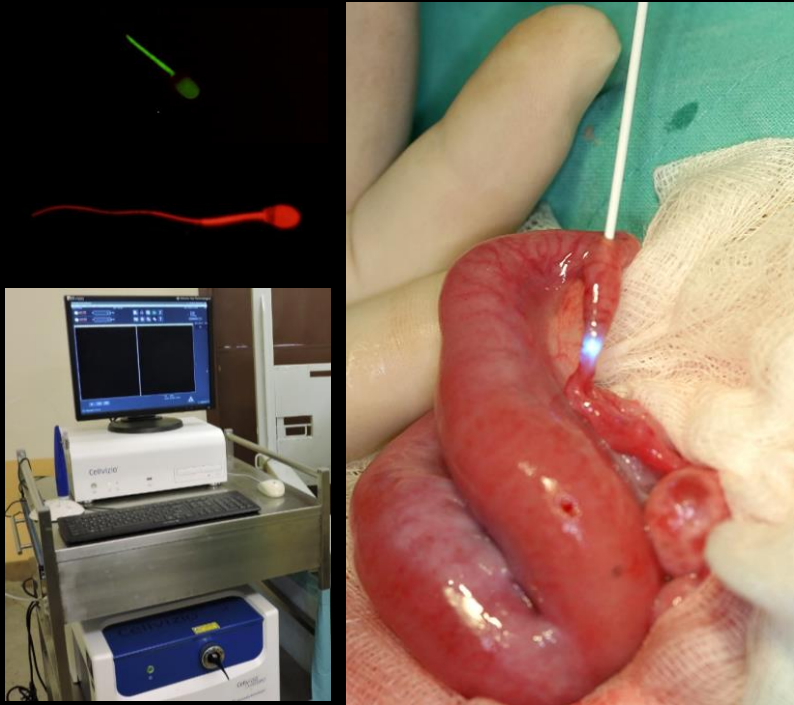
## Sélection des spermatozoïdes

### Jonction Utéro-tubaire

- Mobilité
- Protéines de surface (ADAM) (souris)

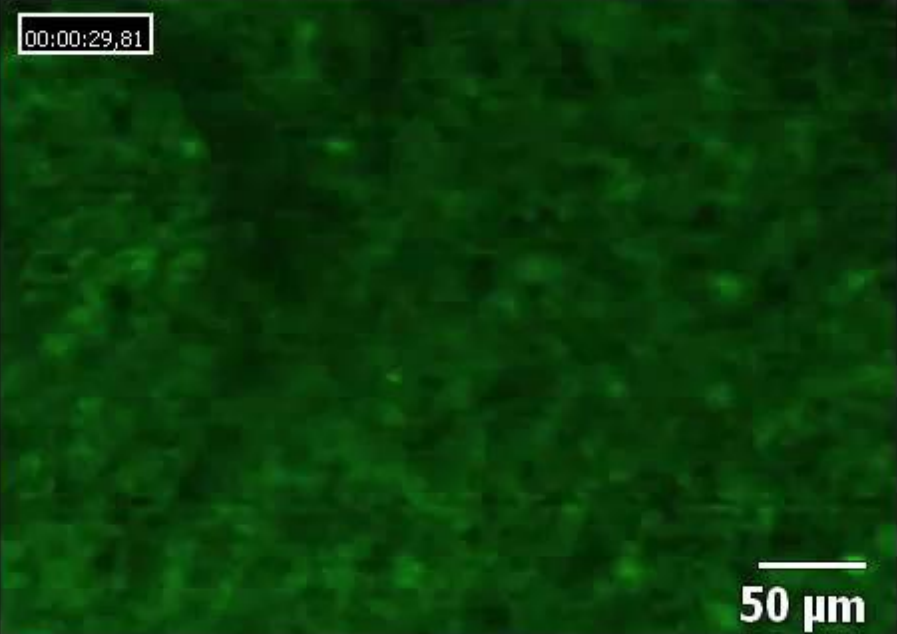
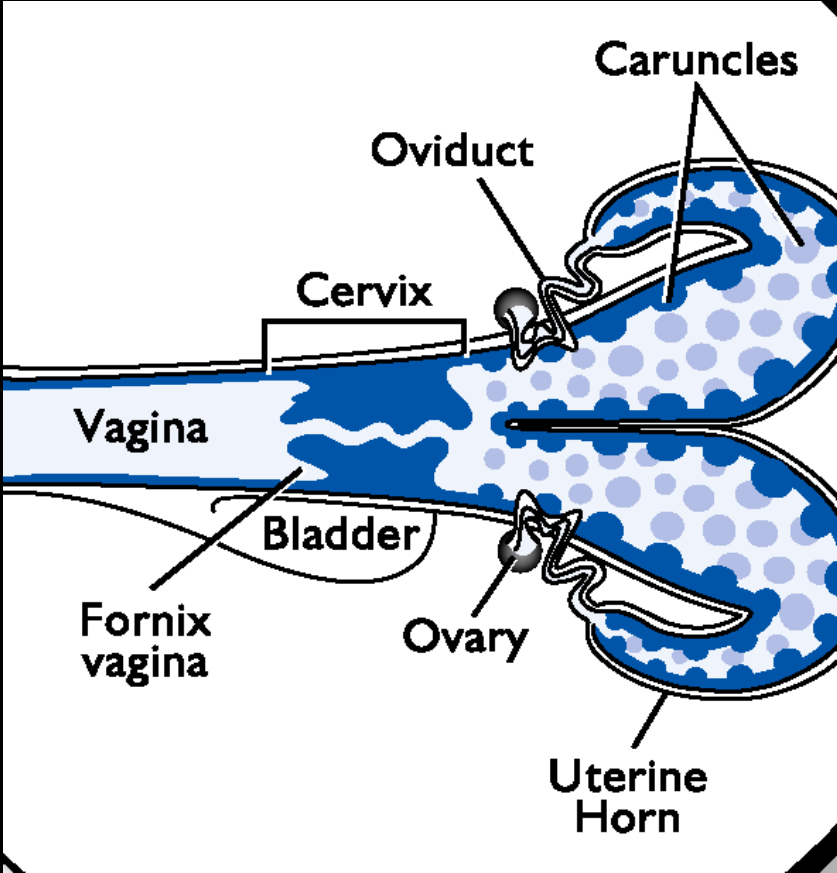
Visualisation des spermatozoïdes  
dans la jonction utéro-tubaire  
chez la brebis *in vivo*

