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Receptores y canales en espermatozoides: ¿biomarcadores de fertilidad?

Manuel Álvarez Rodríguez

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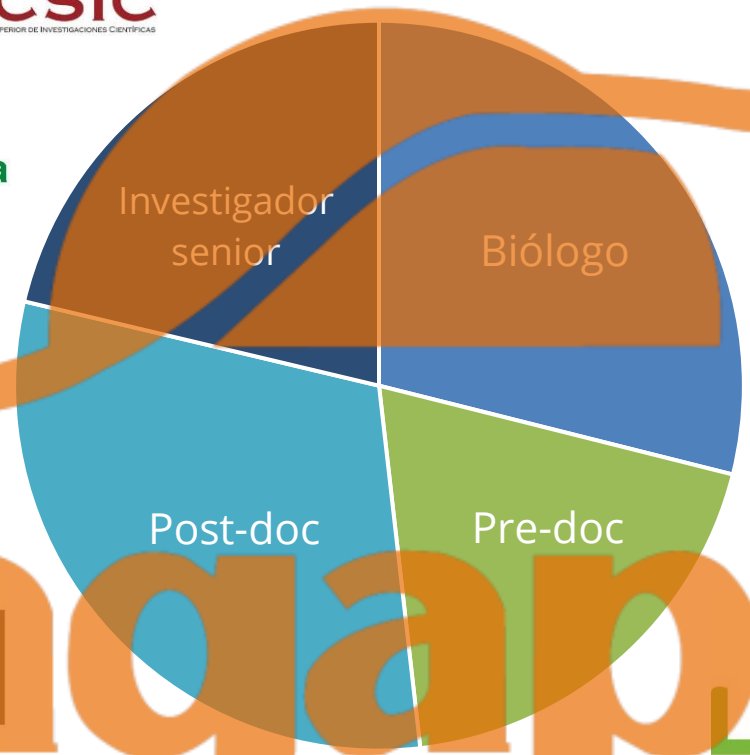

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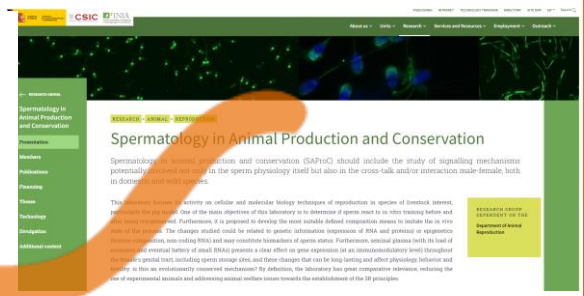

Manuel Álvarez Rodríguez

Eduardo de Mercado de la Peña

Helena Nieto Cristóbal

Adrián Martín San Juan


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01.Fertilidad

02. Receptores y canales

03. Conclusiones

FERTILIDAD


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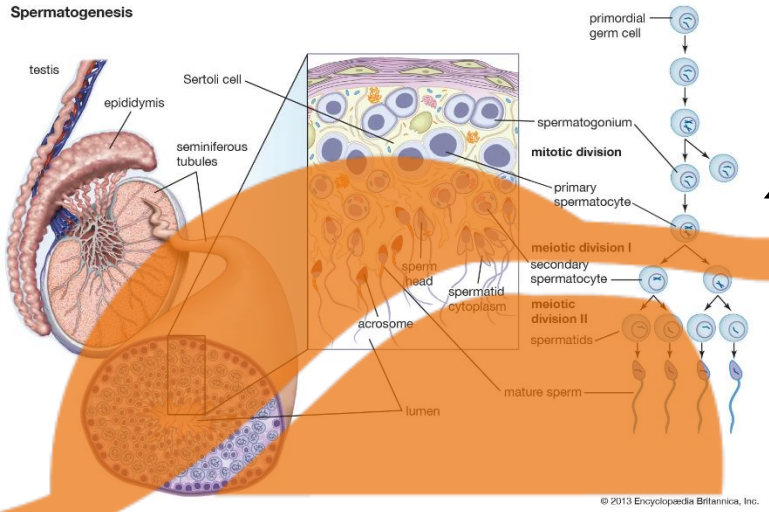
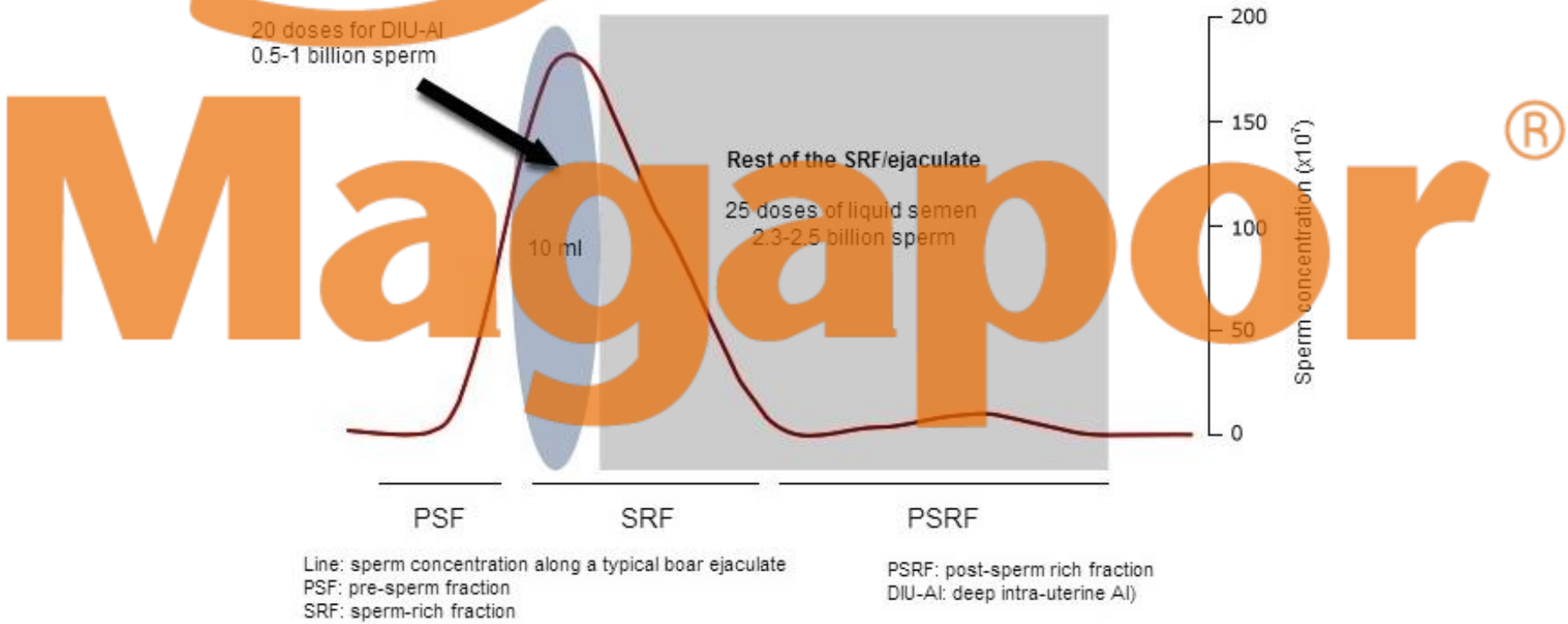
Maduración

Espermatogénesis



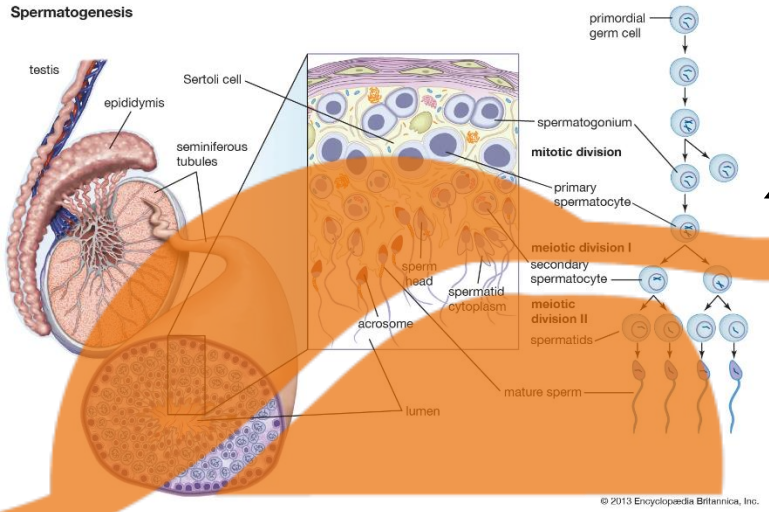


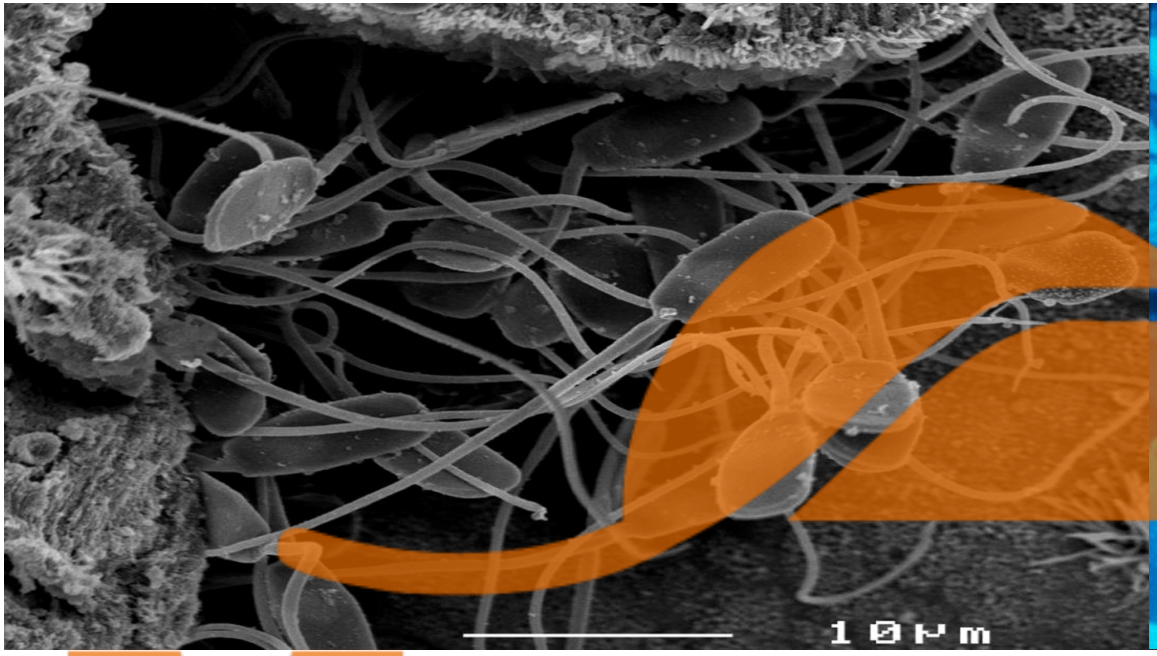
Line: sperm concentration along a typical boar ejaculate
PSF: pre-sperm fraction
SRF: sperm-rich fraction

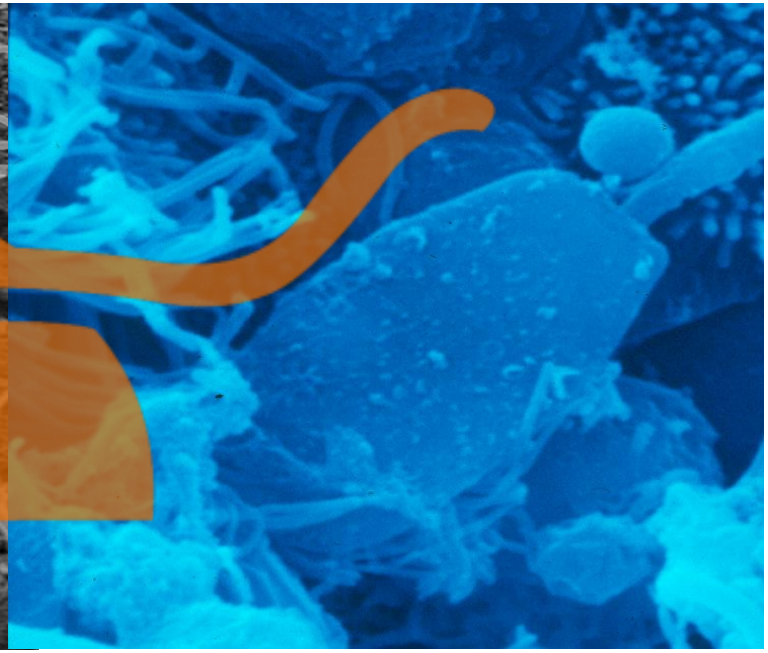
PSRF: post-sperm rich fraction
DIU-AI: deep intra-uterine AI)

