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Learning Objectives

- Define zygote morphology and its biological significance
- Relate zygote morphology to embryo development
- Discuss how zygote morphology can affect the clinical outcome



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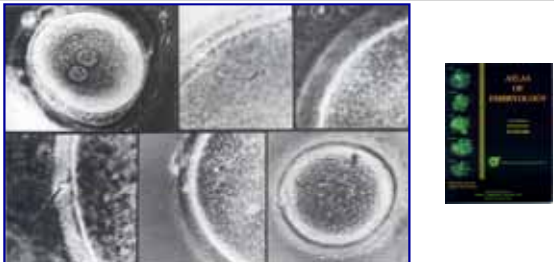
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*"These illustrations were taken between 1962 and 1972 when founding investigations into early human embryology were opening prospects of IVF and assisted human conception, the preimplantation diagnosis of inherited disease and the growth of embryonic stem cells....."*

Robert G. Edwards



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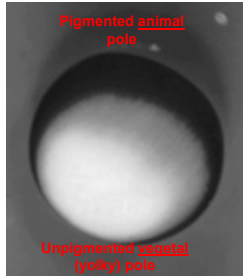
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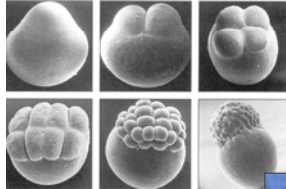
### Oocyte and Embryo Polarity



Siegel, 1987



well established in lower order animals:  
C. Elegans, Xenopus, Drosophila  
.....



S.I.S.M.E.R. VISION 2000

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### Polarity and embryo development

Gardner 1996/ Edwards 1997

Polarity exists in oocytes (polar body position directs the animal-vegetal pole) and controls embryo polarity and axes.

Zernika-Goetz 1998 / 2002

No essential components are localized uniquely to the animal or the vegetal pole. The first axis is set up by sperm entry site.

Hiragi and Solter 2004 / 2005

The plane separating the 2 pronuclei as they move to the center of the oocyte sets up the first axis (in the mouse).

Hansis & Edwards 2003 / 2005

Polarity in human 4-cell embryos, but not related to the oocyte or zygote.

S.I.S.M.E.R. VISION 2000

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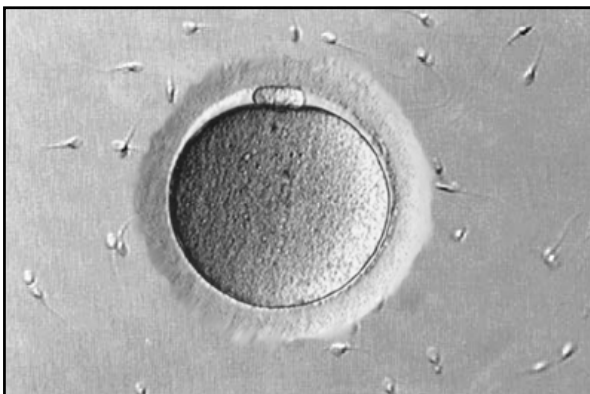
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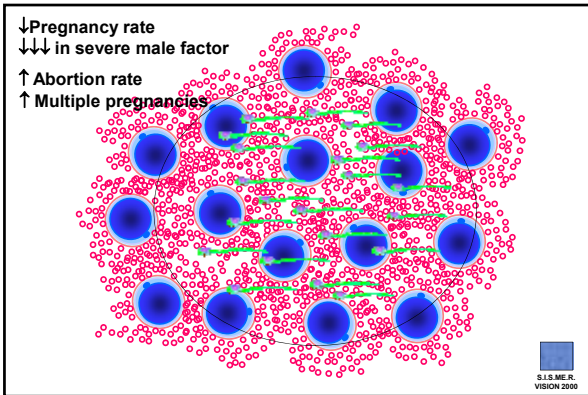
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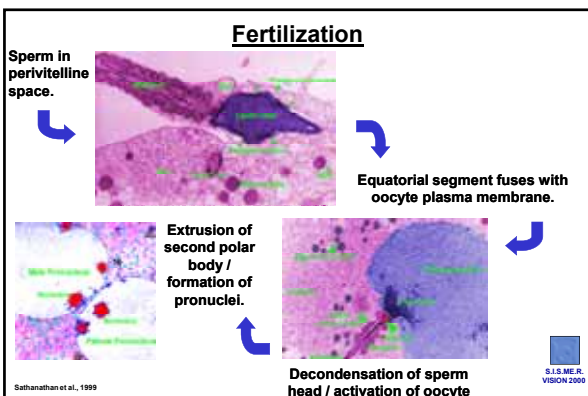
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### Fertilization after ICSI and IVF