00:00:00,00



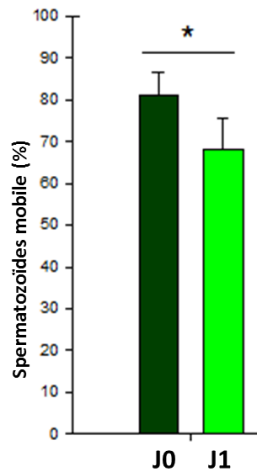
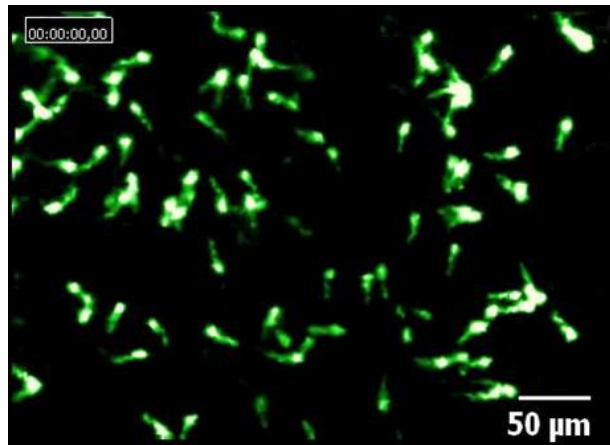
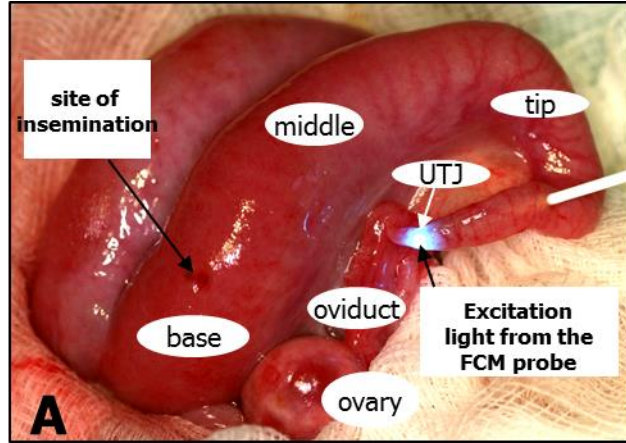
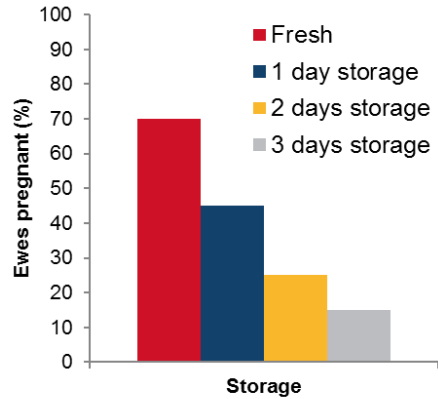
- Marquage fluorescent des spermatozoïdes
- Insémination intra utérine
- Anesthésie générale et imagerie par endoscopie 4h après IA

# Visualisation des spermatozoïdes dans l'utérus chez la brebis *in vivo*



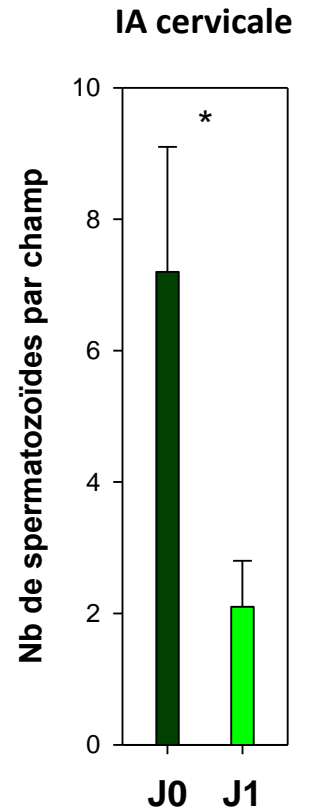
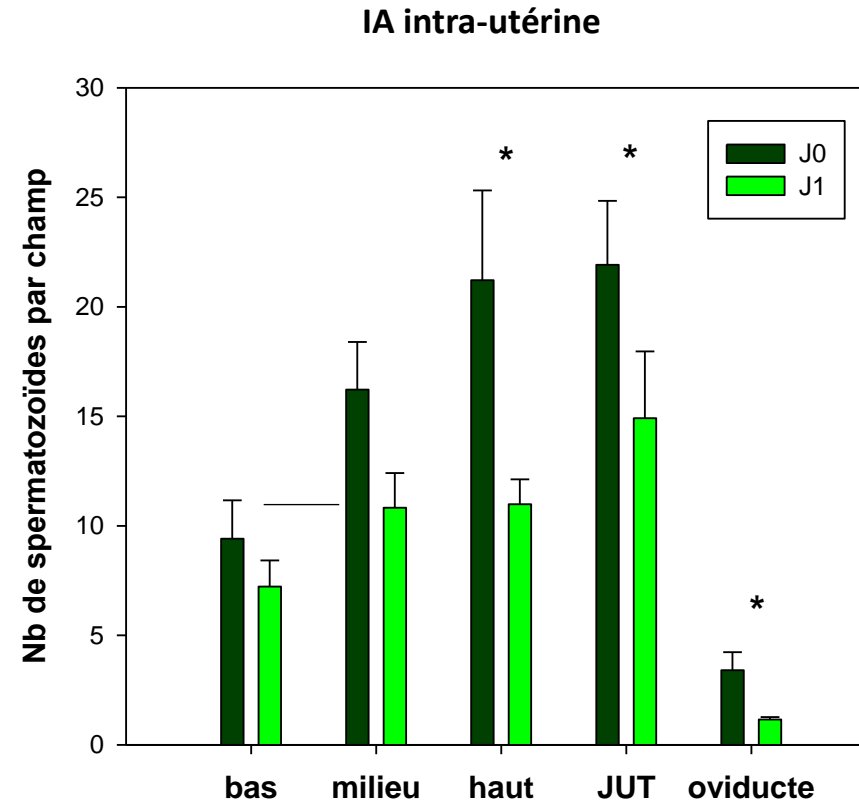