Maduración

Espermatogénesis







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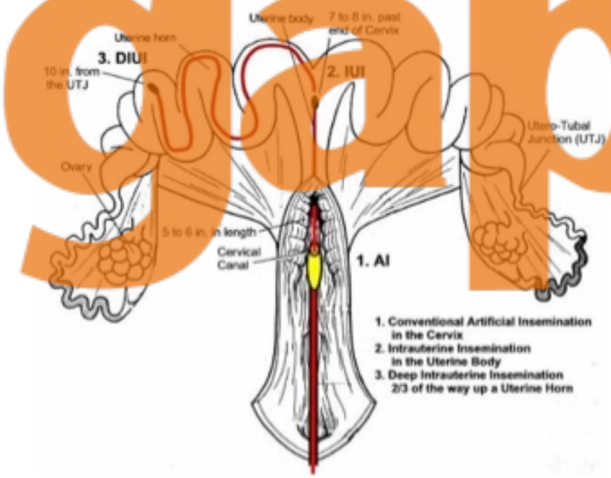
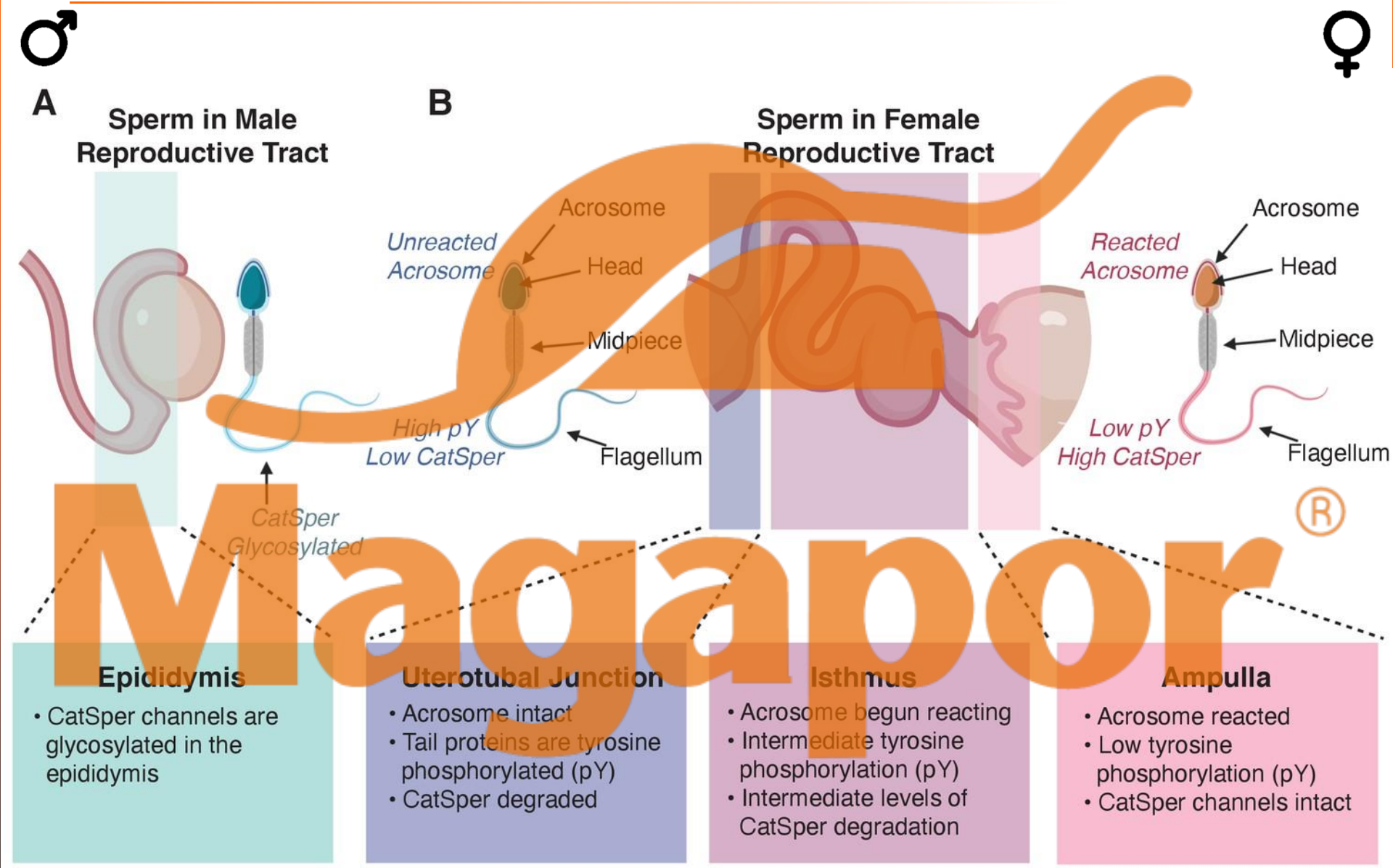
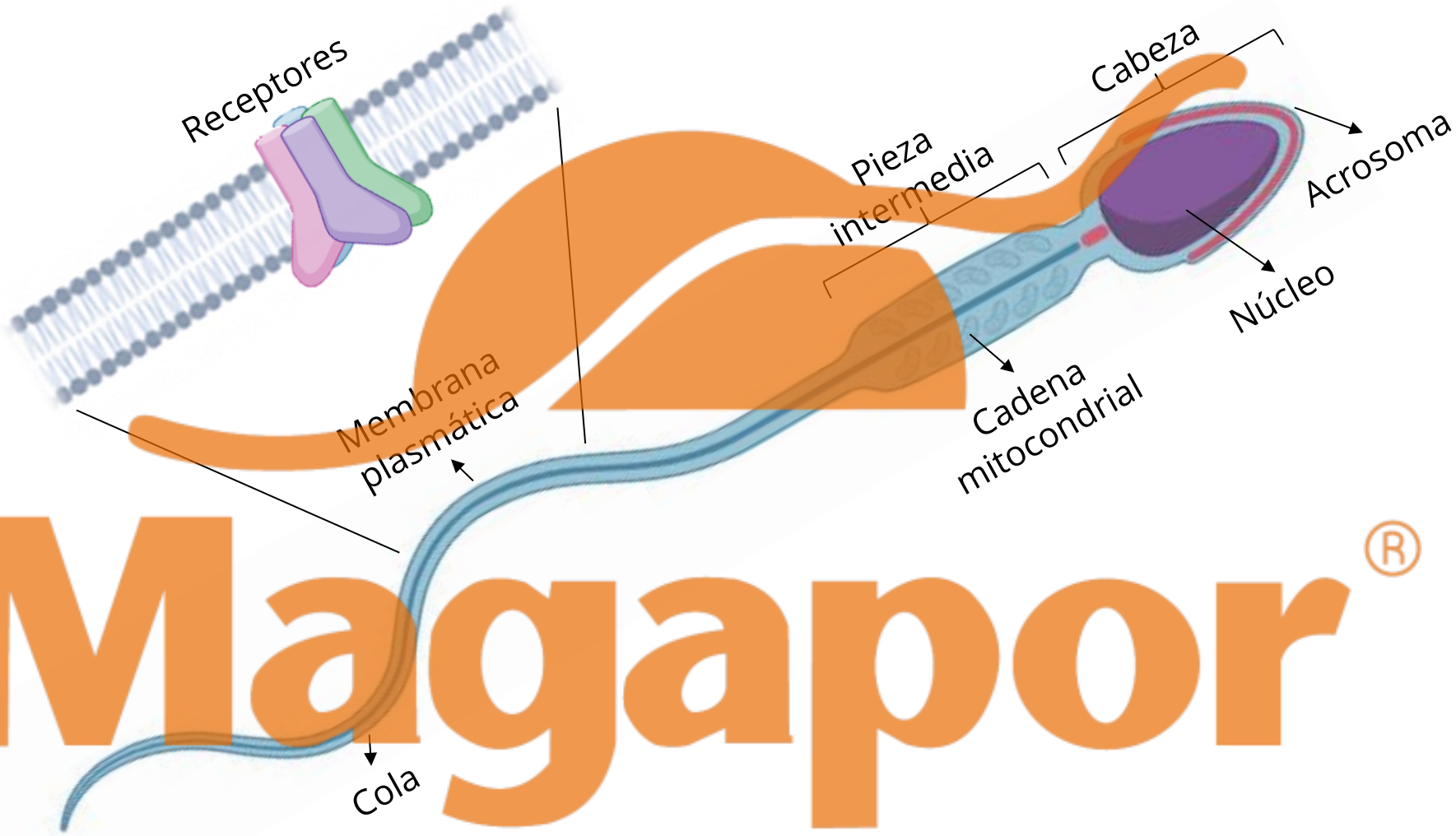


Imágenes: Heriberto Rodríguez-Martínez



Komondor KM & Carlson AE. eLife. Dec 2, 2020

Total Sperm Motility (%): proportion of spermatozoa that moves from the total spermatozoon count.
Progressive Motility (%): proportion of spermatozoa that moves progressively according to different species-specific program settings.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Pieza intermedia
Acrosoma
Núcleo
Membrana plasmática
Cadena mitocondrial
Cola

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Escriba aquí la palabra

por palabras

Consultar

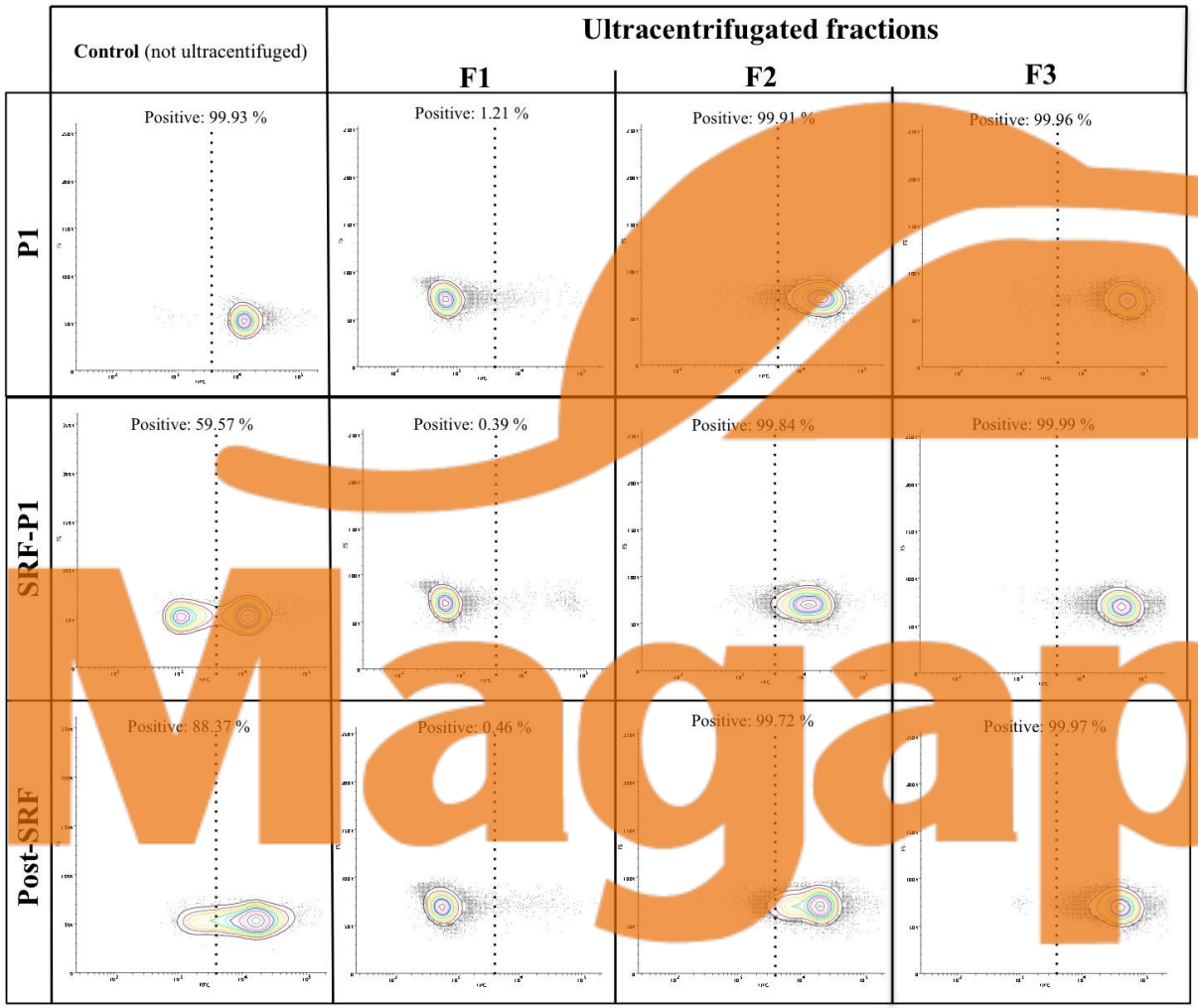
biomarcador

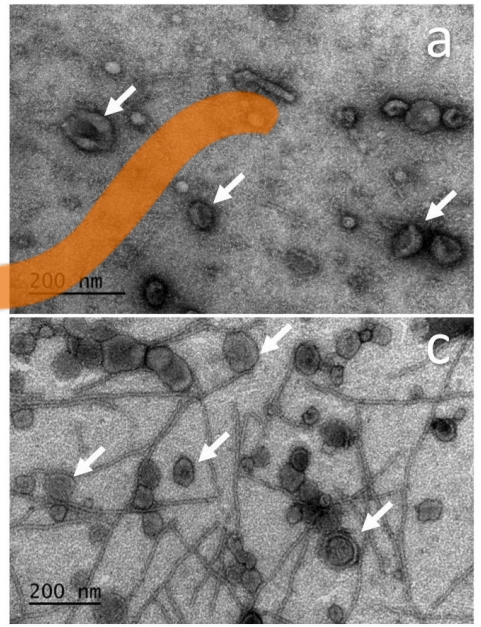
Artículo | De *bio-* y *marcador*.

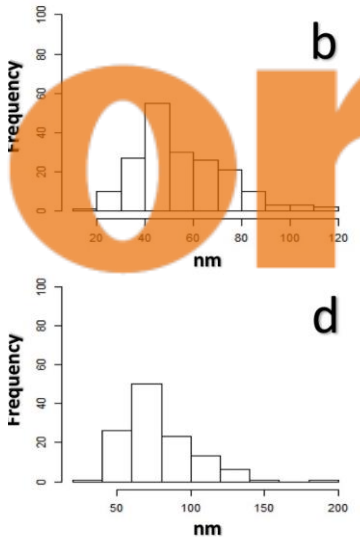
1. m. Sustancia que indica la presencia de material biológico o de un proceso fisiológico, y que se emplea para diagnosticar una enfermedad.

