Predicting embryo quality – mRNA and the preimplantation embryo

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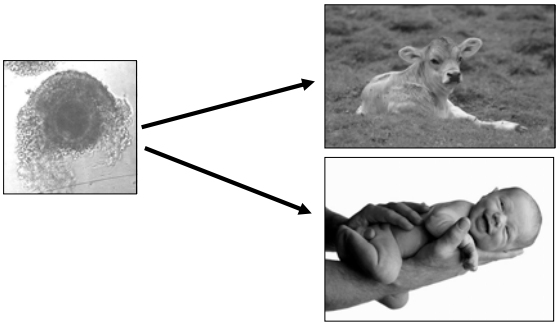
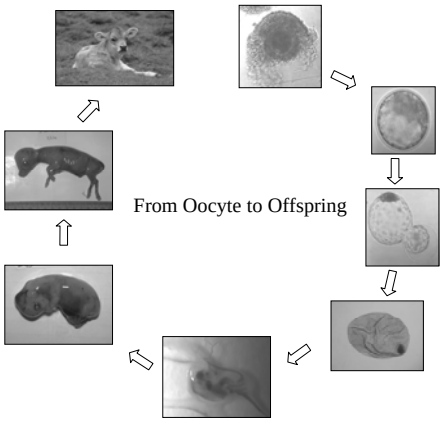
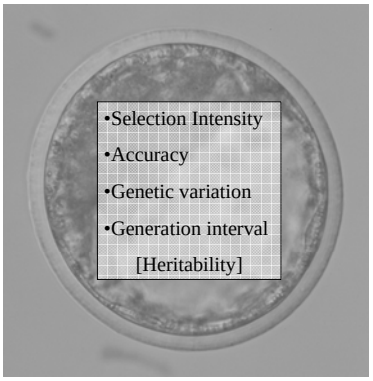
From Oocyte to Offspring

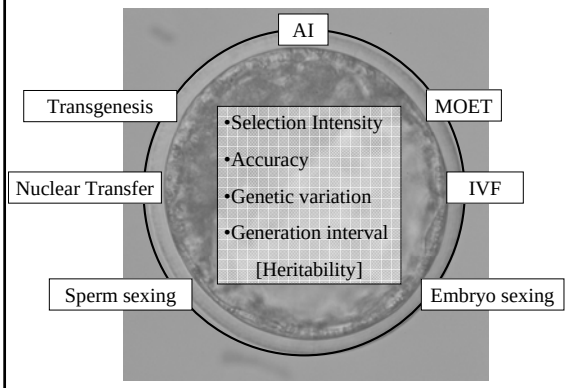


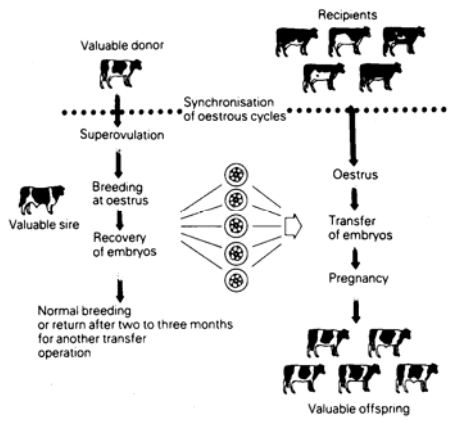


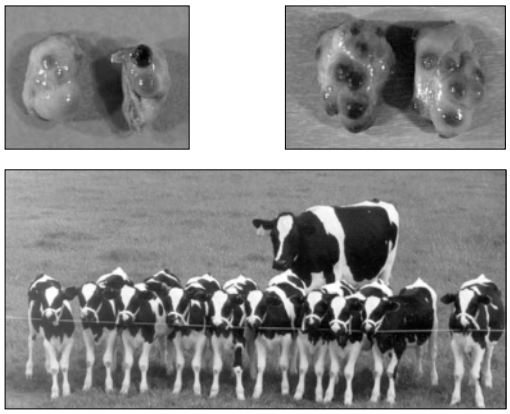
IVF in animals vs humans

- Motivation
  - Basic research
  - Infertility treatment
  - Genetic progress – Production efficiency



