FACULTY OF VETERINARY MEDICINE
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REPRODUCTIVE BIOLOGY

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MULTIPOLAR ZYGOTIC DIVISIONS RESULT IN MULTINUCLEAR AND ANUCLEAR BLASTOMERES IN CATTLE

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Background

- Time-lapse imaging allows continuous monitoring of embryo development.
- Although mammalian zygotes are expected to cleave into two mononuclear blastomeres, zygotes often cleave in three or four cells **(multipolar zygotic division)**.
- Multipolar zygotic divisions are associated with a lower blastocyst development and pregnancy rate, and a higher frequency of chromosomal abnormalities.
- Multinucleated and anuclear blastomeres have been observed in human cleavage-stage embryos.

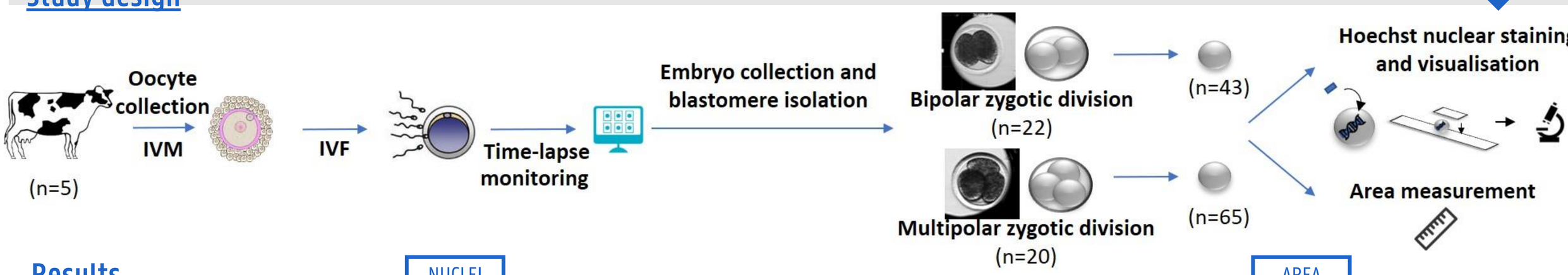
Hypothesis

Multipolar zygotic divisions result in genetic abnormalities by concurrent aberrant segregation of the chromosomal material.

Aims

To determine the prevalence of nuclear abnormalities in bovine embryos after the zygotic cleavage and the effect of multipolar division on nuclear abnormalities in the resulting blastomeres.

Study design



Results

NUCLEI

A greater number of blastomeres presented with an aberrant nuclear content (anuclear or multinuclear) (26.8 ± 0.7%) when the zygote underwent multipolar division (7.6 ± 0.4%) (Fig. 1) as compared to bipolar division (7.4 ± 0.4) ($P < 0.001$) (Fig. 2).

Fig. 1

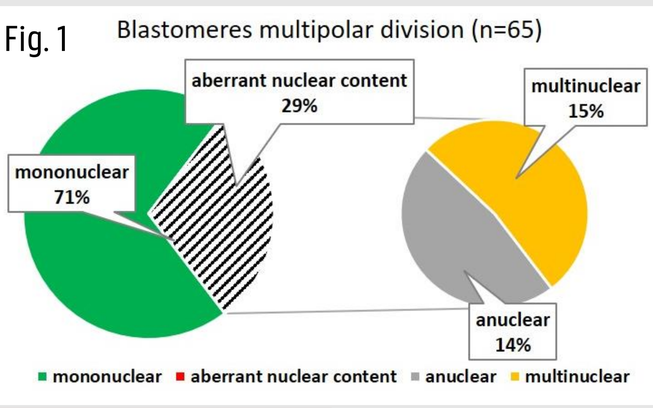
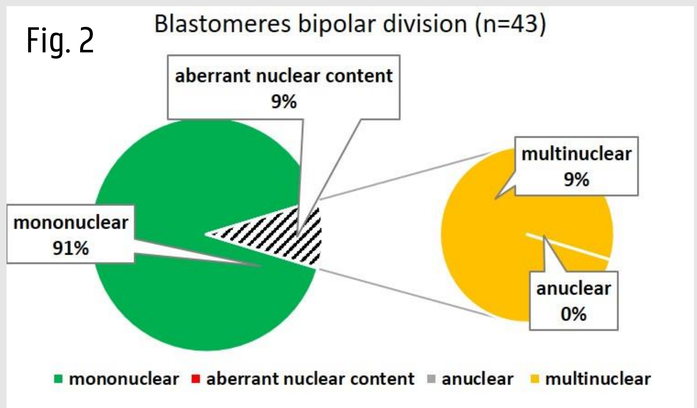