material biológico o de un proceso biológico

Vesículas extracelulares

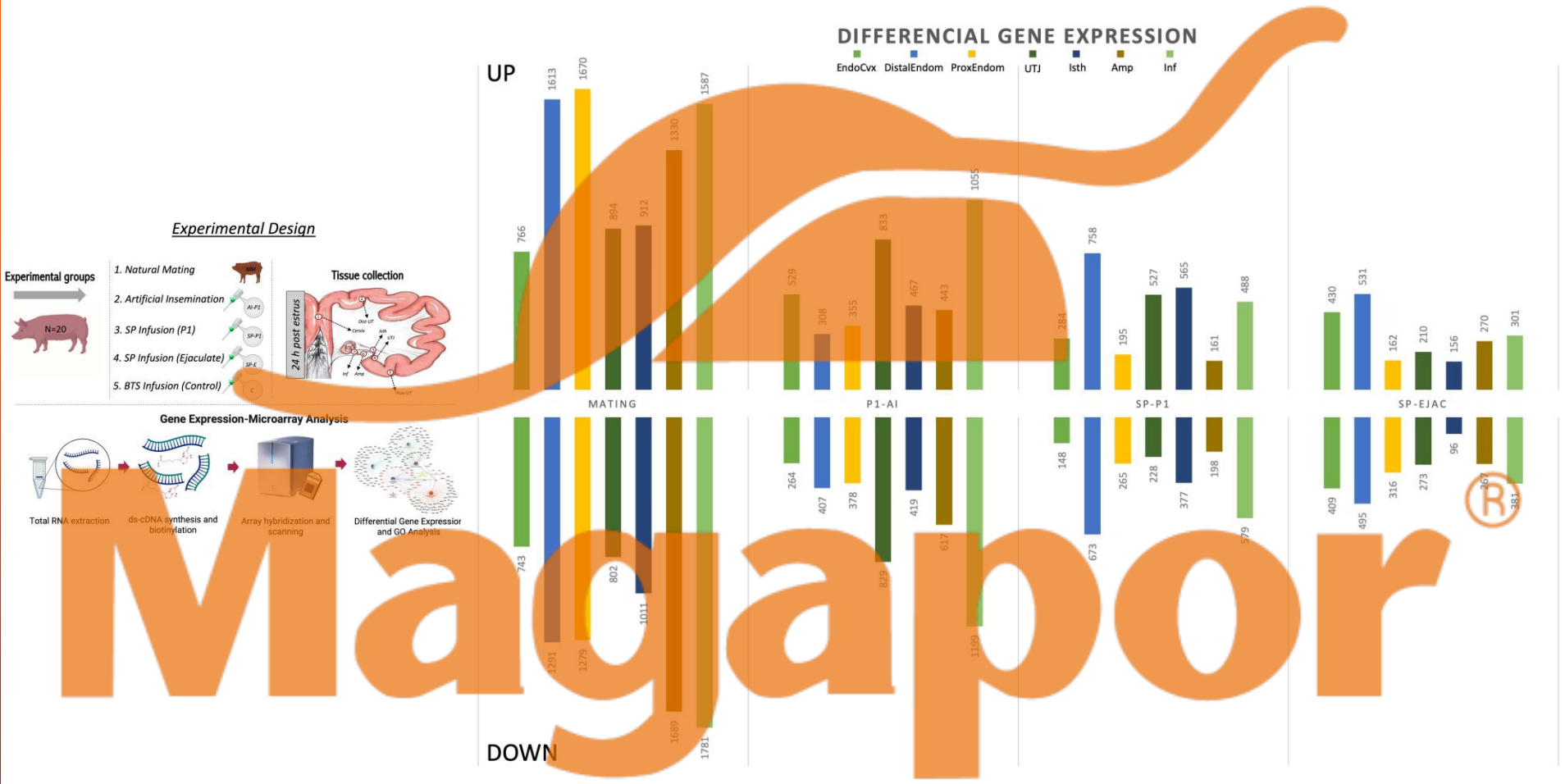






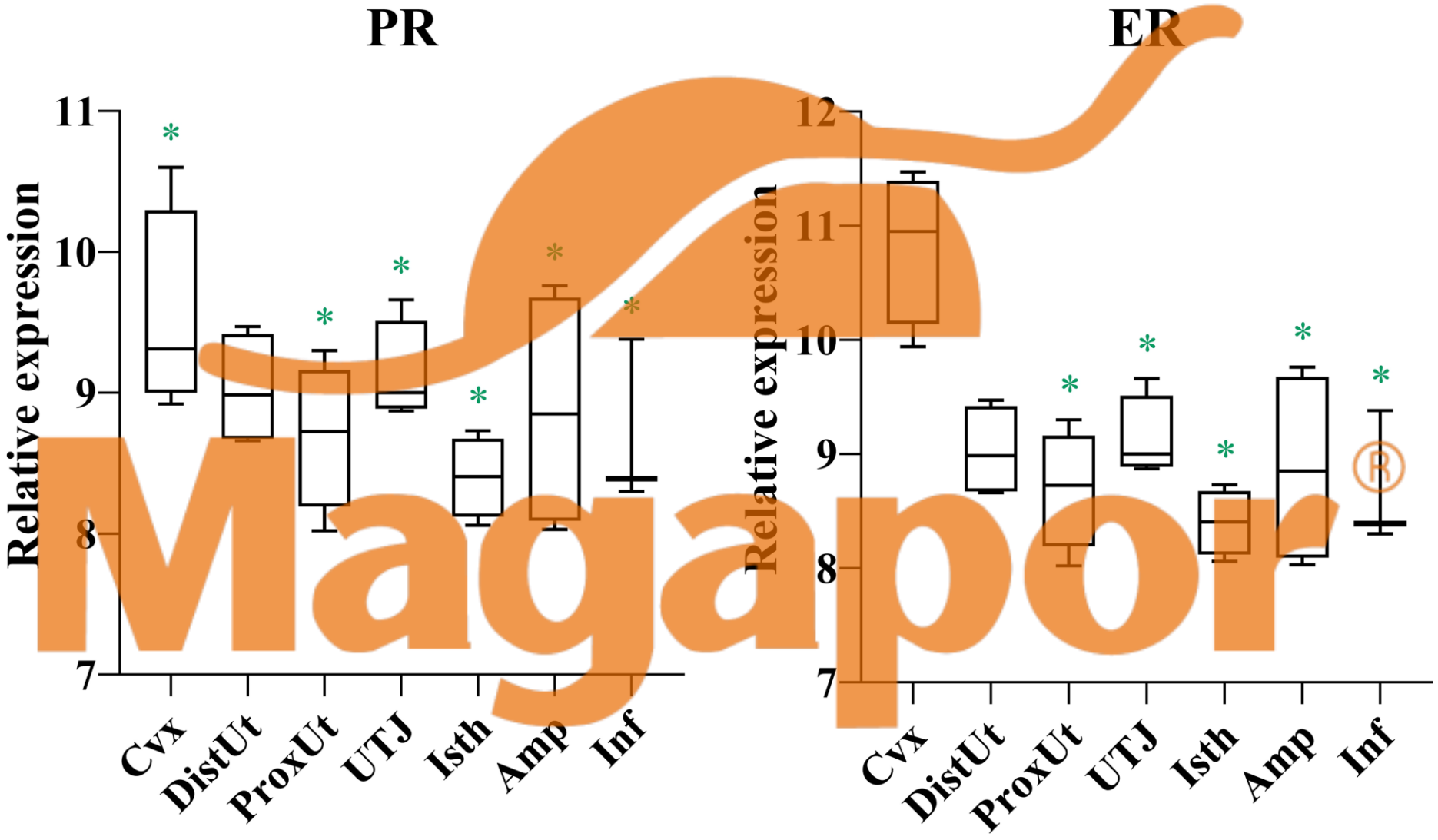
Álvarez-Rodriguez M, et al. Theriogenology, 2019, 140:143-152

Efecto macho en la hembra



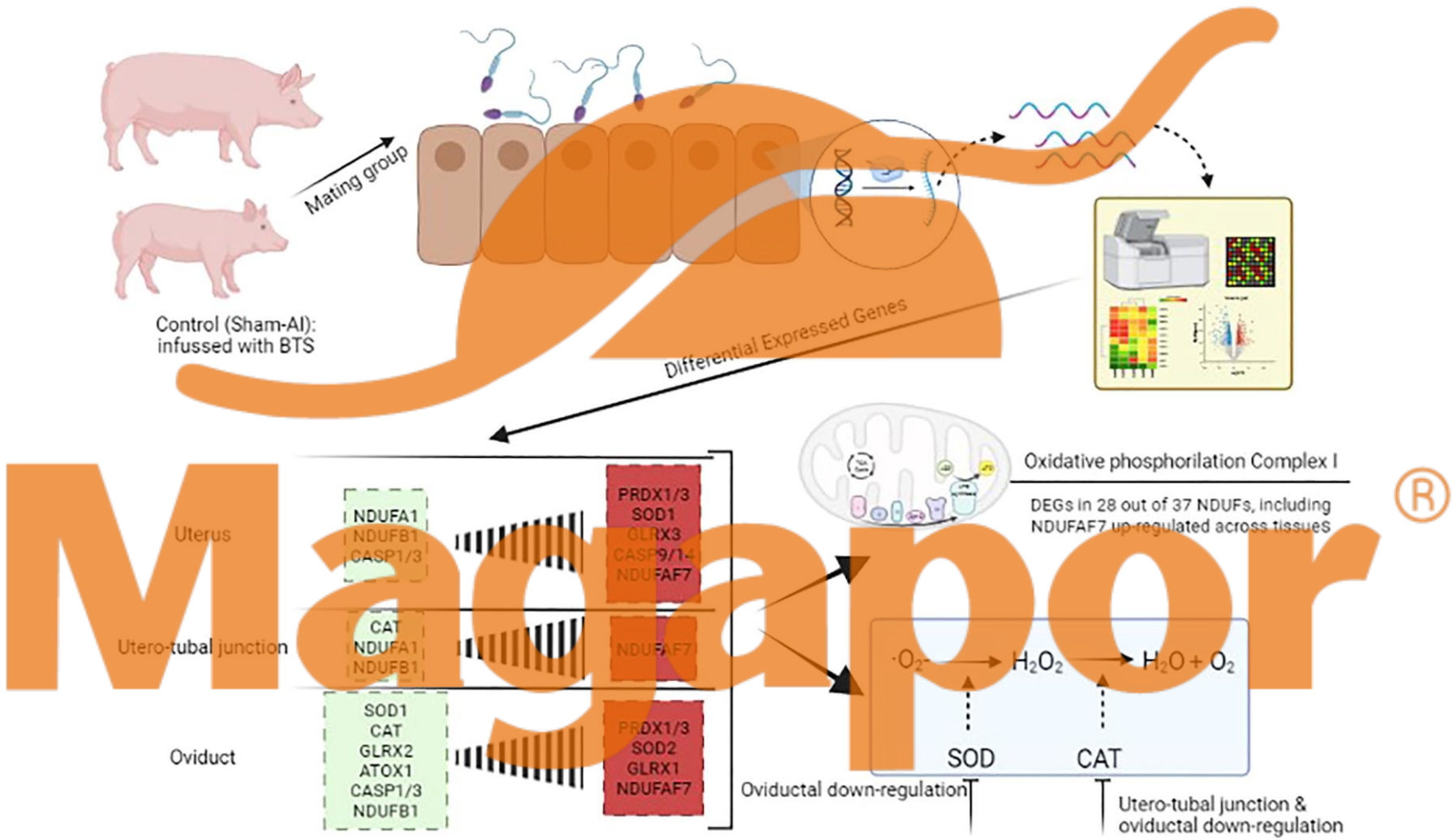
Álvarez-Rodríguez M et al. Sci Rep. 2020 Mar 19;10(1):5061

Receptores en la hembra



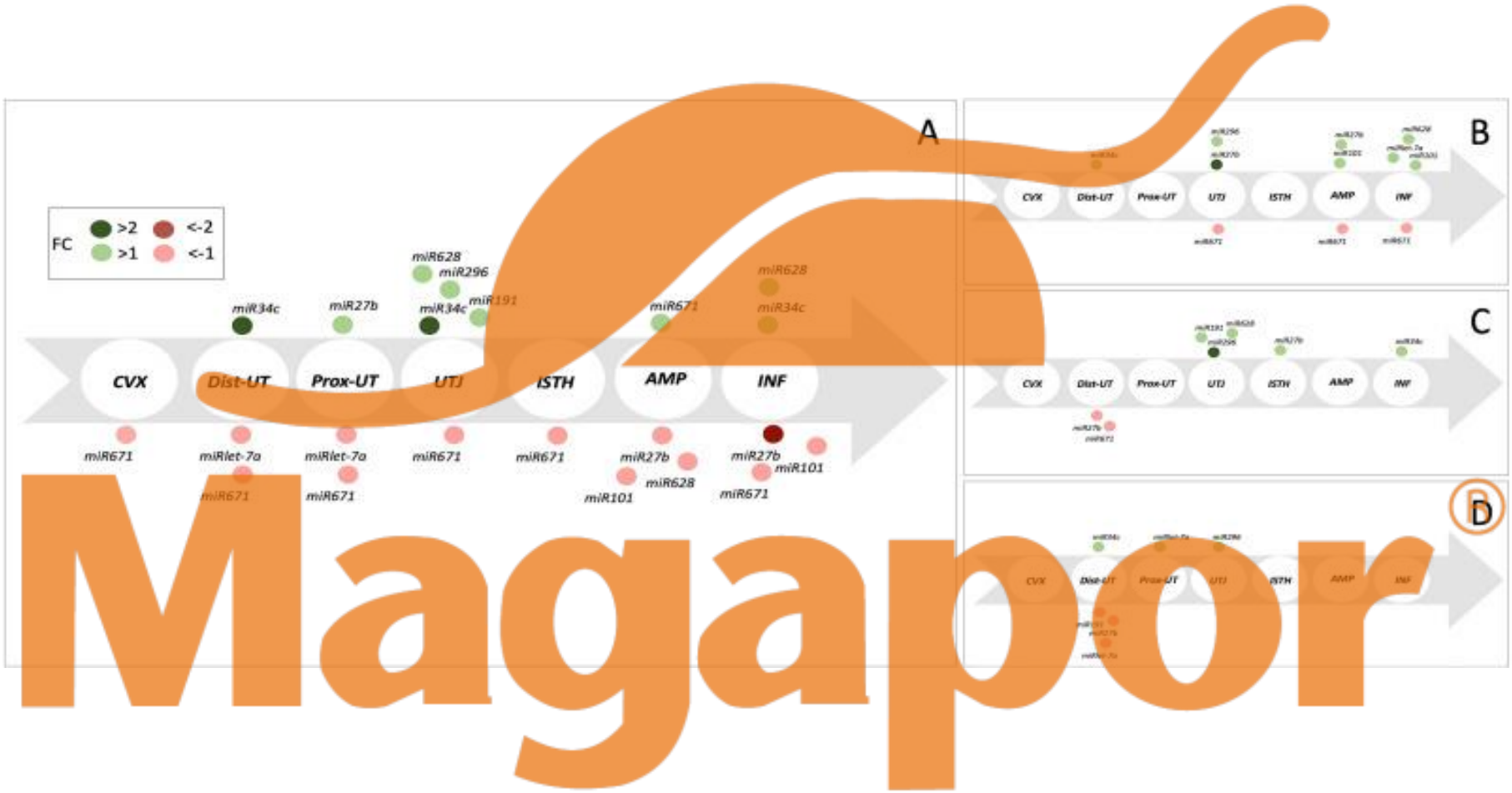
Alvarez-Rodriguez M et al. Front Endocrinol. 2023 Jun 7;14:1042176