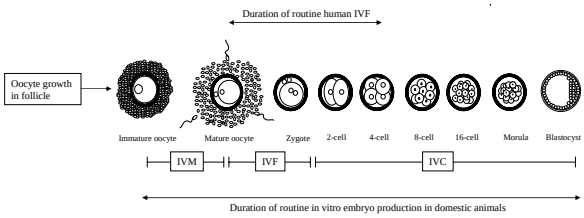


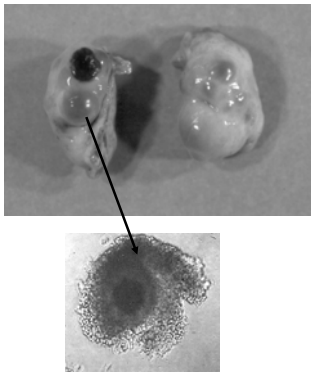


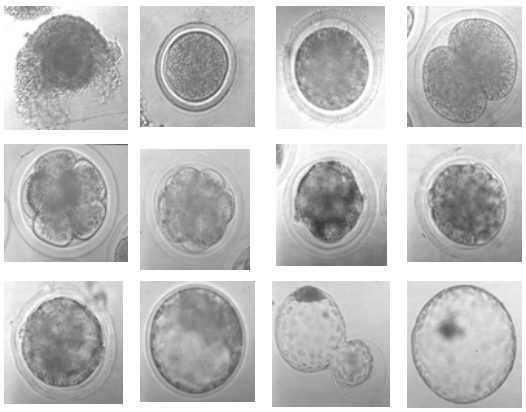


IVF in animals vs humans

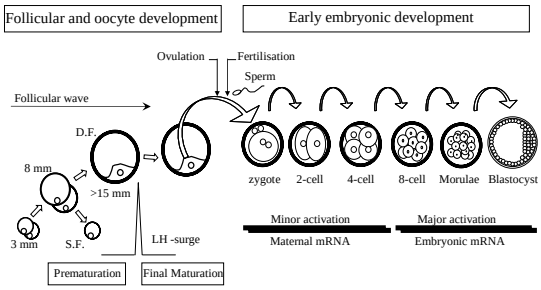
- Motivation
  - Basic research
  - Infertility treatment
  - Genetic progress – Production efficiency
- Ethical/moral issues
- Techniques


Duration of routine human IVF
Oocyte growth in follicle
Immature oocyte
Mature oocyte
Zygote
2-cell
4-cell
8-cell
16-cell
Morula
Blastocyst
IVM
IVF
IVC
Duration of routine in vitro embryo production in domestic animals