Fig. 2



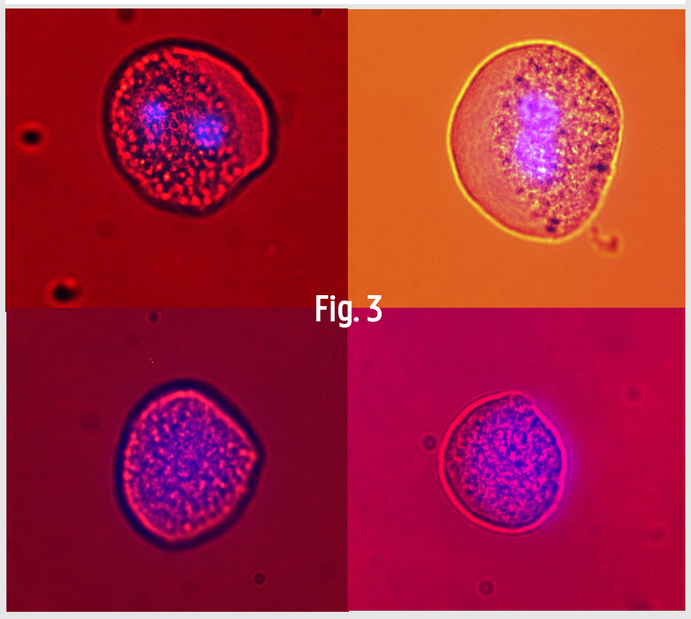


Fig. 3 Two multinuclear (top) and two anuclear (bottom) blastomeres resulting from a tetrapolar zygotic division.

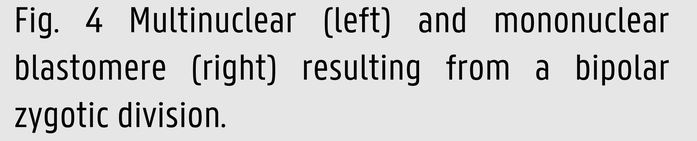
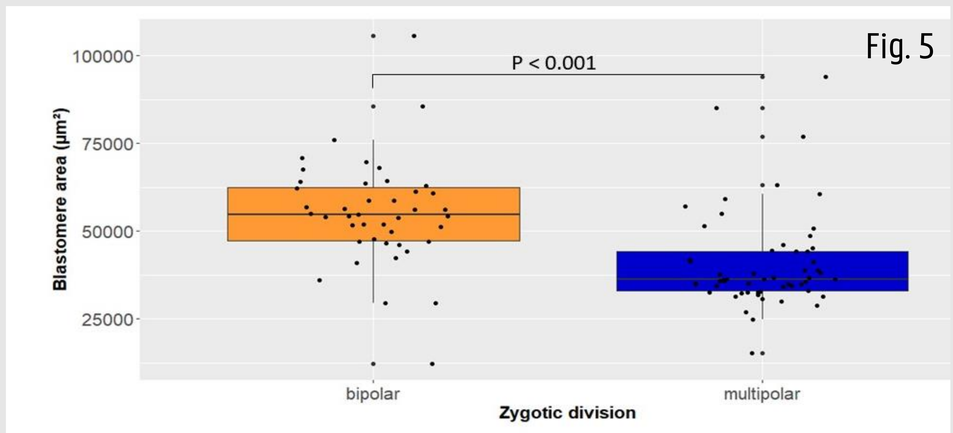


Fig. 4 Multinuclear (left) and mononuclear blastomere (right) resulting from a bipolar zygotic division.