Events	IVF*	ICSI*	
Extrusion of 2 PB	2:47 ± 39	2:50 ± 1:09	ns
Formation of Male PN	5:25 ± 1:13	5:15 ± 1:19	ns
Formation of Female PN	5:41 ± 1:06	5:17 ± 1:30	ns
Abuttal	7:31 ± 1:27	7:35 ± 1:34	ns

\*hours:mins

Diana Payne, 2006




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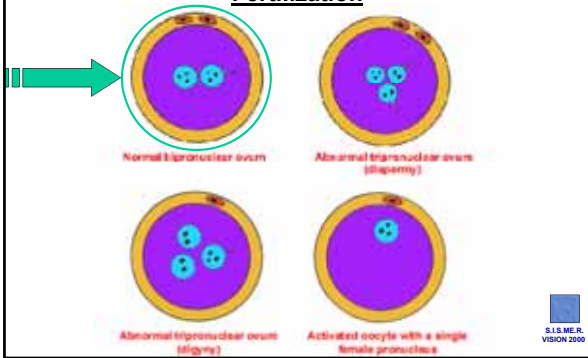
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### Fertilization




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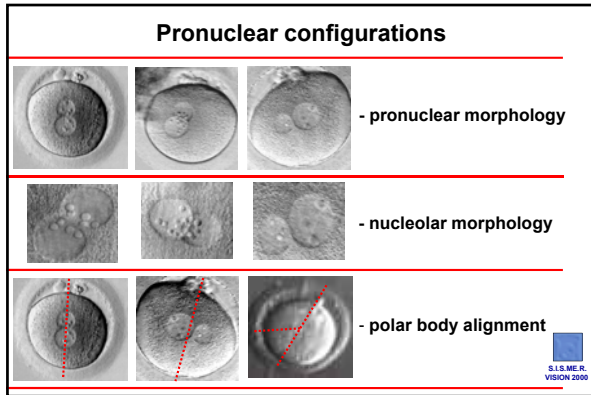
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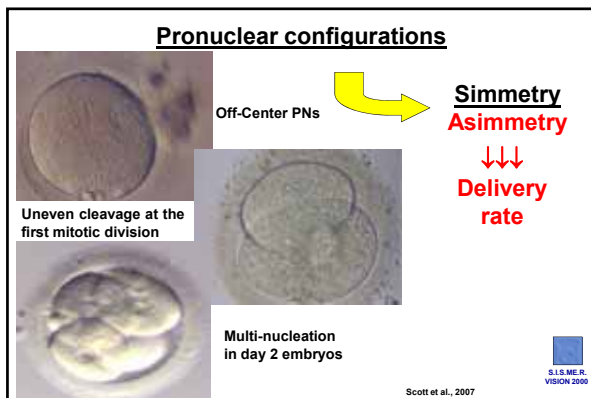
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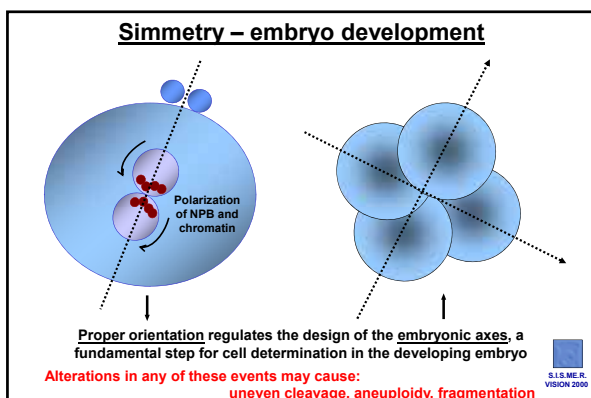
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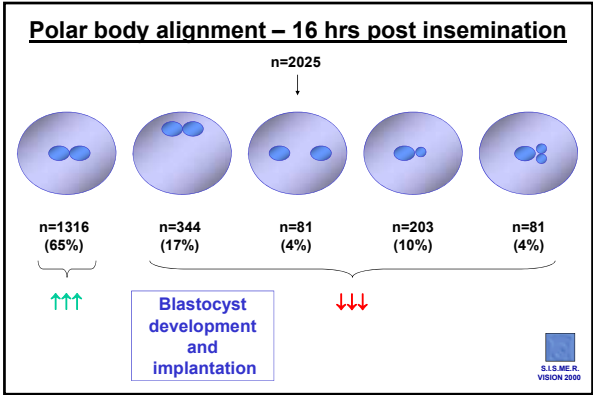
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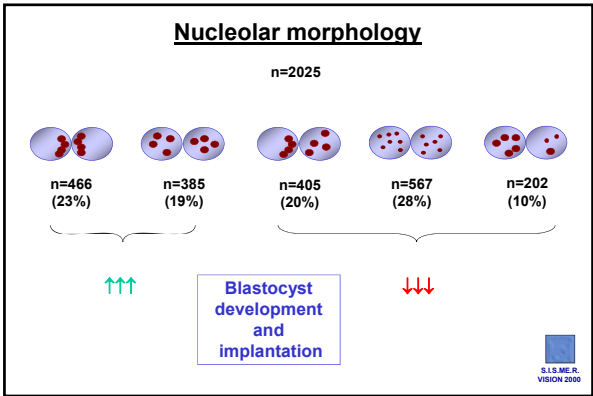
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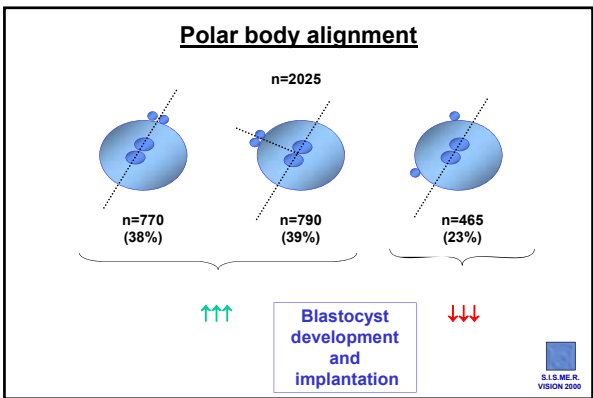
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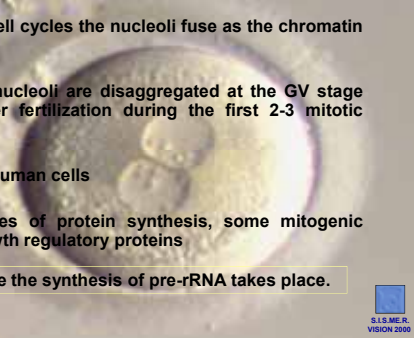
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### Nucleolar morphology