# Conservation de la semence de bélier et transit dans l'utérus

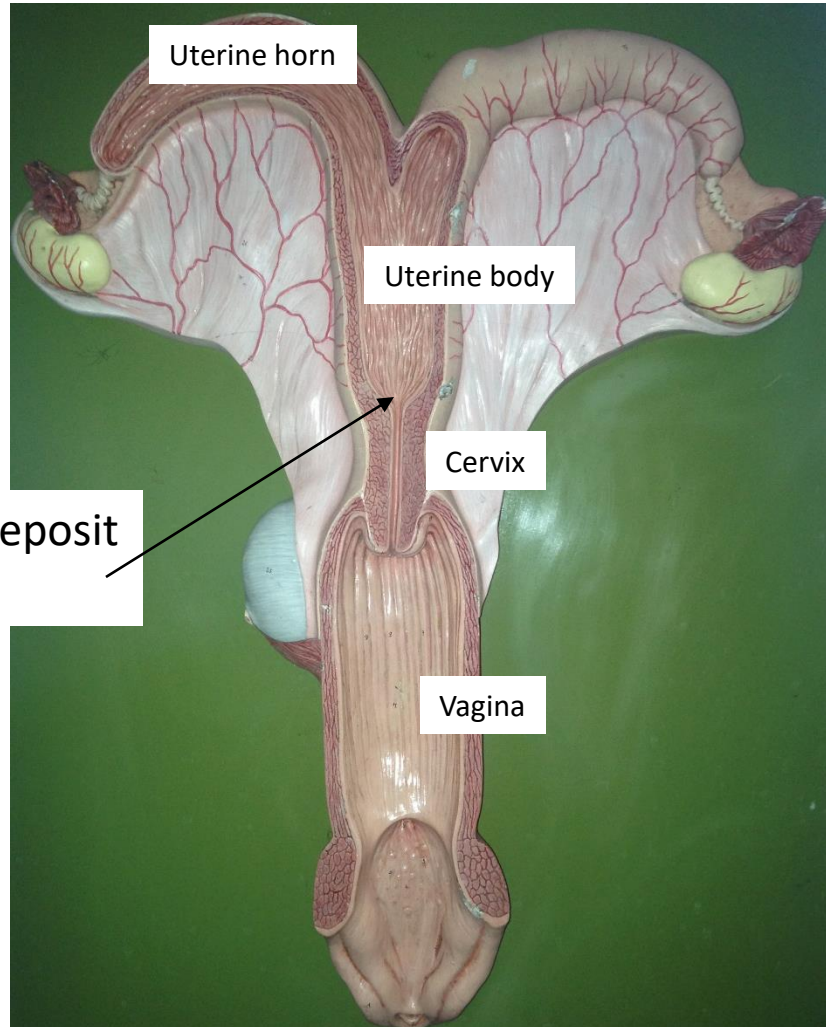


*In vitro*

*In vivo*



# Le transit des spermatozoïdes chez la jument

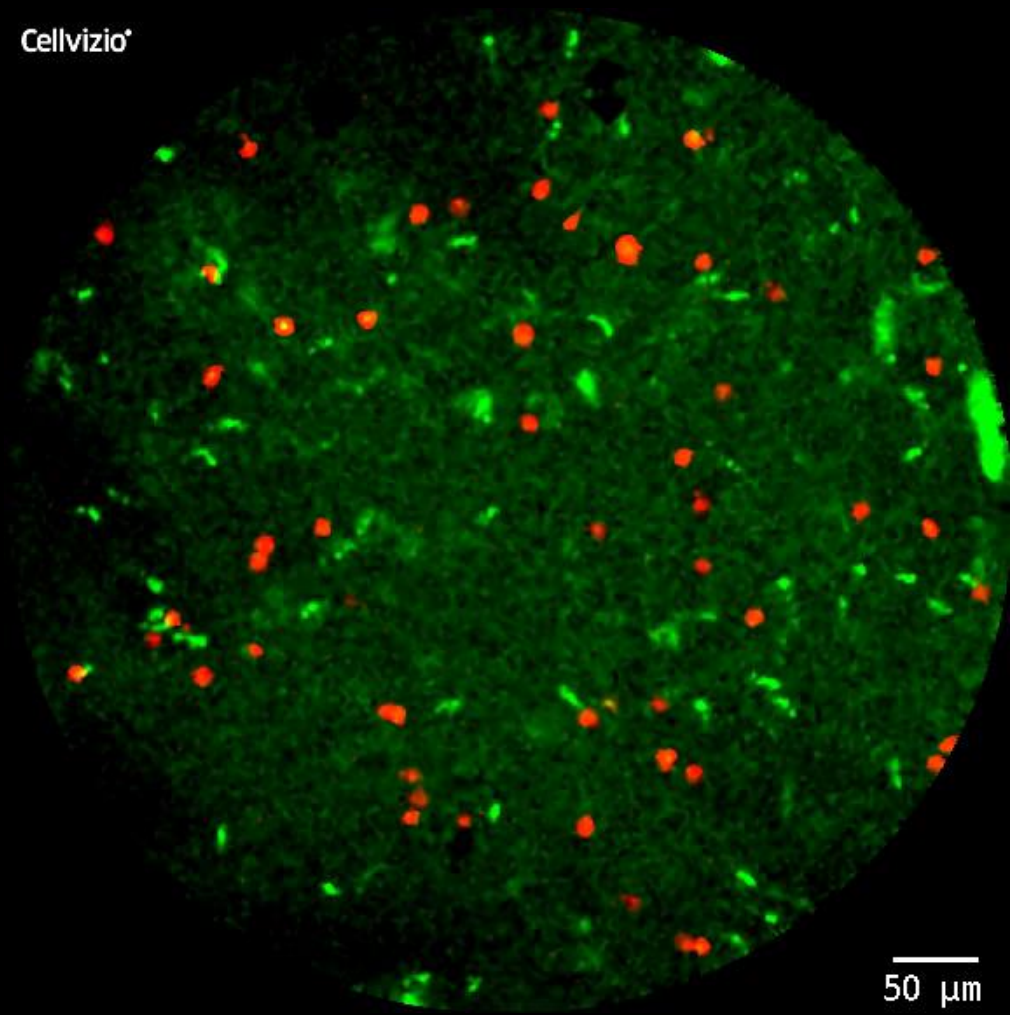


- Deposit of horse semen during mating takes place in the cervical side of the uterus.
- Sperm found in the oviduct 2h after AI (Bader, 1982)
- Most spermatozoa are eliminated from uterus 4h after AI (Katila, 1995).
- The process of elimination starts 1h after AI (Katila, 2000)
- Transit is expected to be the result from sperm mobility and uterine contractions.