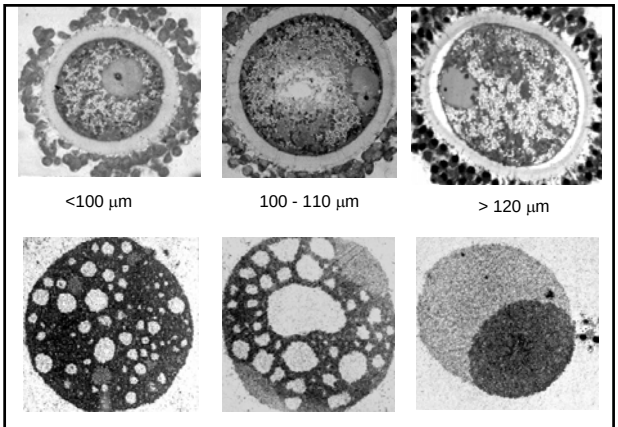




Oocyte and Embryo Development

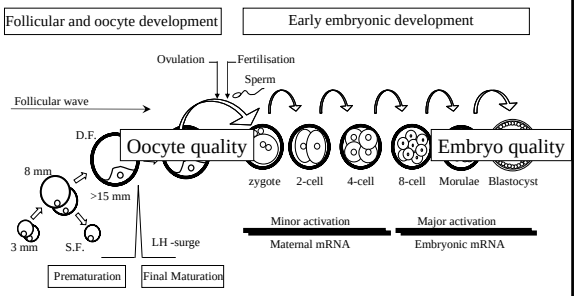


Dieleman et al., 2002 *Theriogenology*



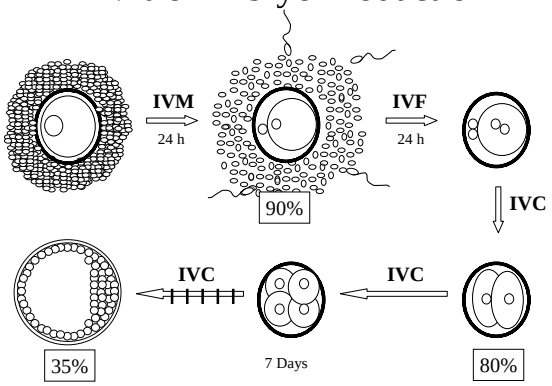
Fair et al.,(1996). Mol Reprod Dev.

Oocyte and Embryo Development

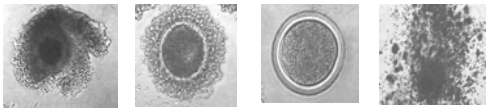


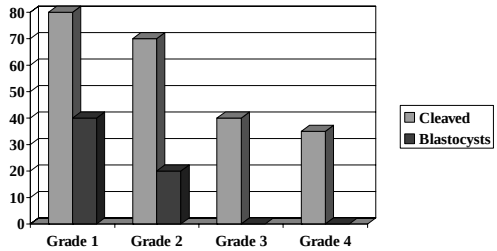
Dieleman et al., 2002 *Theriogenology*

In Vitro Embryo Production



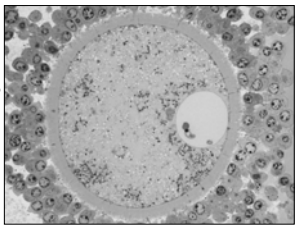
Oocyte Morphology



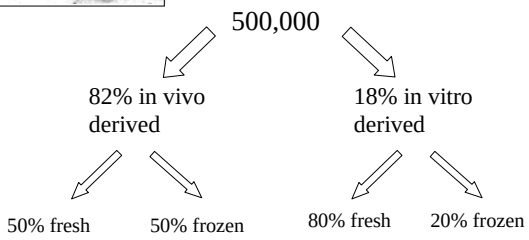


Towards Improving Blastocyst Yield

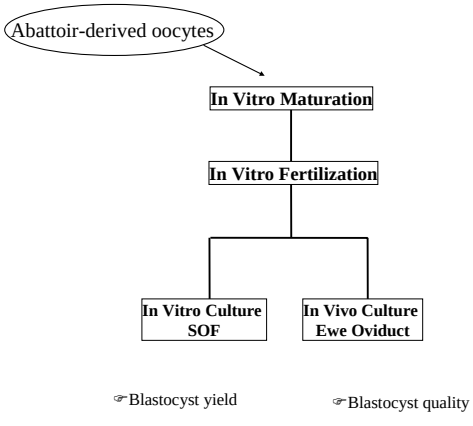
- "Prematuration"
  - Co-culture
  - cAMP modulators
  - 6-DMAP
  - Cycloheximide
  - Butyrolactone I
  - Roscovitine



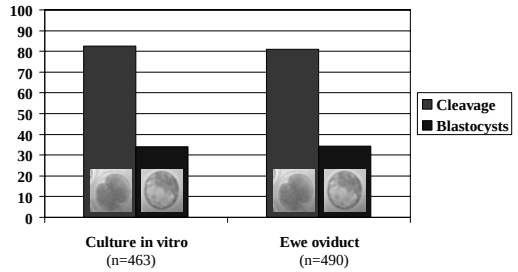
Commercial Embryo Transfer Data



Thibier (2004)