Equilibrio oxidativo/reductivo



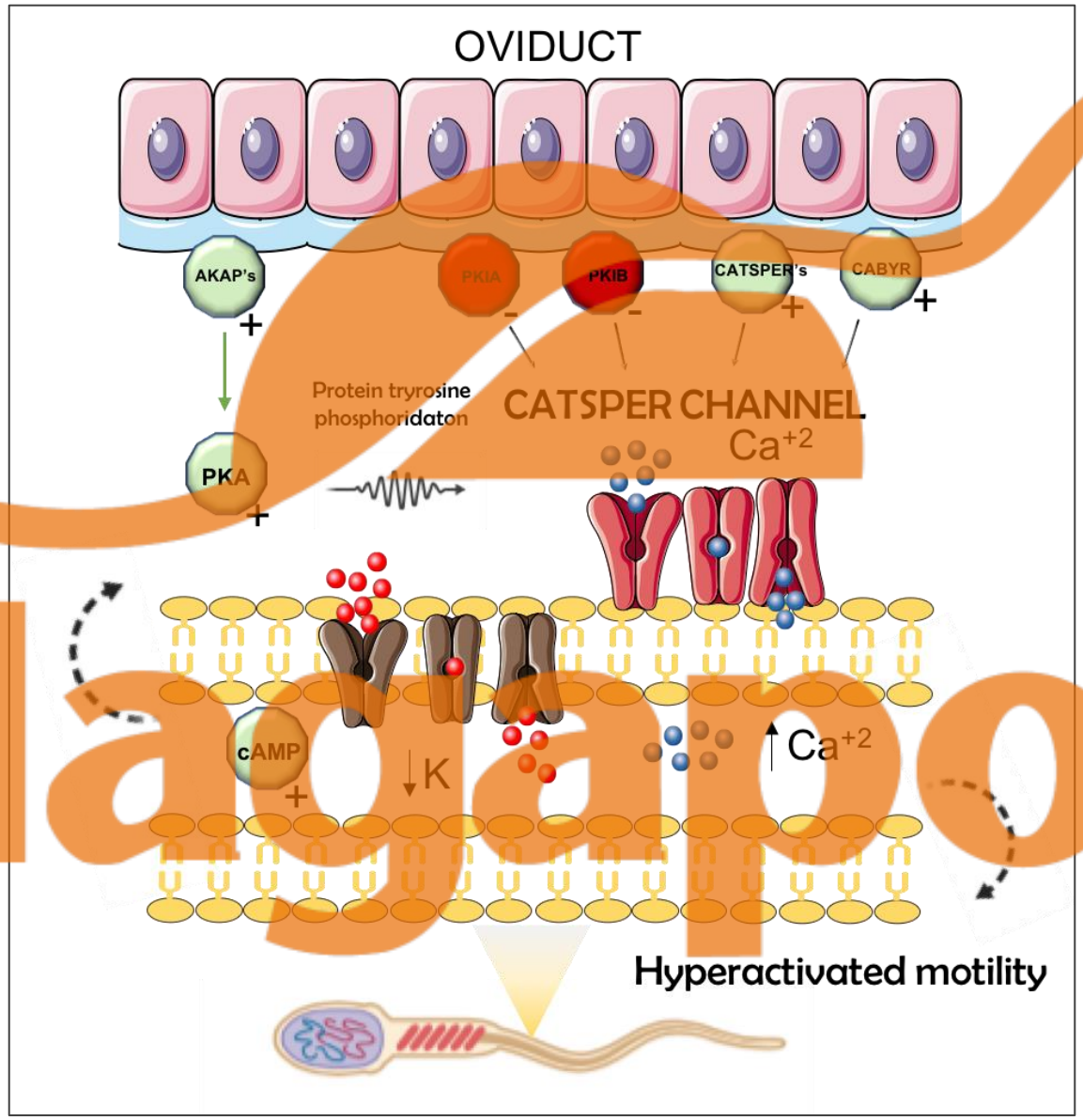
Alvarez-Rodriguez M et al. Front Endocrinol. 2023 Jun 7;14:1042176

Micro ARNs



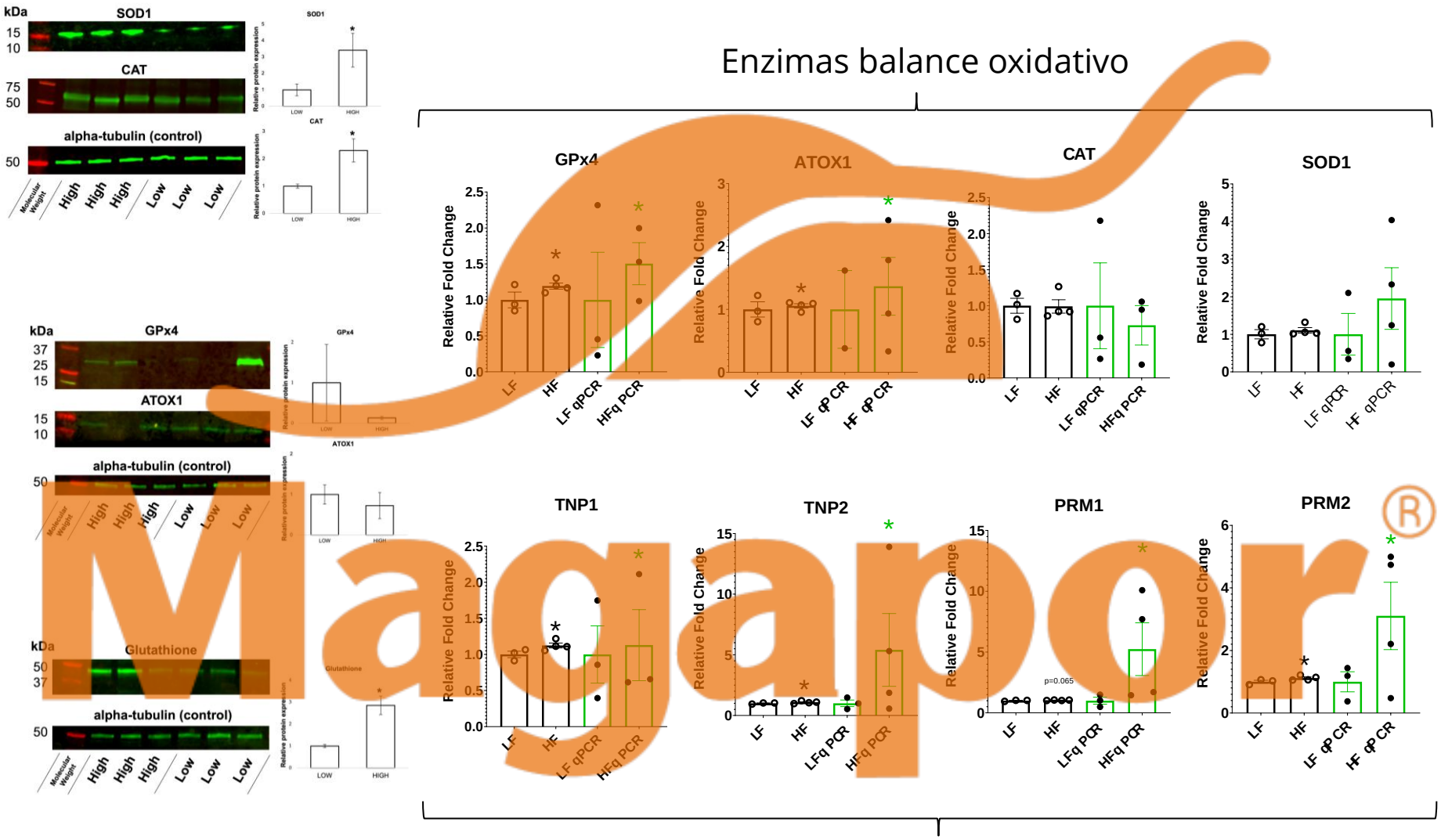
Álvarez-Rodríguez M et al. Res Vet Sci. 2024 168:105134

Capacitación



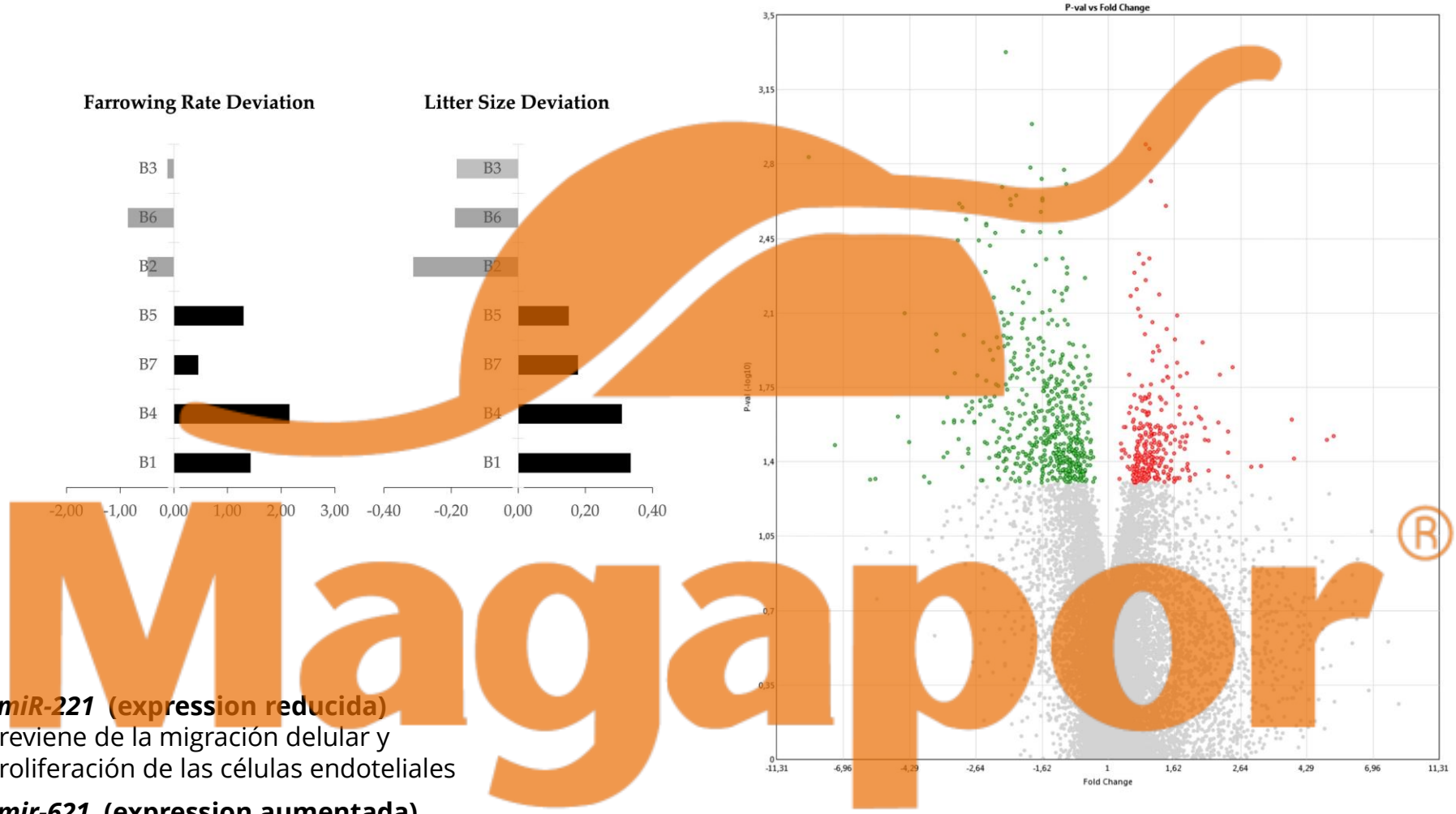
Martinez CA et al. Int J Mol Sci. 2020, 21(5), 1840

Cargo de ARN y proteínas vs. fertilidad



Álvarez-Rodríguez M et al. Res Vet Sci. 2021 Dec:141:195-202

Cargo de ARN pequeños vs. fertilidad



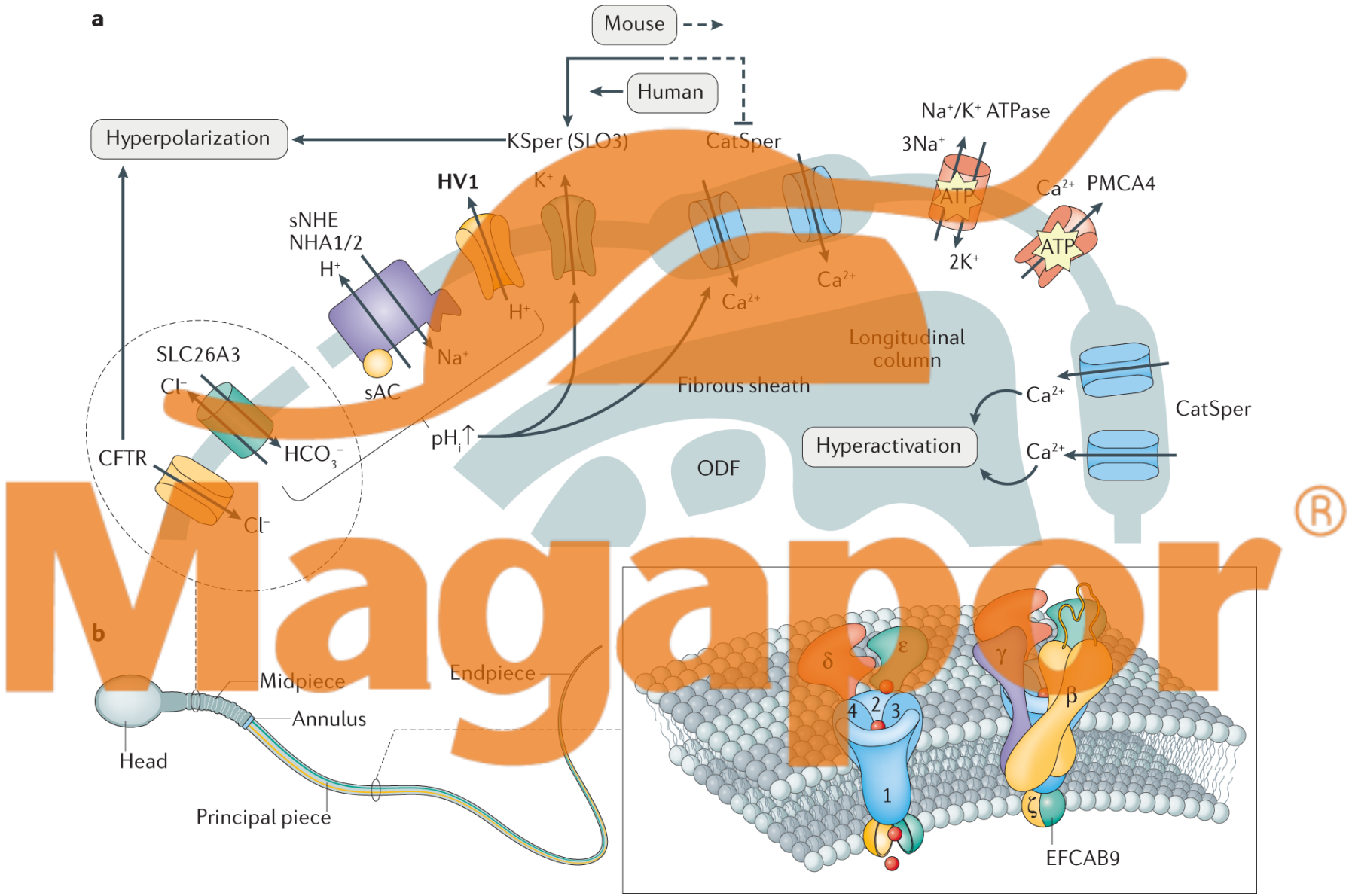
· ***miR-221*** **(expression reducida)**
previene de la migración delular y proliferación de las células endoteliales