# Imagerie in vivo des spermatozoïdes chez la jument

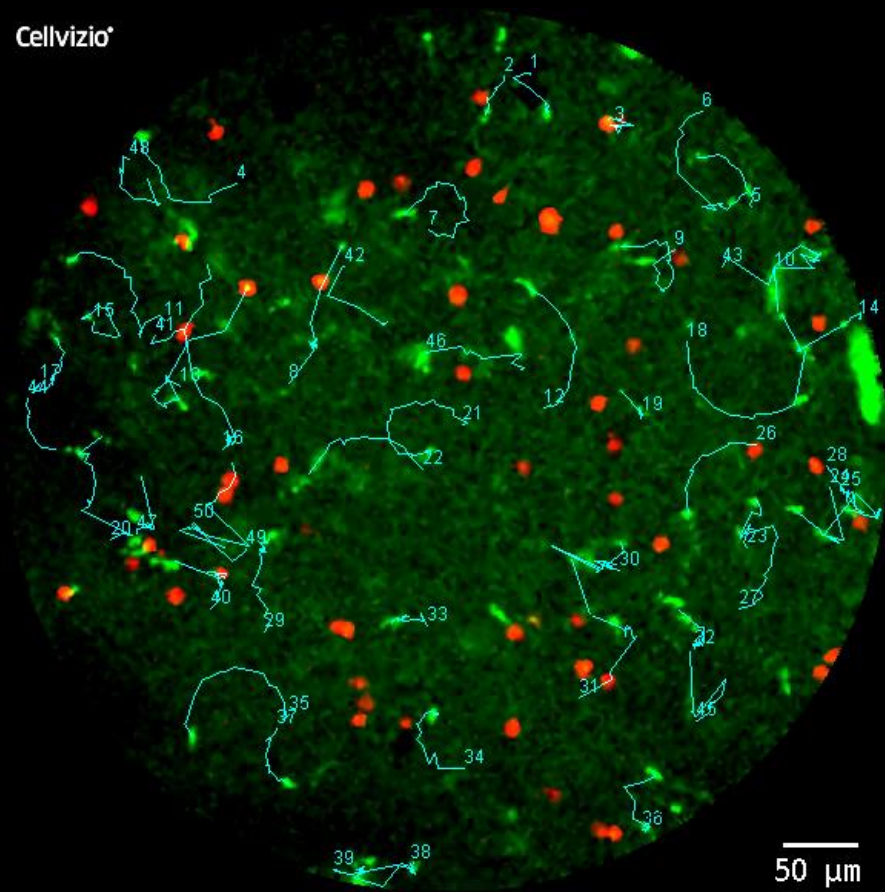


Cellvizio®

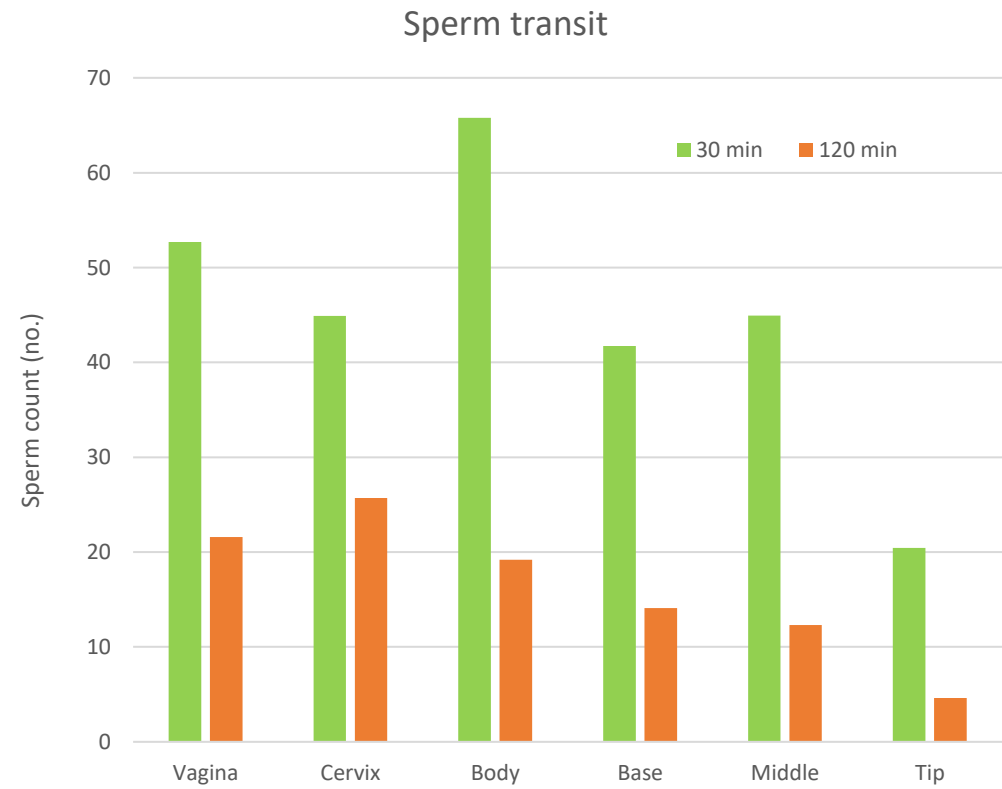
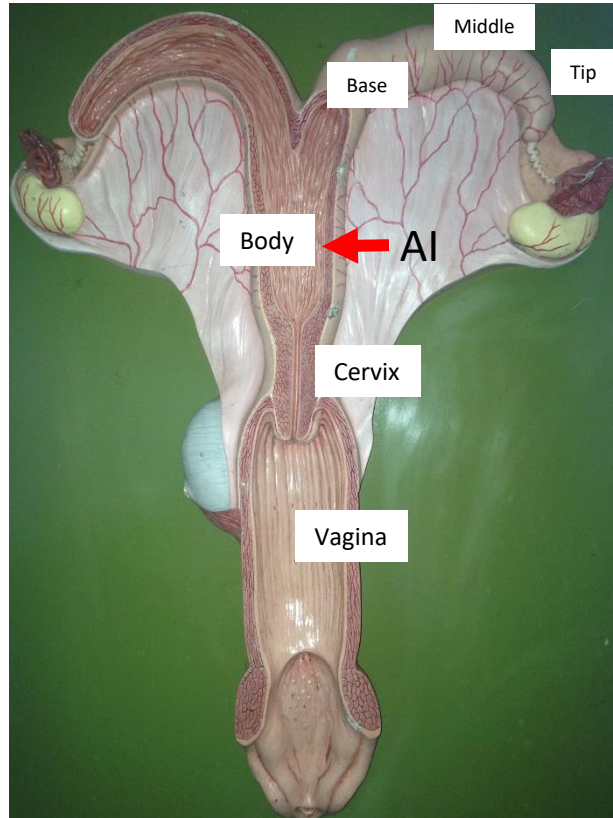


50 μm

Cellvizio®



50 μm



Site de dépôt  
de la semence



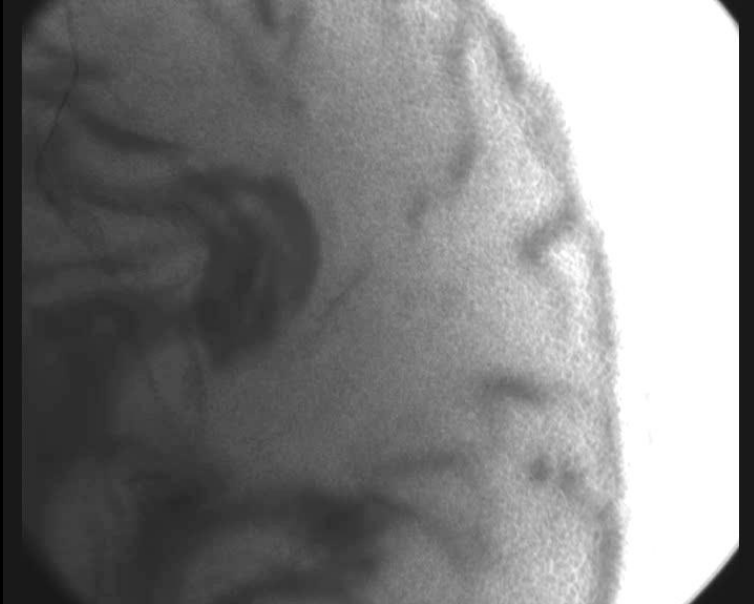
## Motilité massale

- sperme pur
- lame tiédie
  - dépôt d'une goutte
- observation des vagues
  - très rapidement
- échelle de 0 à 5
  - 0 immobilité totale
  - 1 mouvements individualisés
  - 2 mouvements très lents
  - 3 motilité massale générale de faible amplitude
  - 4 motilité massale rapide sans tourbillon
  - 5 motilité massale rapide avec tourbillons