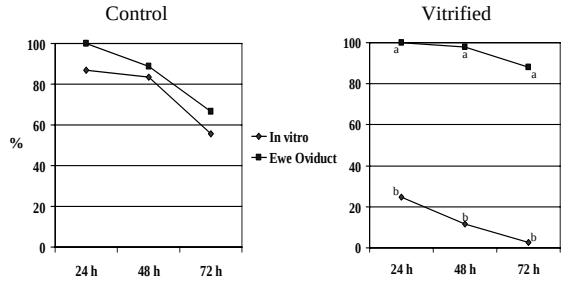


Culture In Vivo Does Not Improve Blastocyst Yield

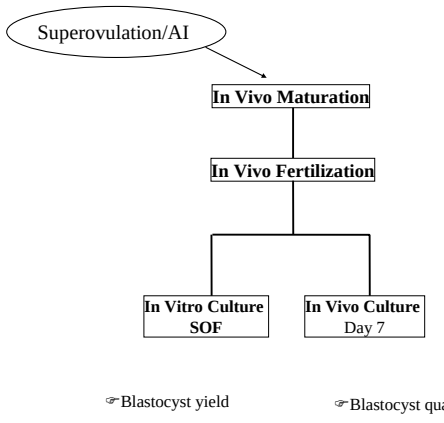


Rizos et al., 2002 *Mol Reprod Dev*

Culture In Vivo Improves Blastocyst Quality



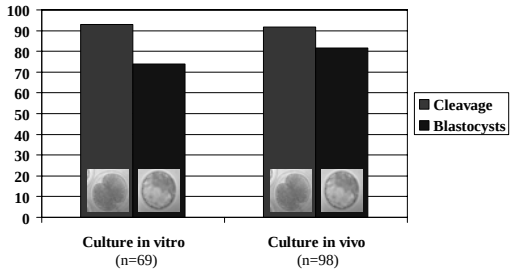
Rizos et al., 2002 *Mol Reprod Dev*



☞Blastocyst yield

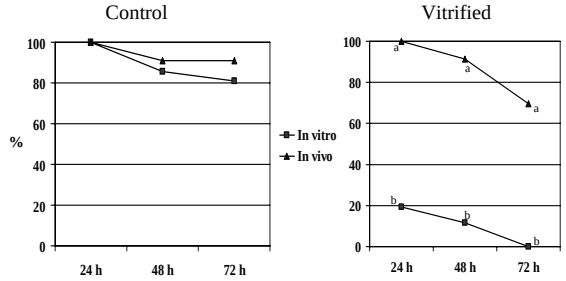
☞Blastocyst quality

Culture In Vitro Is Not Detrimental For Blastocyst Yield

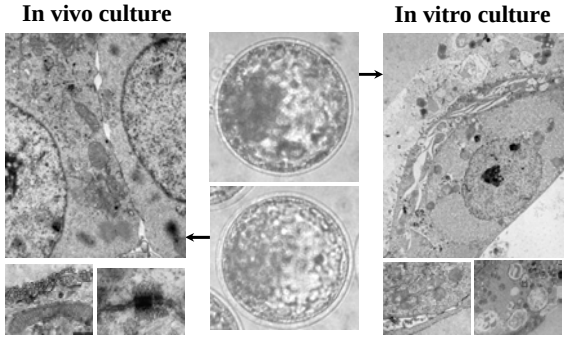


Rizos et al., 2002 *Mol Reprod Dev*

Culture In Vitro Is Detrimental For Blastocyst Quality



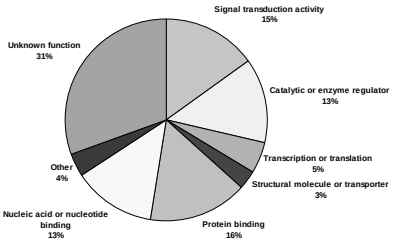
Rizos et al., 2002 *Mol Reprod Dev*



Fair et al., 2001; Rizos et al., 2002 *Mol Reprod Dev*

Distribution of significant genes

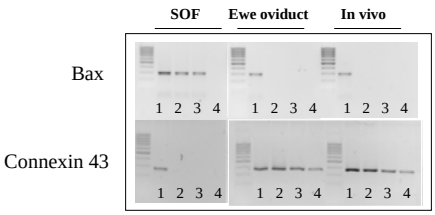
◆Biological process ◆Cellular component ◆Molecular function



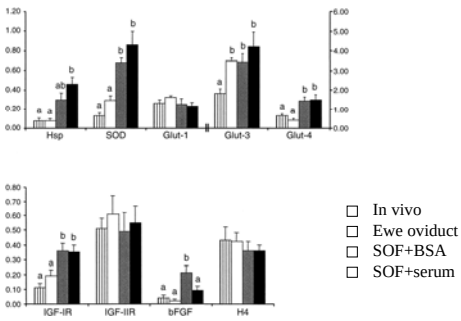
% up and down regulated (P<0.05)