· ***mir-621*** **(expression aumentada)**
Activador de *p53-signaling pathway*

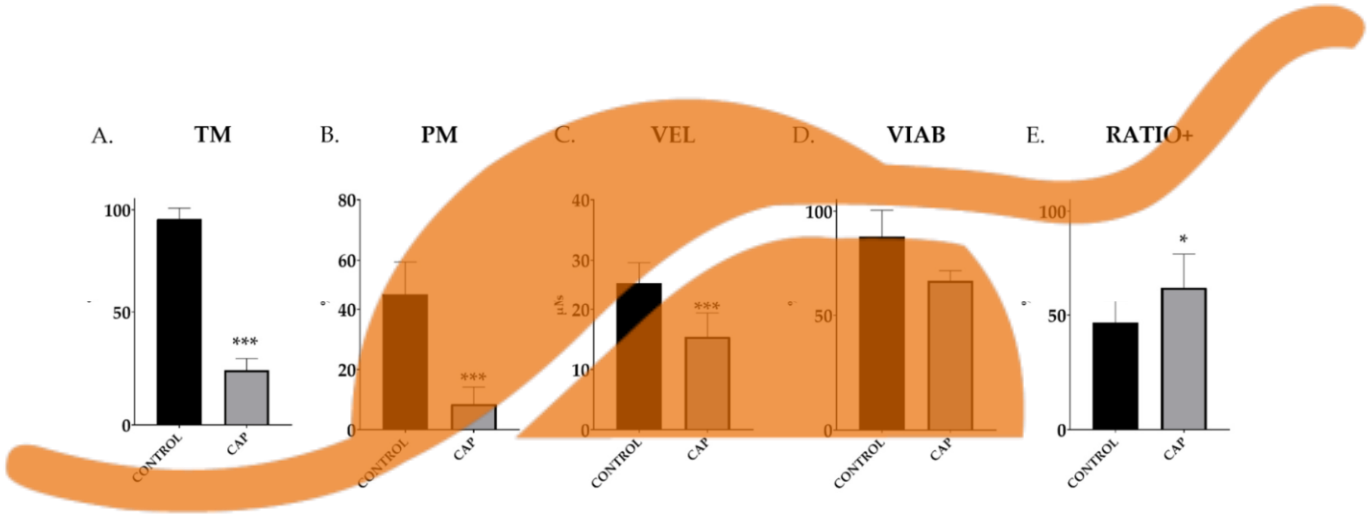
· **Sub-unidad gamma CATSPER**

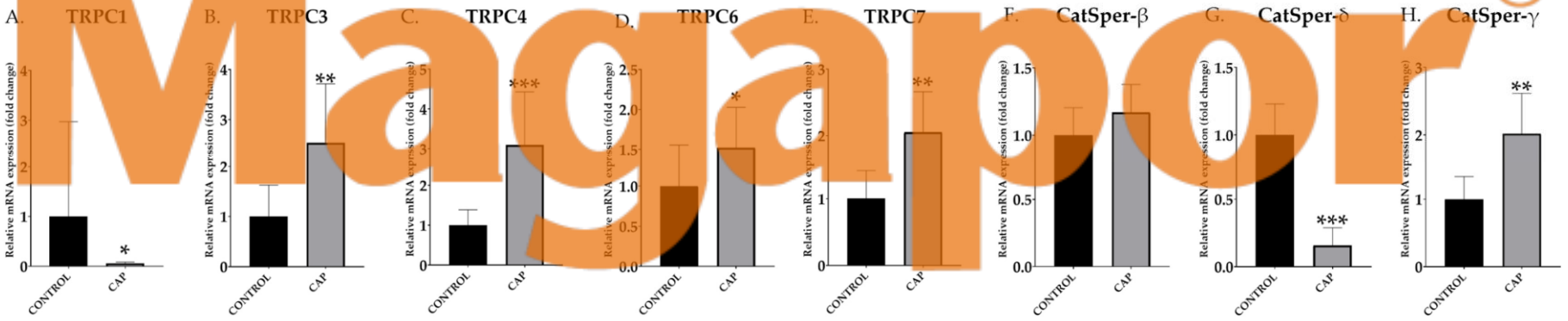
· ***TNP1 transition protein 1*** **(reemplazo de histonas por protaminas)**

02. Receptores y canales


a
Mouse
Human
Hyperpolarization
KSper (SLO3)
CatSper
Na+/K+ ATPase
3Na+
ATP
2K+
Ca2+ PMCA4
ATP
HV1
K+
sNHE
NHA1/2
H+
H+
Na+
sAC
Ca2+
Ca2+
Longitudinal column
Fibrous sheath
SLC26A3
Cl−
HCO3−
CFTR
Cl−
pHi↑
Ca2+
CatSper
Hyperactivation
Ca2+
ODF
b
Midpiece
Endpiece
Annulus
Head
Principal piece
δ
ε
γ
β
4
2
3
1
ζ
EFCAB9

TRPCs en capacitación

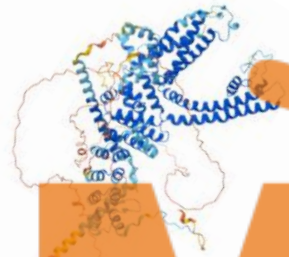


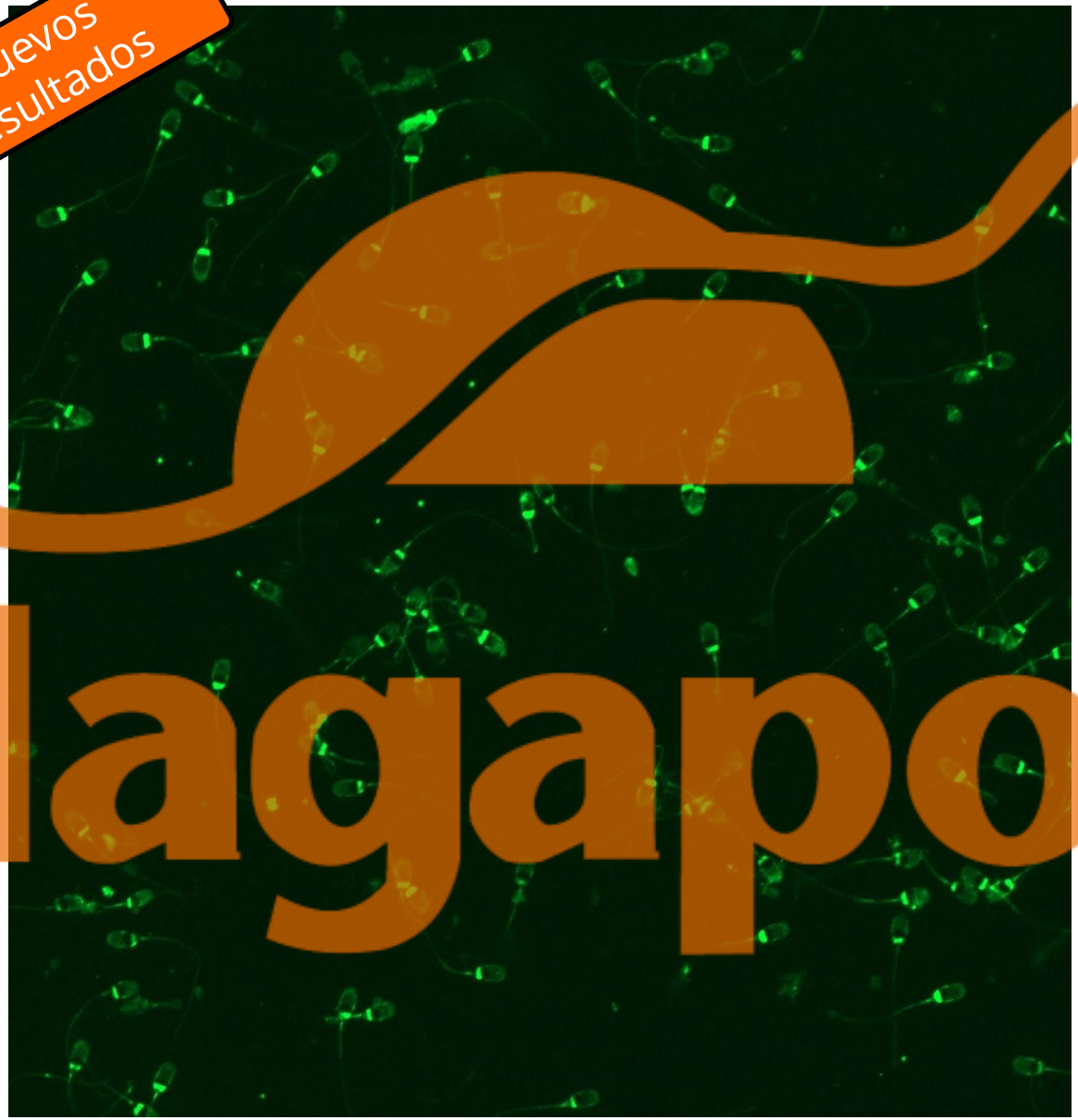


Lacalle E et al. Animals. 2022 Apr 13; 12(8):1012

TRPC-4

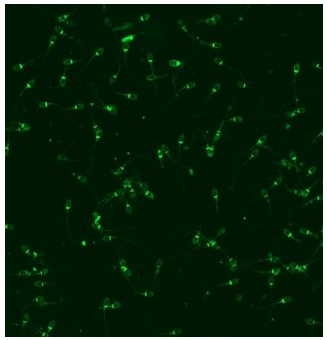
Nuevos Resultados





De Mercado et al. Resultados no publicados

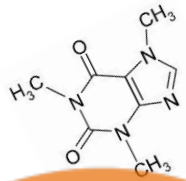
TRPC-4

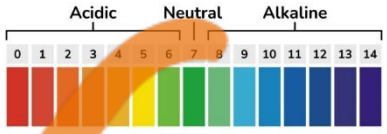


- **Receptor de potencial transitorio**
- No selectivo, pero principalmente activado por calcio
- Funciones descritas
  - proliferación celular, intercambio de calcio en epidídimo
- *Búsqueda en "TRPC sperm" en pubmed ¡solo 19 entradas!*
- Flagelo espematozoide humano (Castellano et el. 2013)
- Potencialmente relacionado con: **cafeína y pH**

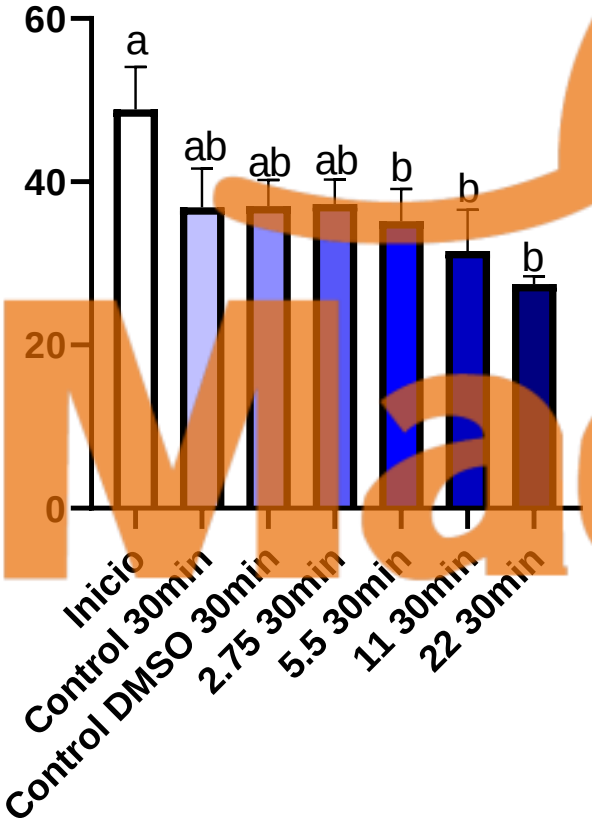
TRPC-4

Nuevos Resultados

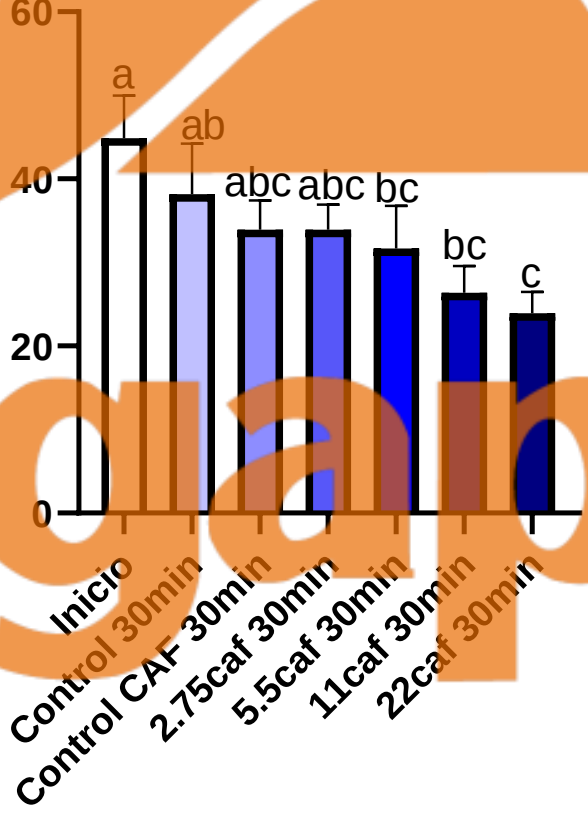




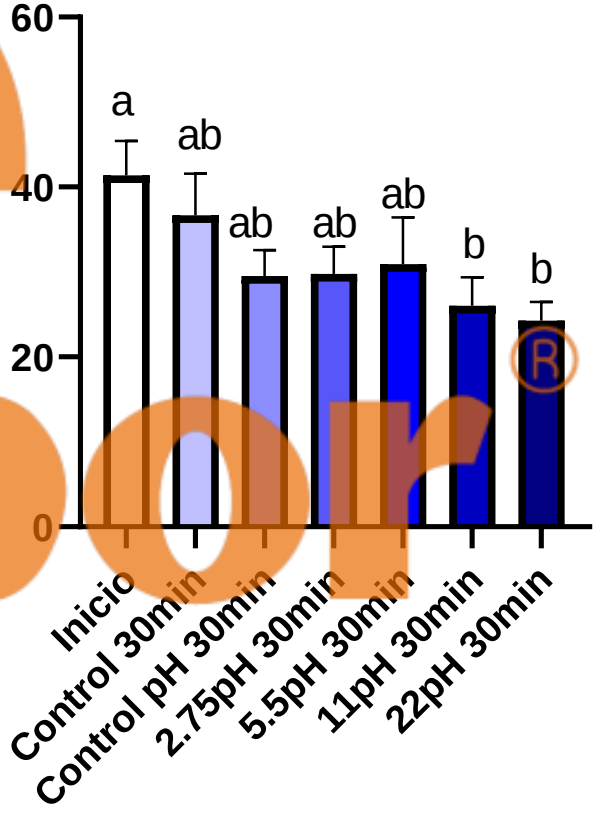
MT con inicio



MT con inicio



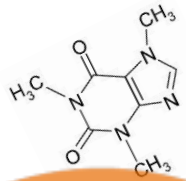
MT con inicio

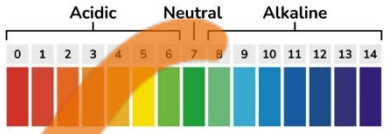


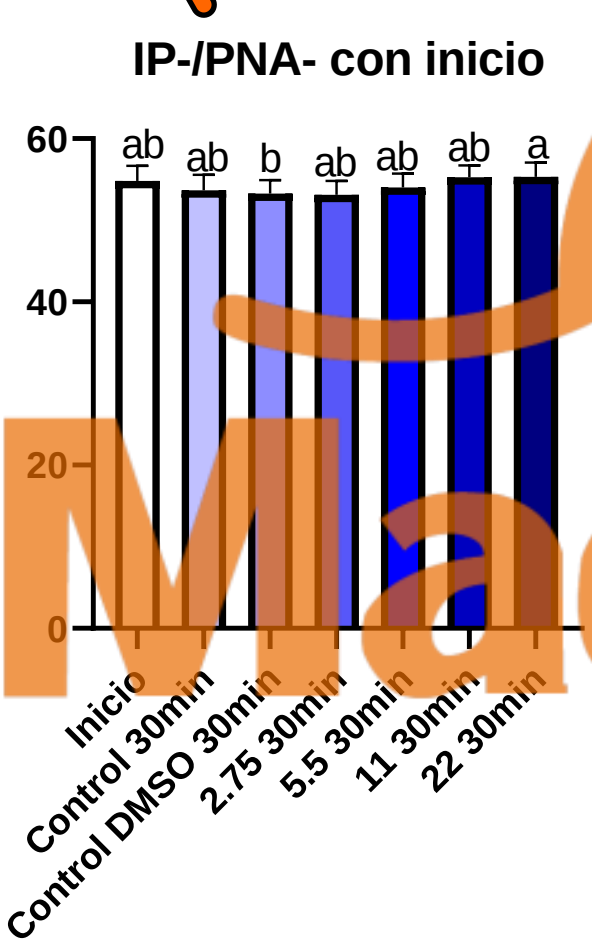
De Mercado et al. Resultados no publicados