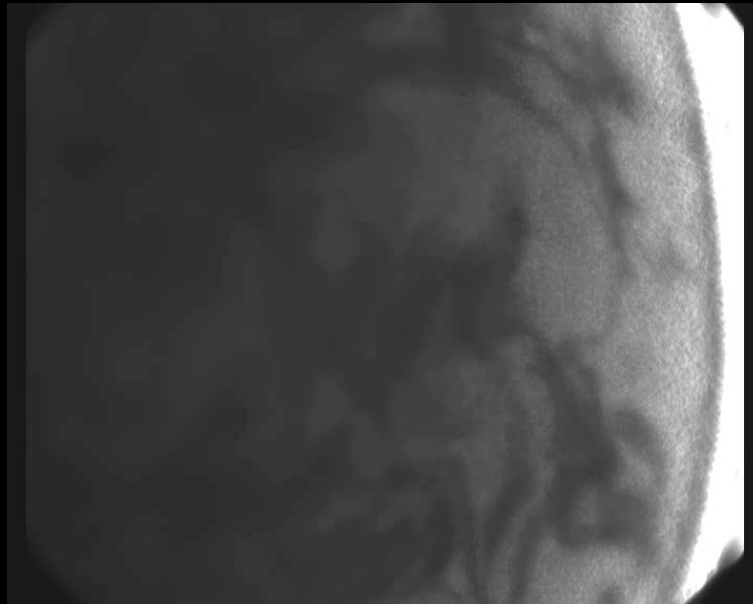


# Mobilité massale chez les ovins

MM = 3



MM = 4



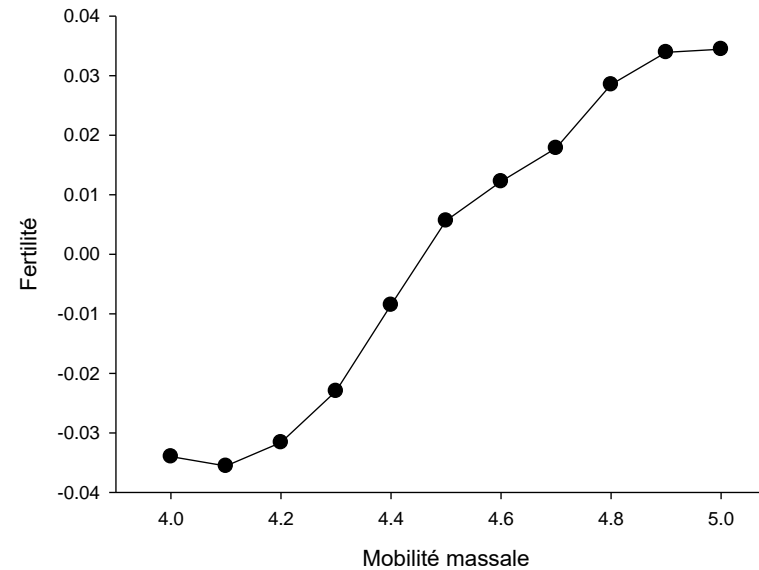
MM = 5



# Mobilité massale et fertilité chez les ovins

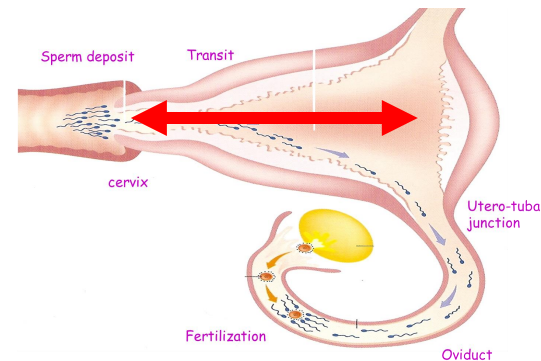
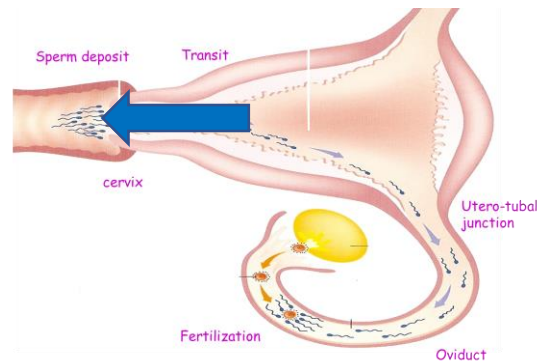
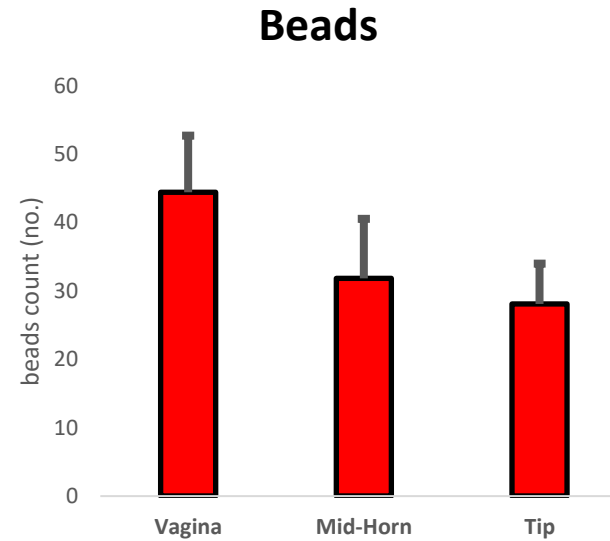
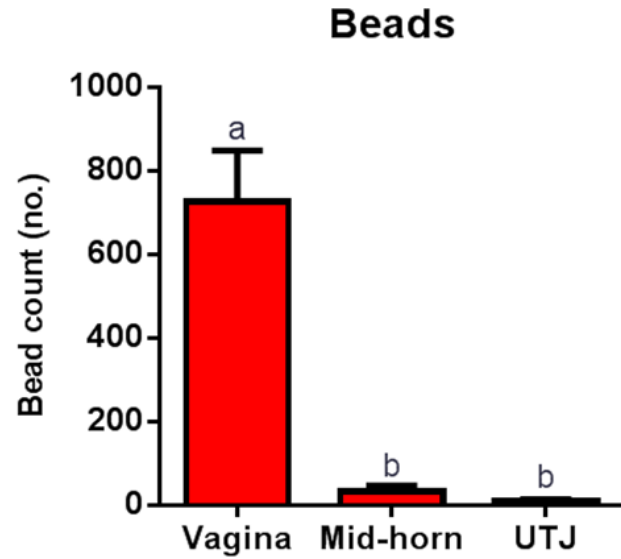
- Grille de notation subjective beaucoup plus fine dans les CIA entre 4 et 5
- Traduit la vitesse de rotation des tourbillons