- During mitotic cell cycles the nucleoli fuse as the chromatin condenses
  - In oocytes the nucleoli are disaggregated at the GV stage and reform after fertilization during the first 2-3 mitotic divisions
  - Between 5-7 in human cells
  - Nucleoli are sites of protein synthesis, some mitogenic factors and growth regulatory proteins
- the sites where the synthesis of pre-rRNA takes place.



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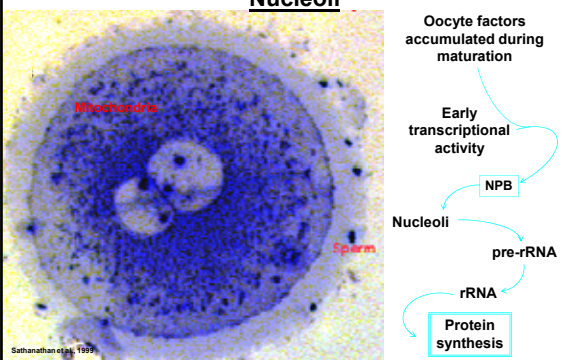
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### Nucleoli



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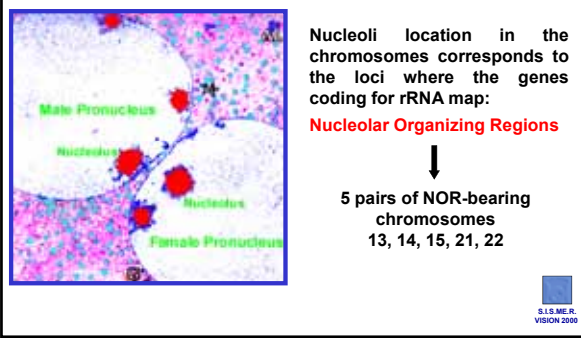
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### Nucleoli