AREA

Blastomeres resulting from a multipolar zygotic division presented with a reduced area (28%) compared to blastomeres resulting from a bipolar zygotic division (Fig. 5).

Fig. 5



Blastomeres resulting from multipolar (Fig. 6) or bipolar zygotic divisions (Fig. 7) tended to have a larger blastomere area if more nuclei were present.

Fig. 6

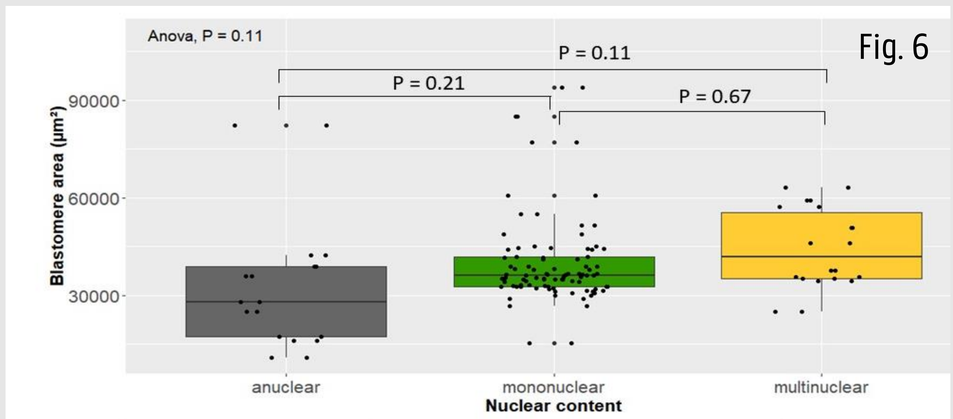
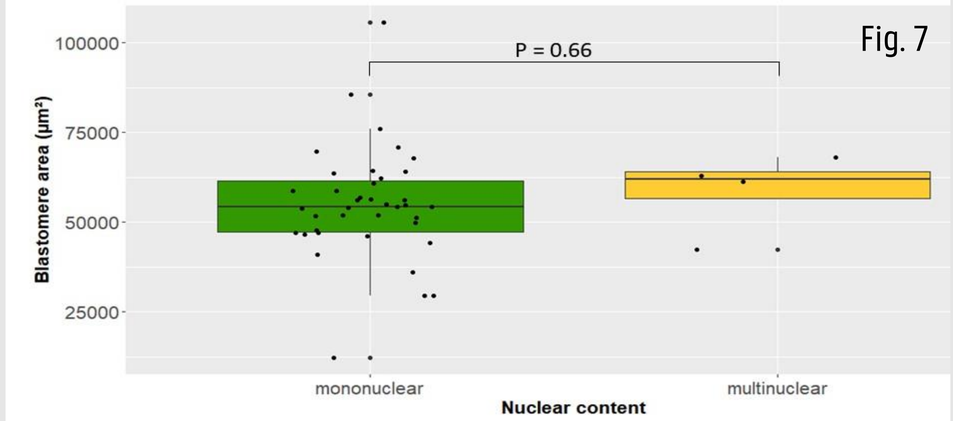


Fig. 7



Conclusion

- Nuclear abnormalities are prevalent in bovine embryos after the zygotic division.
- Multipolar zygotic division results in an increased number of nuclear abnormalities.
- Embryo dynamics of the zygotic division may be associated with aberrant genome segregation, explaining some of the genetic abnormalities observed at early development.

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