Mobilité massale de la semence  
et fertilité chez les ovins

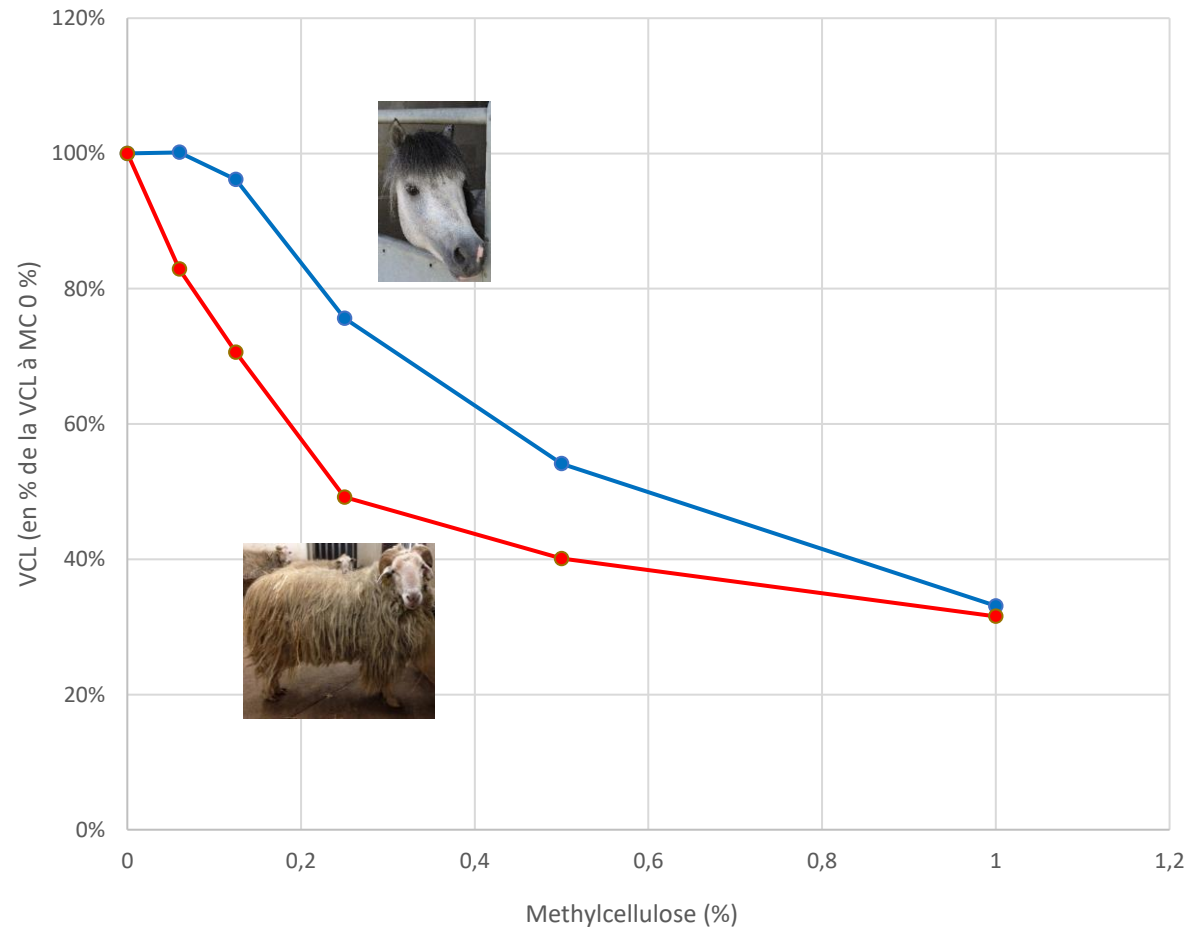


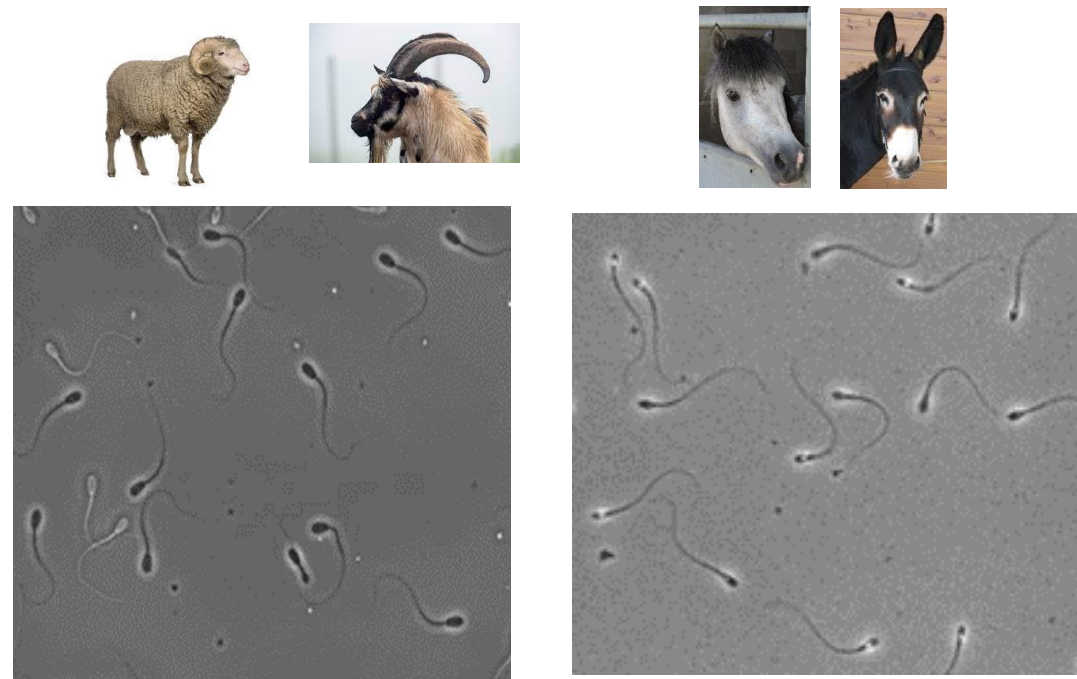
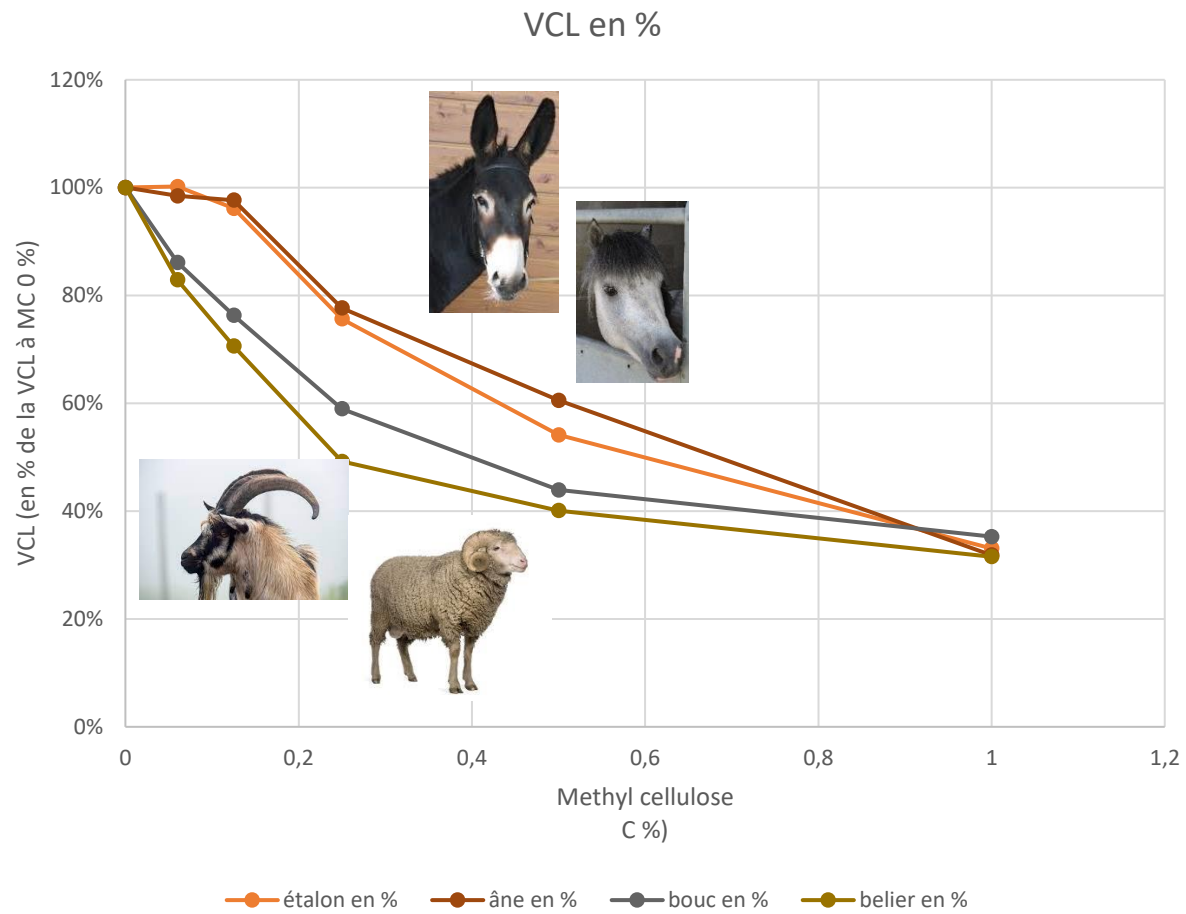


# La mobilité des spermatozoïdes est elle utile ?



# Viscosité du milieu et mobilité des spermatozoïdes



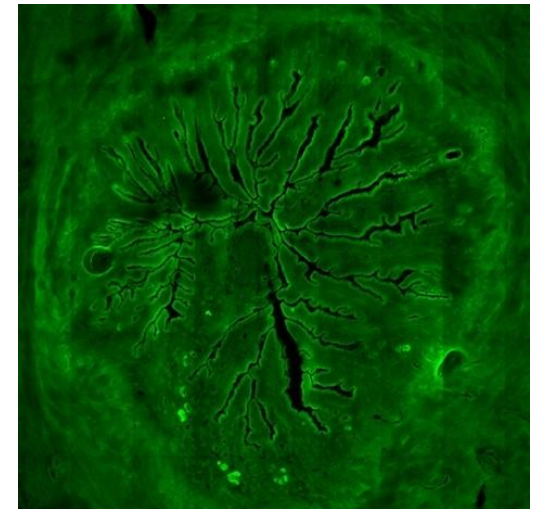
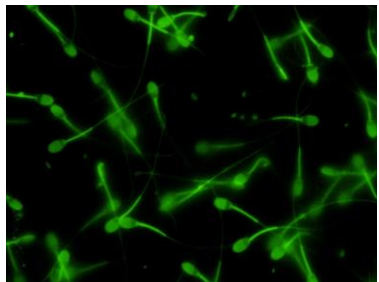


La morphologie de la tête explique t-elle la mobilité en milieu visqueux ?

# Conclusion



- Anatomie du tractus génital femelle et site de dépôt de la semence variables selon les espèces
- Stratégie de sélection des spermatozoïdes féconds variable
- Transit potentiellement expliqué par :
  - les contractions du tractus femelle
  - la mobilité des spermatozoïdes
  - La viscosité du milieu



A large, glowing blue number '3' is positioned on the left side of the image. The number has a soft, ethereal glow and is set against a solid black background.

Merci pour votre attention