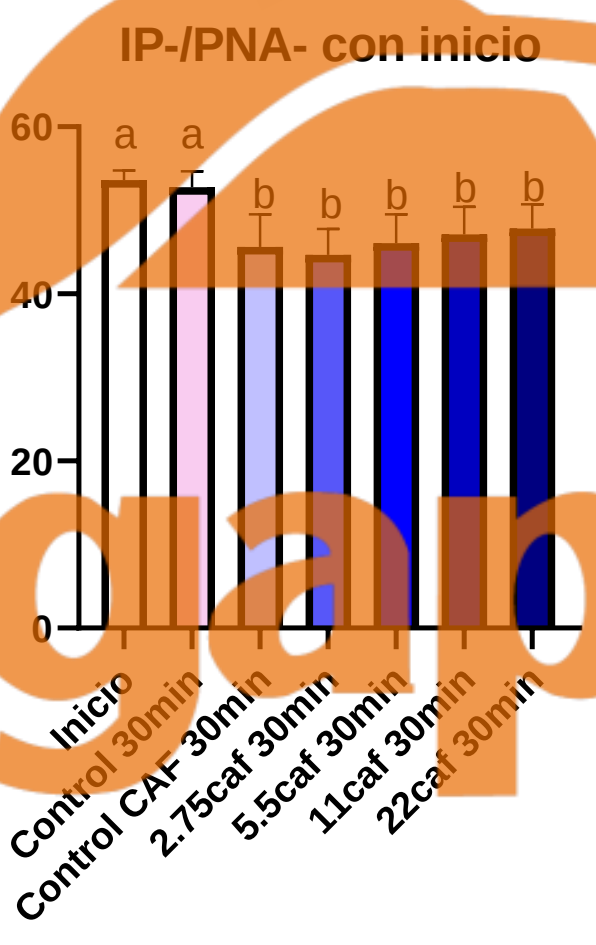
TRPC-4

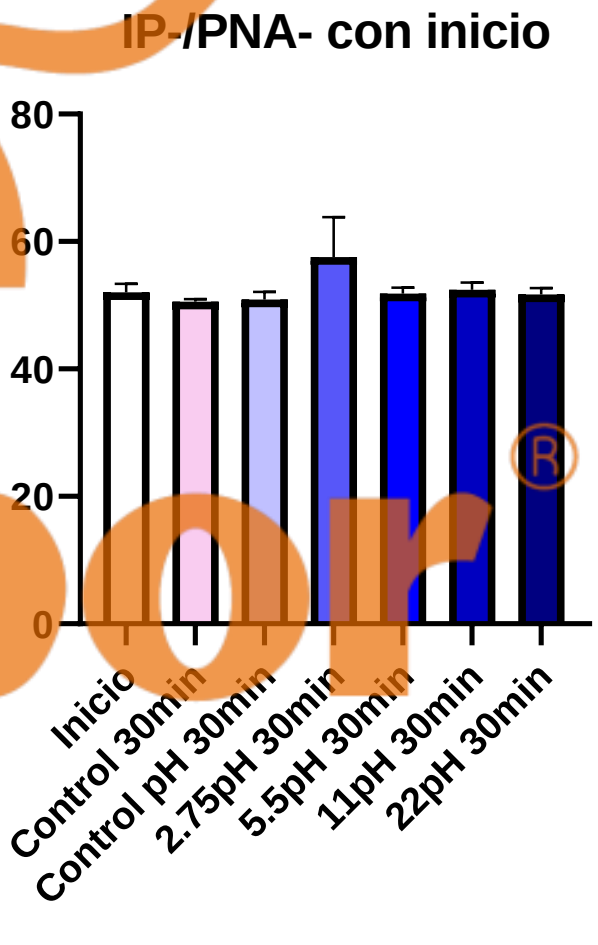
Nuevos Resultados







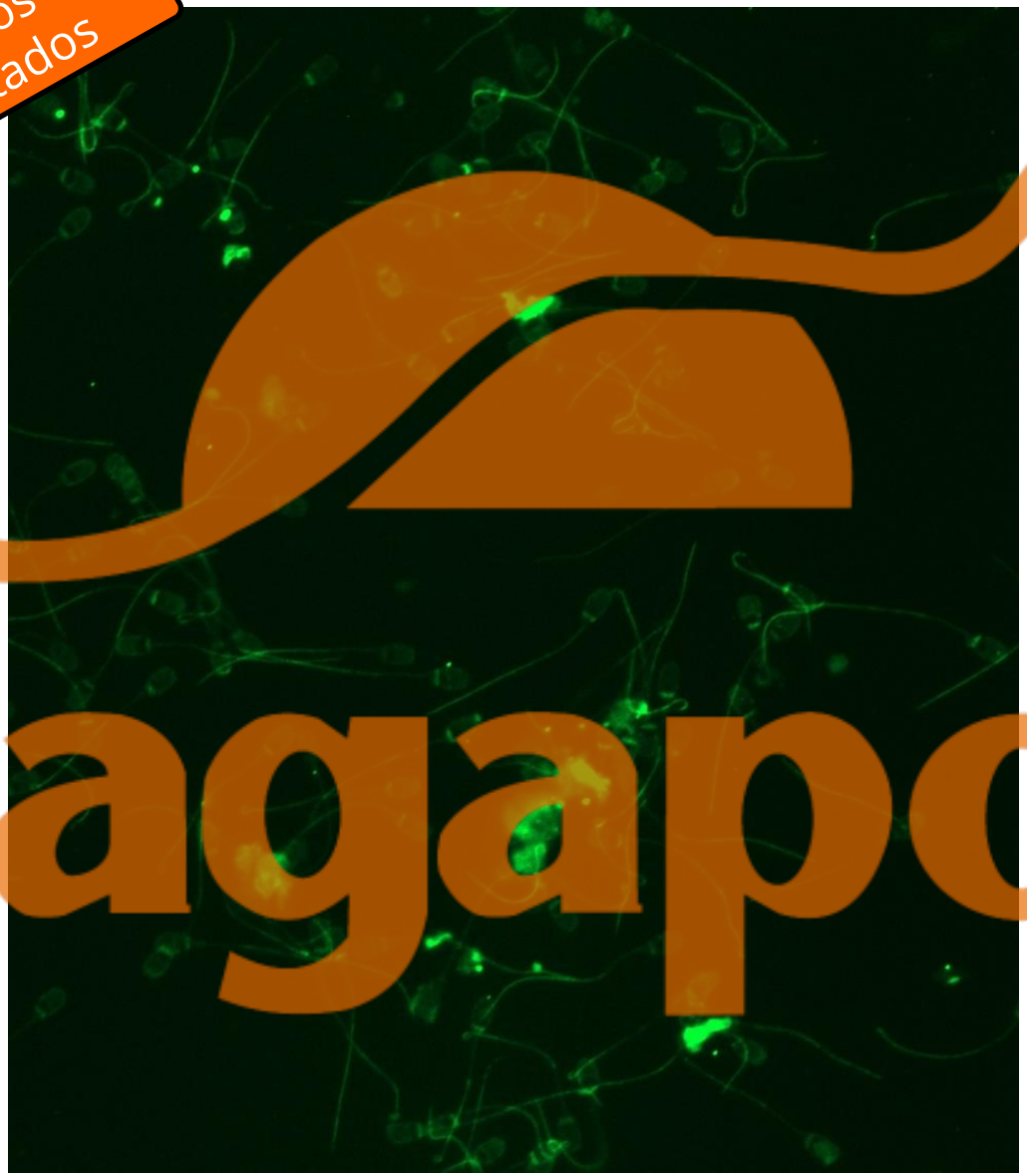




De Mercado et al. Resultados no publicados

TRPC-6

Nuevos Resultados



De Mercado et al. Resultados no publicados

TRPV-6

Nuevos Resultados

e 180 (2024) 105400

lists available at ScienceDirect

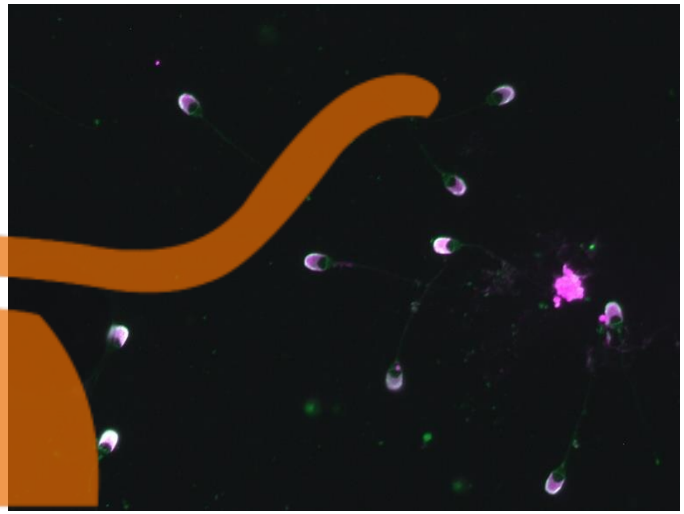
Research in Veterinary Science

journal homepage: www.elsevier.com/locate/rvsc

Effect of the addition of exogenous progesterone and the progesterone receptor inhibitor (RU 486) on boar cryopreservation semen extenders

Adrián Martín-San Juan [1], Nerea Gala [1], Helena Nieto-Cristóbal, Manuel Álvarez-Rodríguez [*,2], Eduardo de Mercado [2]

Department of Animal Reproduction, Spanish National Institute for Agricultural and Food Research and Technology (INIA-CSIC), 28040 Madrid, Spain



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OLF-1

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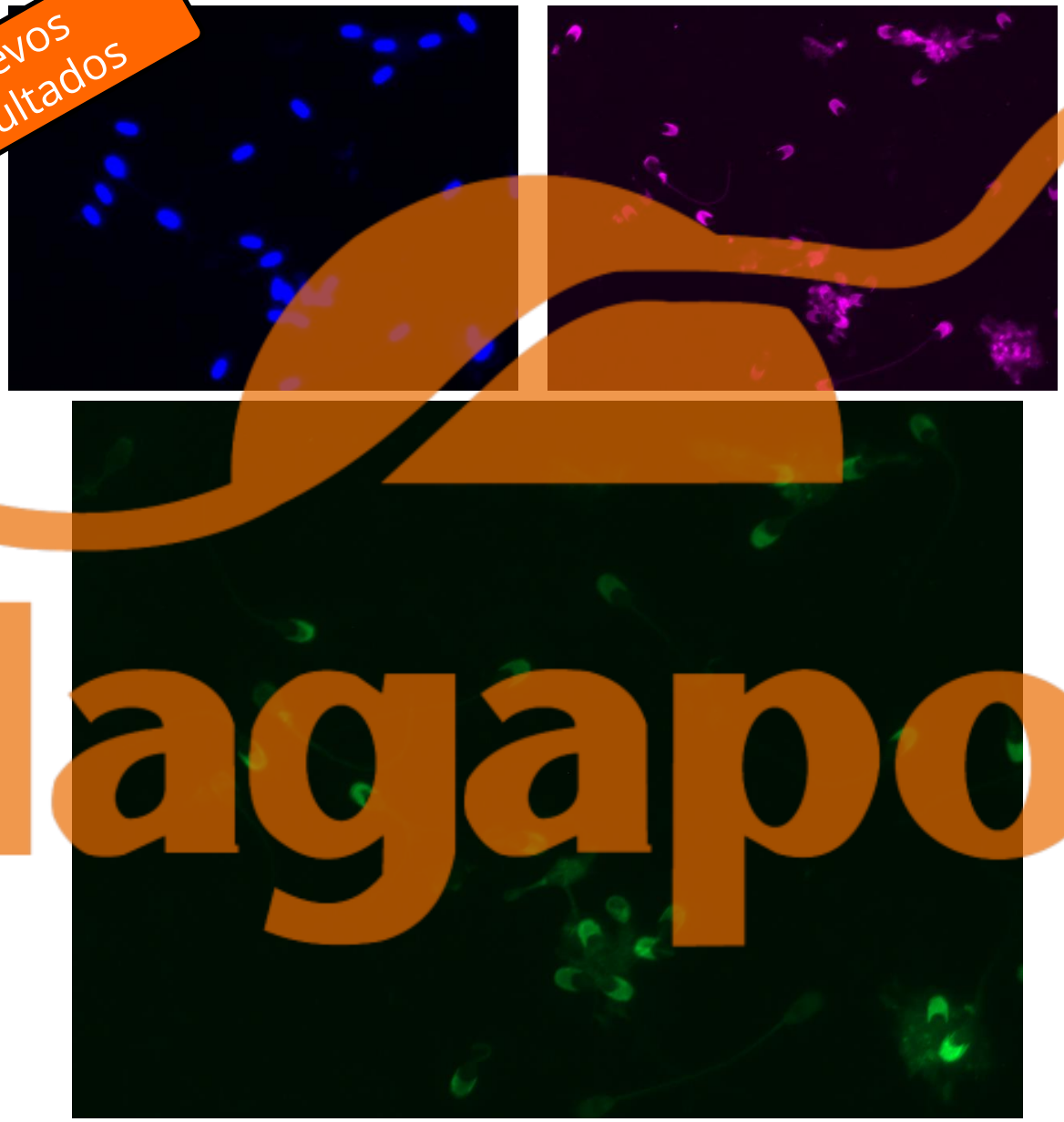
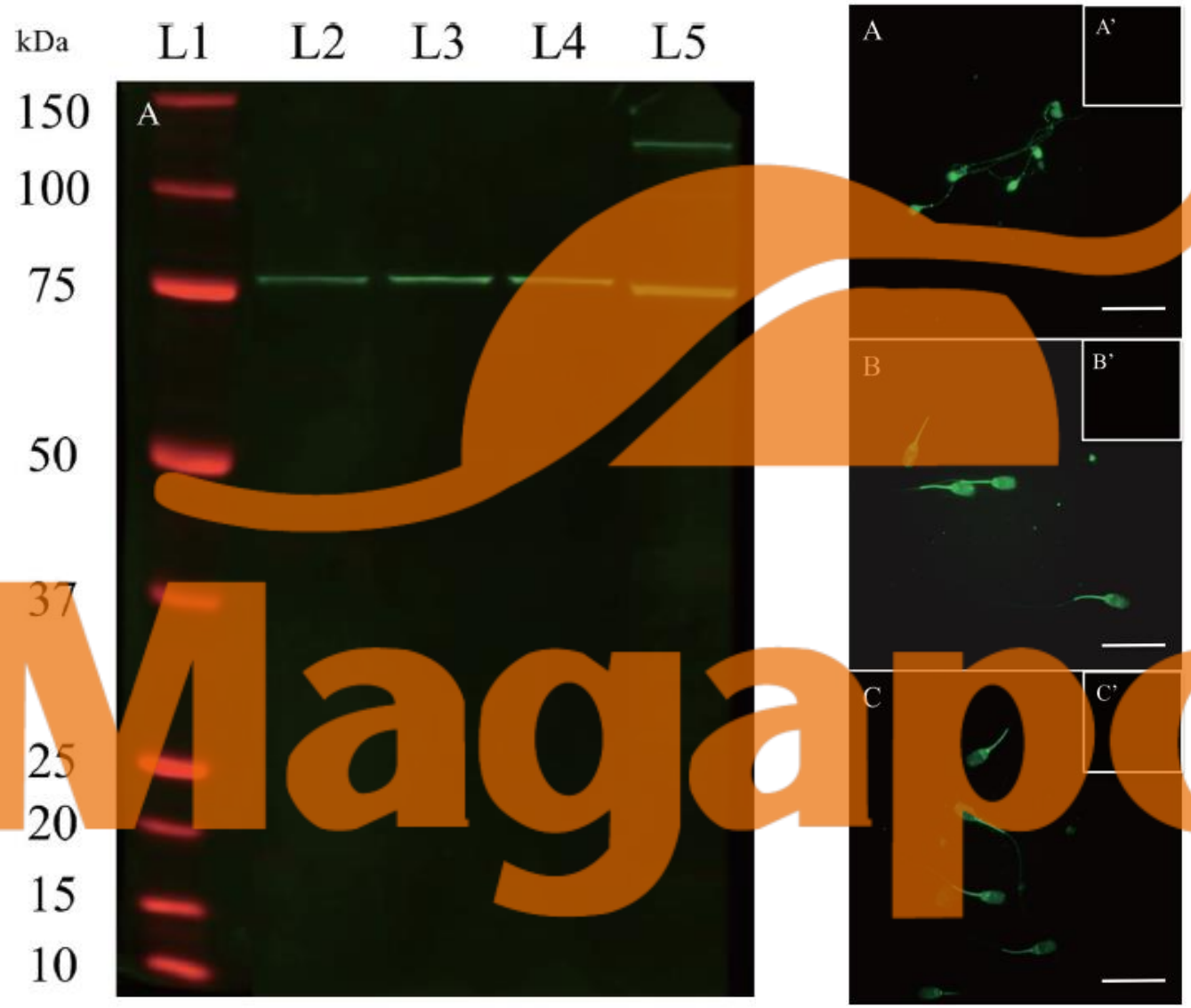