Corcoran et al., 2006 *Reproduction*

mRNA Abundance Reflects Quality

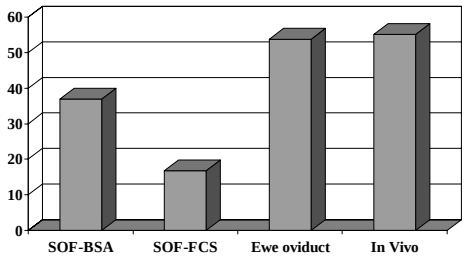


Rizos et al., 2002 *Biol Reprod*

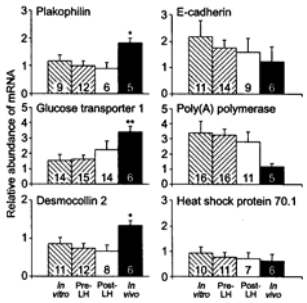


Lazzari et al., 2002 *Biol Reprod*

Pregnancy rates

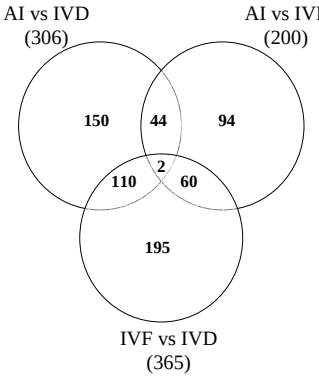


Lazzari et al., 2002 *Biol Reprod*

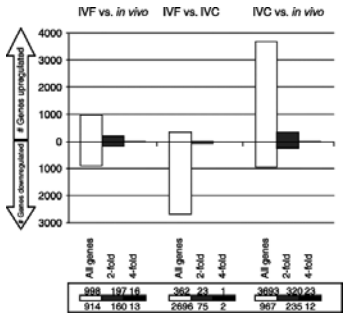


Knijn et al., 2002, *Reproduction*

- 6300 genes
- Blastocyst %: 37 v 75%

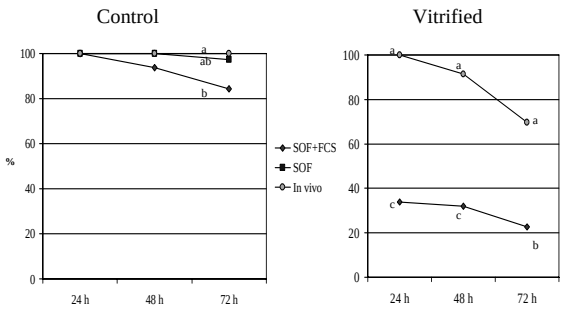


Smith et al. *IETS 2006, Poster 6*



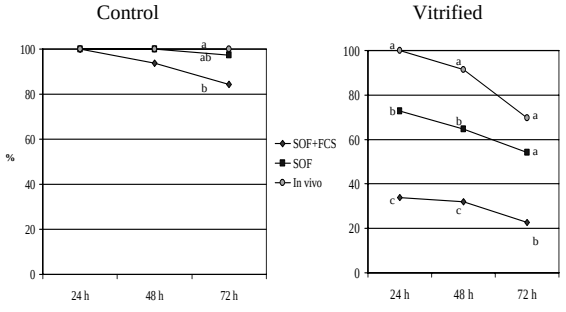
Giritharan et al., 2007 *Reproduction*

Effect of serum on cryotolerance

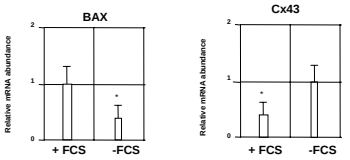


Rizos et al., 2003 *Biol Reprod*

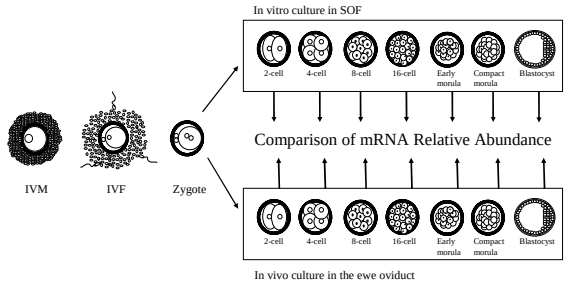
Effect of serum on cryotolerance



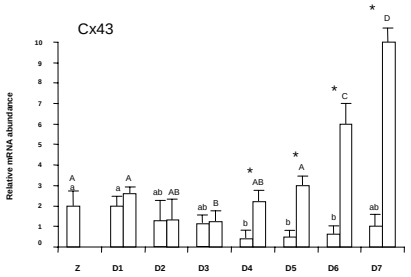