Ortega I, de Mercado et al. Resultados no publicados

CD44



Alvarez-Rodriguez et al. JRD, 64 (4),2018

Receptor de andrógenos

Nuevos Resultados

de Mercado E, Nieto-Cristóbal H et al. Resultados no publicados

Receptor de progesterona

Nuevos Resultados

de Mercado E, Nieto-Cristóbal H et al. Resultados no publicados

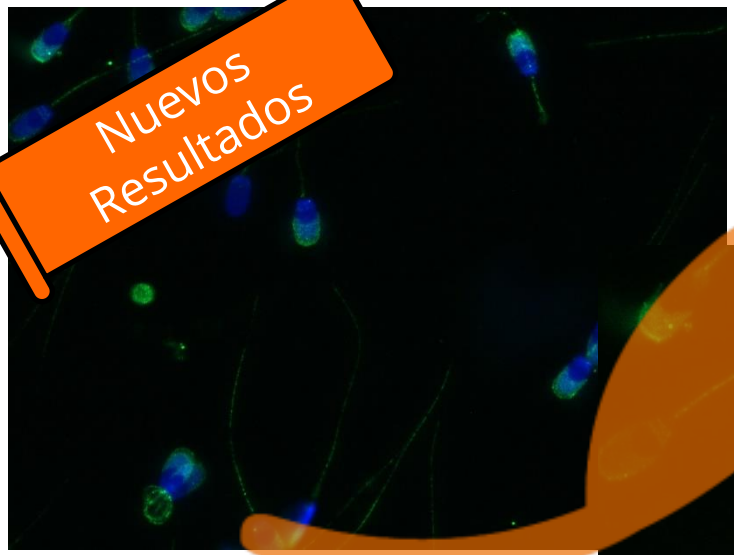
Receptor de cortisol (NR3C1)

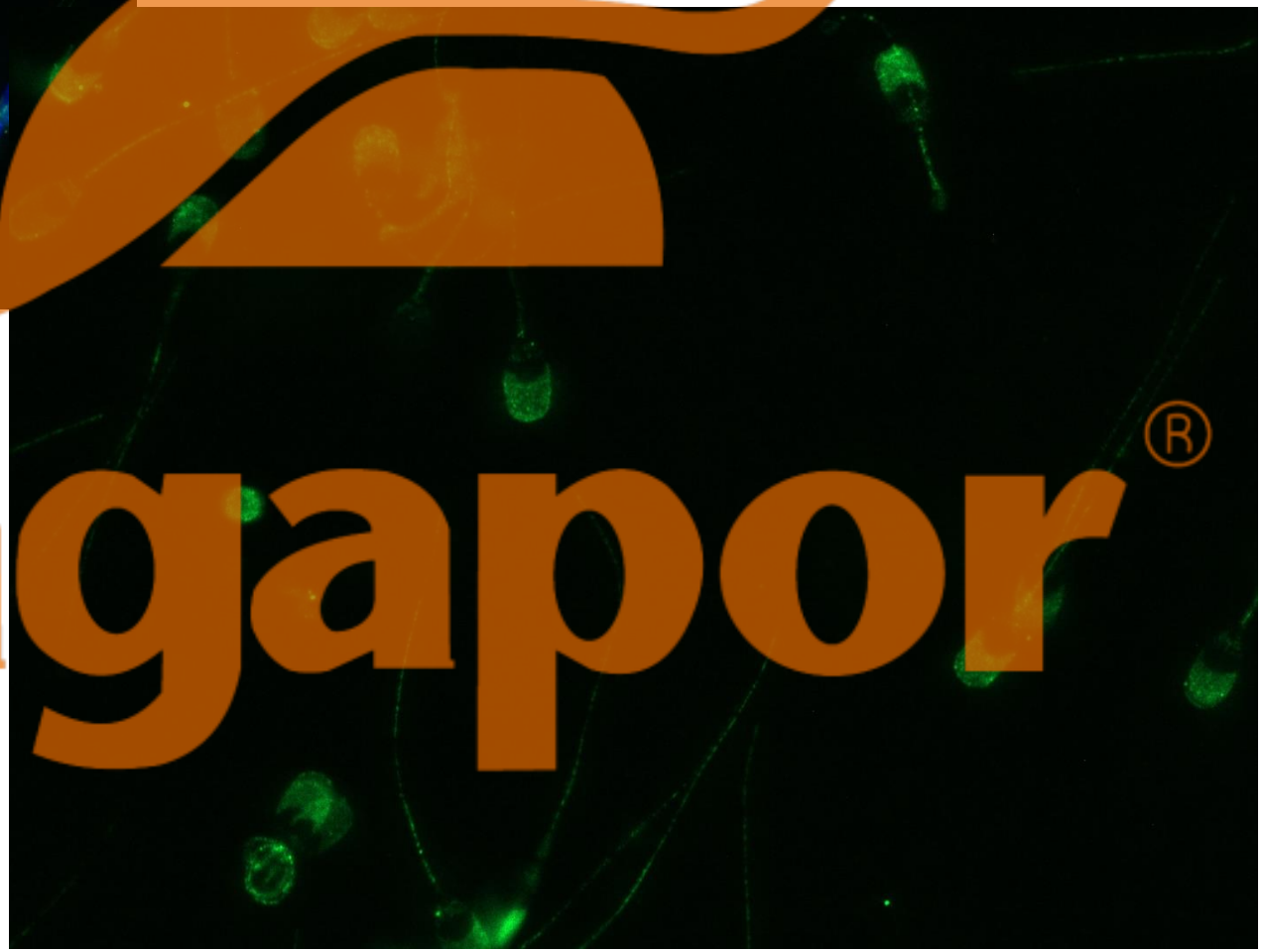
Nuevos Resultados

de Mercado E, Nieto-Cristóbal H et al. Resultados no publicados

Alix

Nuevos Resultados





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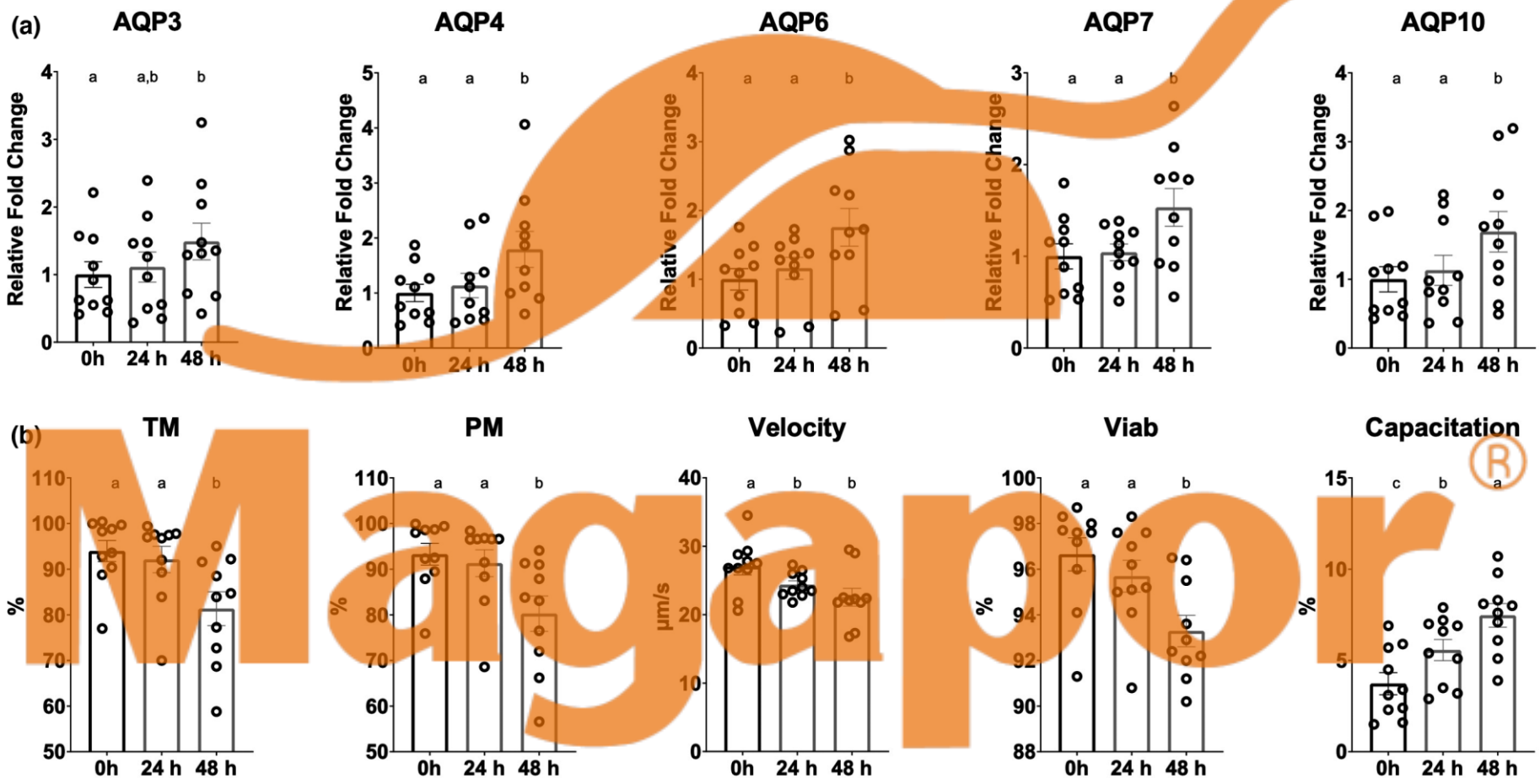
de Mercado E, Nieto-Cristóbal H et al. Resultados no publicados