Rizos et al., 2003 *Biol Reprod*



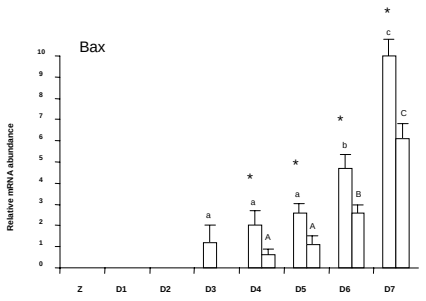
Rizos et al., 2003 *Biol Reprod*



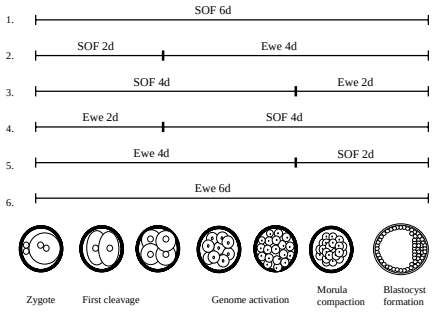
Lonergan et al., 2003 *Biol Reprod*



Lonergan et al., 2003 *Biol Reprod*

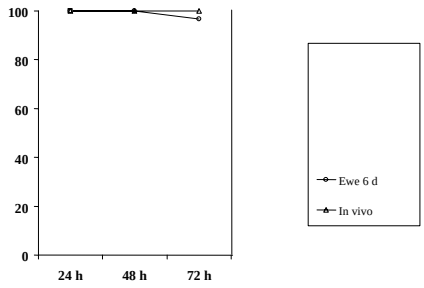


Lonergan et al., 2003 *Biol Reprod*



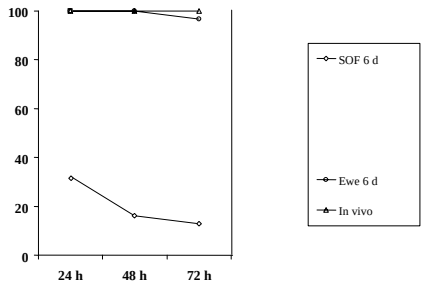
Lonergan et al., 2003 *Reproduction*

Cryotolerance



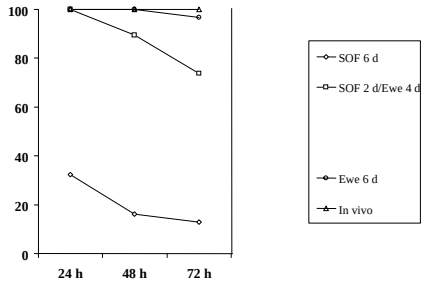
Lonergan et al., 2003 *Reproduction*

Cryotolerance



Lonergan et al., 2003 *Reproduction*

Cryotolerance



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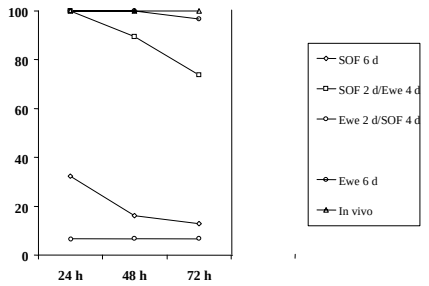
Cryotolerance



Lonergan et al., 2003 *Reproduction*

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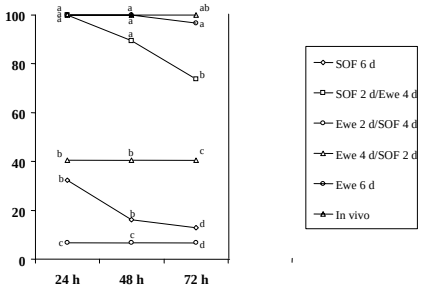

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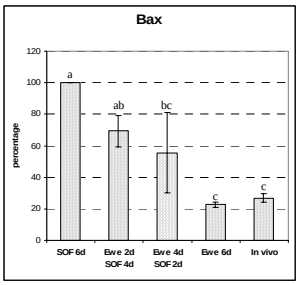

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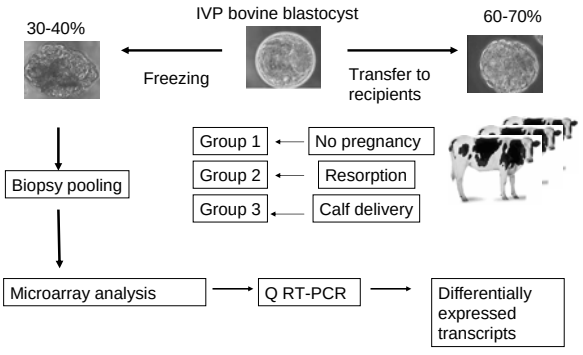
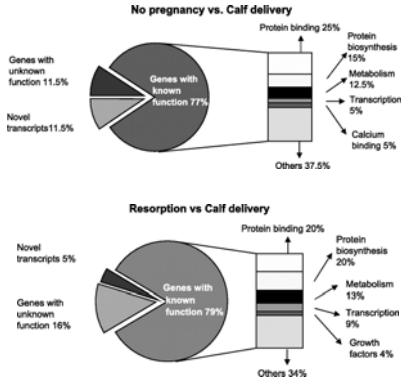


El-Sayed et al., 2006 *Physiol Genomics*



El-Sayed et al., 2006 *Physiol Genomics*

Conclusions

- Oocyte quality main determinant of blastocyst yield
- Post-fertilization culture environment main determinant of blastocyst quality
- Can alter the pattern of mRNA expression by modification of the media with an associated increase in cryotolerance
- Temporal association between culture environment and mRNA expression
- Some windows of development may be more predisposed to aberrant programming than others

Acknowledgments

- INIA, Madrid
- MSU
- Universities of Bonn/Vienna
- UCD

Thank You