Fosforilación de tirosinas

Nuevos Resultados

de Mercado E, Nieto-Cristóbal H et al. Resultados no publicados

Acuaporinas



Castany Quintana M et al. Reprod Domest Anim. 2022 Oct;57 Suppl 5(Suppl 5):78-81

Mu, delta y kappa: opioides

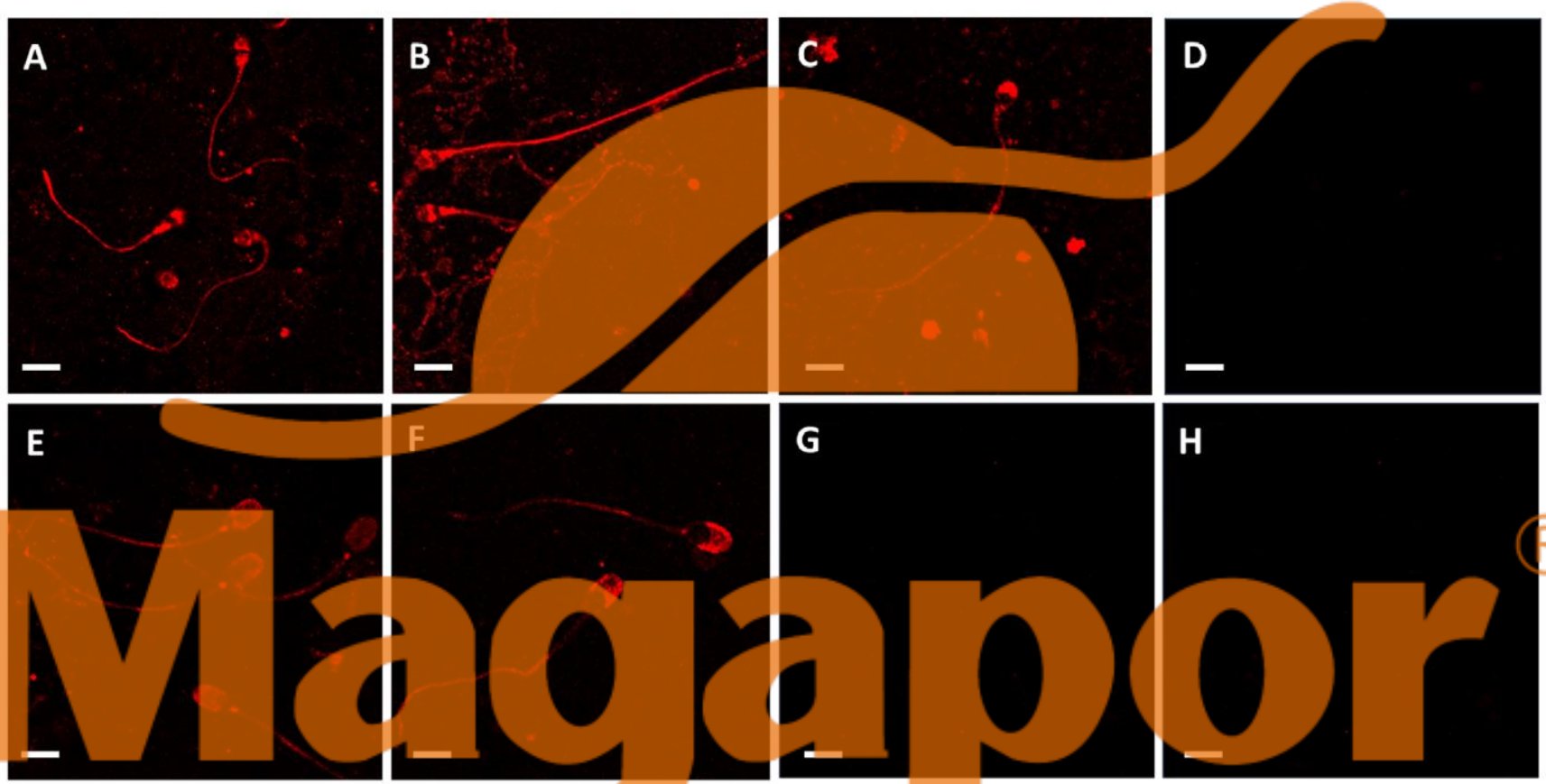


Figure 2. Localization of μ- and δ-opioid receptors in human and boar spermatozoa by laser confocal microscopy. **A**: μ-opioid receptor, human spermatozoa. **B**: δ-opioid receptor, human spermatozoa. **C**: κ-opioid receptor, human spermatozoa. **D**: negative control (primary antibody excluded), human spermatozoa. **E**: μ-opioid receptor, boar spermatozoa. **F**: δ-opioid receptor, boar spermatozoa. **G**: κ-opioid receptor, boar spermatozoa. **H**: negative control (primary antibody excluded), boar spermatozoa. Scale bar, 10 μm.

Vicente-Carrillo A et al. Molecular Reproduction and Development. 2016. 83:724–734

Nuevos Resultados

Transition nuclear protein 2 (TNP2) mRNA cargo: a putative marker for assessment of breed differences?

Manuel Álvarez-Rodríguez[1]; Helena Nieto-Cristobal[1]; Alejandro Vicente-Carrillo[2]; Maria José Martinez-Alborcia[3]; Eduardo de Mercado[1]

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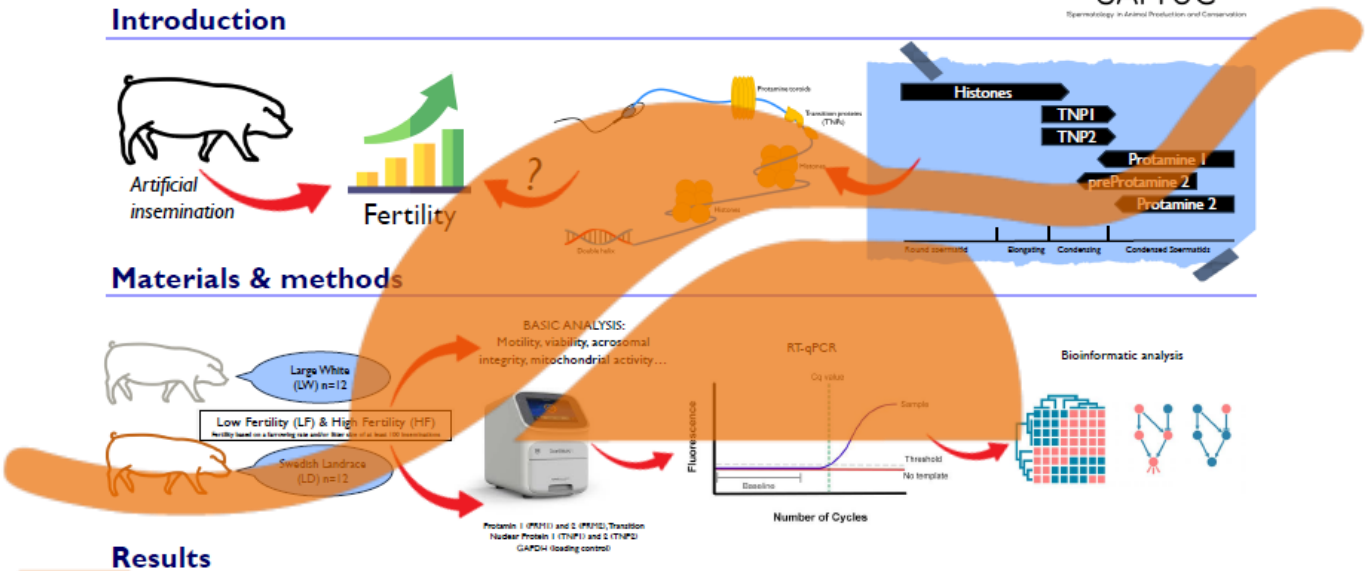
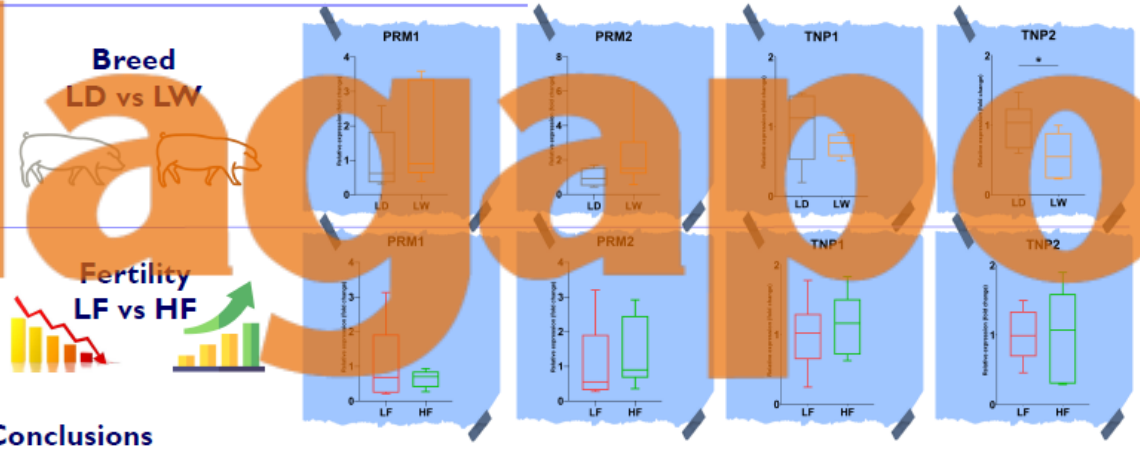
Introduction



Materials & methods

Results



Conclusions

Our preliminary results of breed-specific differences, mainly in **TNP2**, pave for further studies to elucidate whether this differential expression could have an impact on *sperm in vitro handling techniques*, in particular paying attention to DNA integrity preservation.

Acknowledgements

This study was supported by RyC2020-028615-I, PID2022-136561OB-I00, and CNS2023-144564, funded by MICIU/AEI /10.13039/501100011033 (Spain) and FSE, FEDER (EU) and NextGenerationEU/PRTR.

Nuevos Resultados

High fertile boars present a decrease in the mRNA cargo of TRPC1, a key regulator of sperm motility

Eduardo de Mercado[1]; Helena Nieto-Cristobal[1]; Maria José Martinez-Alborcia[2]; Alejandro Vicente-Carrillo[3]; Manuel Álvarez-Rodríguez[1]

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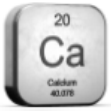
Introduction

Artificial Insemination (AI) centers and farms look for biomarkers for early identification of subfertility individuals



modulation of
- Motility
- Sperm capacitation
- Acrosome reaction

The modulation of calcium trafficking from sperm cells is linked with the presence of subfertile animals?

The transport of Ca^{2+} is mainly mediated for

CatSper channels (sperm-specific)
- Facilitate the entrance of cations during sperm capacitation
- Pivotal role in sperm egg penetration

TRPC channels 1, 4, 6
- Regulate hyperactivation
- Regulate acrosome reaction

Materials & methods

This study aimed to investigate the mRNA transcript cargo for the β, γ, and δ subunits of CatSper, as well as TRPC channels 1, 4, and 6 in sperm samples of two different pig breeds

Landrace (LD) n=12
- High Fertility (HF)
- Low Fertility (LF)

Large White (LW) n=12
- High Fertility (HF)
- Low Fertility (LF)

(Fertility based on a farrowing rate and/or litter size of at least 100 inseminations)

qPCR Real-time PCR

Total RNA extraction (miRNeasy mini kit (Qiagen, Germany)

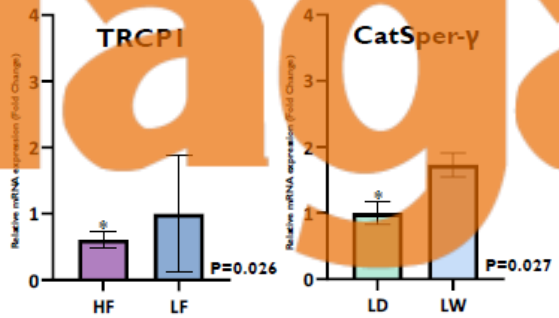
Quantitative polymerase chain reaction (qPCR) (High-Capacity RNA-to-cDNA™; Fisher-Scientific)

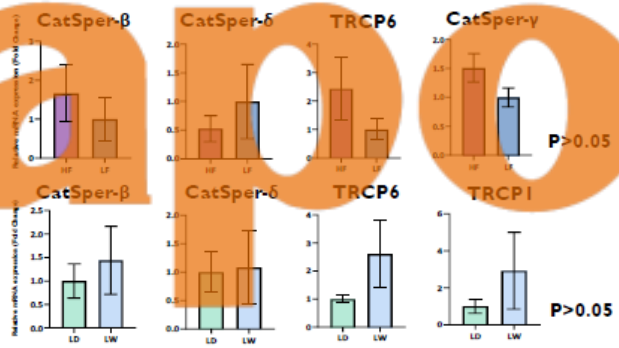
BIO-RAD

Commercial primers for TRPC1, TRPC4, TRPC6, CatSper-β, CatSper-δ, CatSper-γ and GAPDH (loading control) (Bio-Rad, USA)

SsoAdvanced Universal SYBR-Green Supermix

Results





For TRCP4, adequate expression is not achieved for all animals in our experimental conditions

Conclusions

Under our experimental conditions, a decrease in **TRPC1** mRNA could be a potential biomarker for the early identification of fertile boars. Additionally, the study found an increase in **CatSper-γ** mRNA in the Large White breed compared to the Landrace breed, highlighting breed-specific differences in fertility markers.

Acknowledgements

This study was supported by PrYC2020-006615-I, PID2020-126561OB-100, and CNS2022-144564, funded by MICIU/AEI /10.13039/501100011033 (Spain) and FSE, FEDER (EU) and NextGenerationEU/PRTR.

Nuevos Resultados

Differential expression of oestrogen and androgen receptors in spermatozoa from different boar breeds and fertility levels

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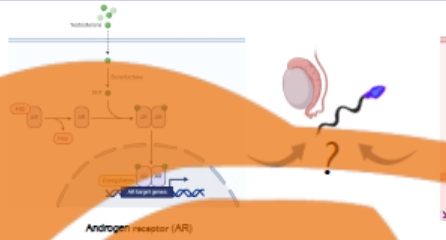
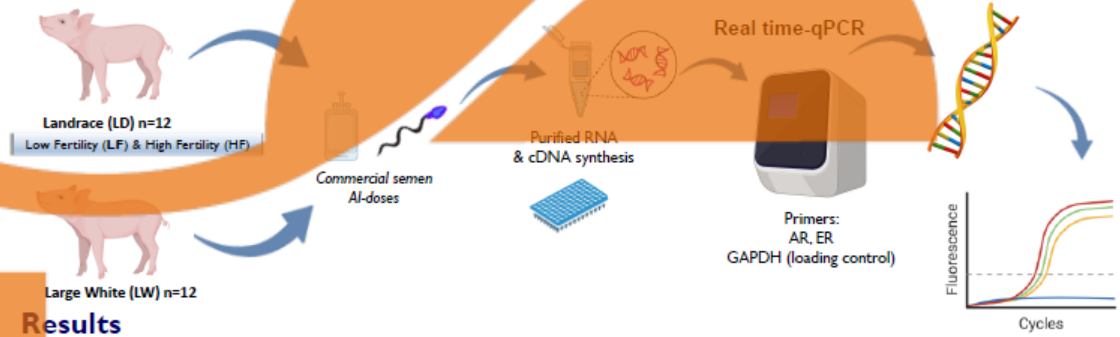
Introduction

This study aimed to identify the presence of oestrogen (**ER**) and androgen receptors (**AR**) mRNA in pig spermatozoa from two different commercial hybrid breeds (Landrace (**LD**) vs Large White (**LW**)). Moreover, a comparative analysis between two fertility levels (High Fertility (**HF**) vs Low Fertility (**LF**)) was carried out to observe potential differences.

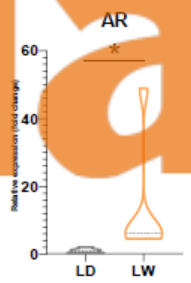


Materials & methods

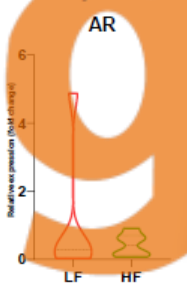


Results

Breed: LD vs LW



Fertility: LF vs HF



Summary!

* *Significant differences were found in the expression of **AR** in **LW** vs **LD**.*
* *There was no expression of **ER** in any of the selected breeds.*
* *No significant differences between **HF** and **LF** boars were found in any of the **receptors** (mRNA) analyzed.*

Conclusions

AR expression could be used as a quality biomarker under our experimental conditions, highlighting a potential key role of androgens in the maintenance and development of epididymal functions. However, further studies are needed to evaluate the specific mechanisms behind the mRNA expression of its receptor, AR, among groups of different breeds.

Acknowledgements

This study was supported by RyC2020-028615-I, PID2022-136561OB-I00, and CNS2023-144564, funded by MICIU/AEI /10.13039/501100011033 (Spain) and FSE, FEDER (EU) and NextGenerationEU/PRTR.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03. Conclusiones

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- Receptores presentes en espermatozoides
- Relación con fertilidad: ¿macho?
- Estudios funcionales
- ¿Mecanismos conservados entre especies?
- Modulación: herramientas biotecnológicas

THANKS

GRACIAS

Manuel Álvarez Rodríguez