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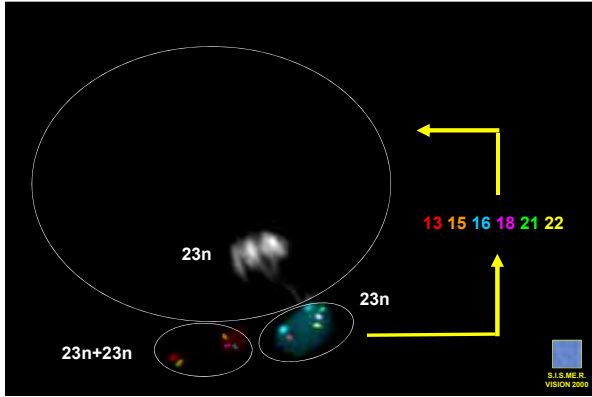
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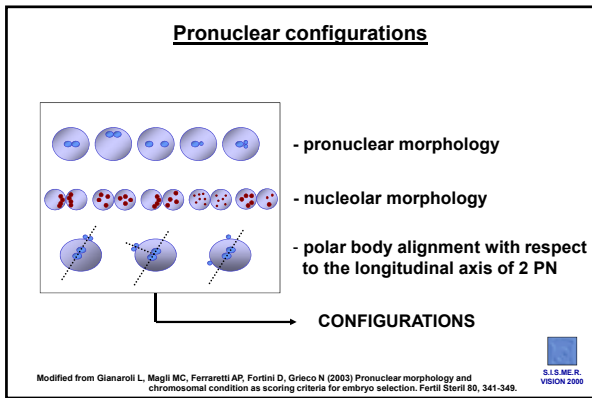
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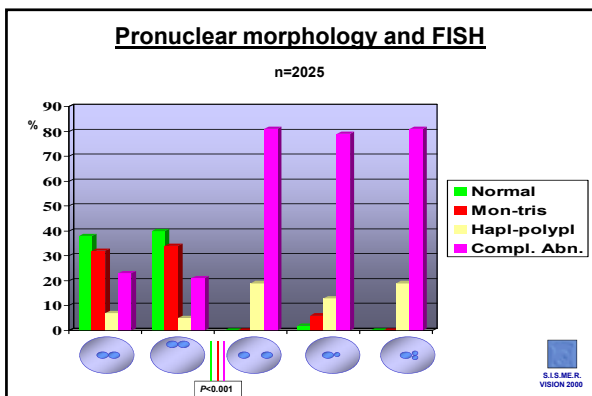
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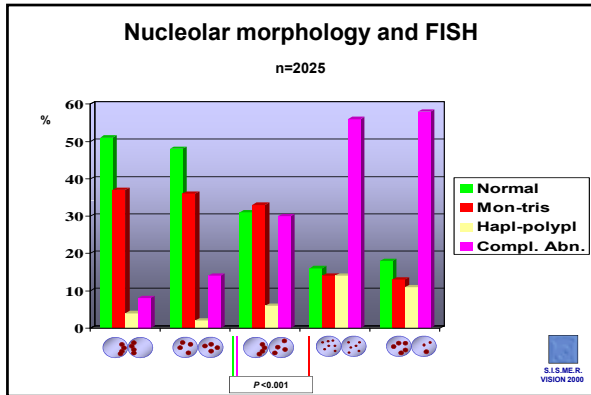
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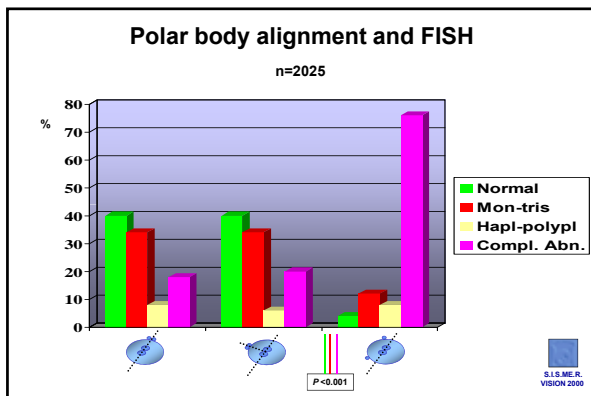
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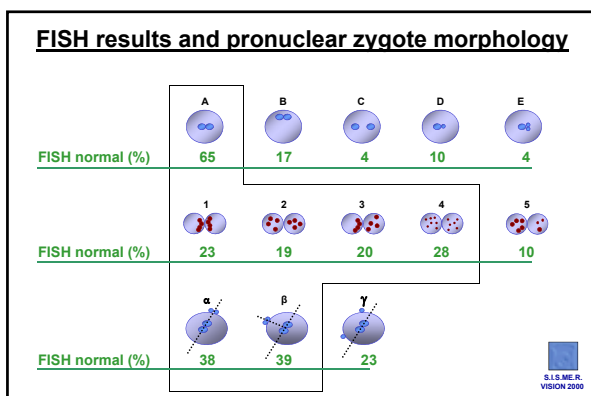
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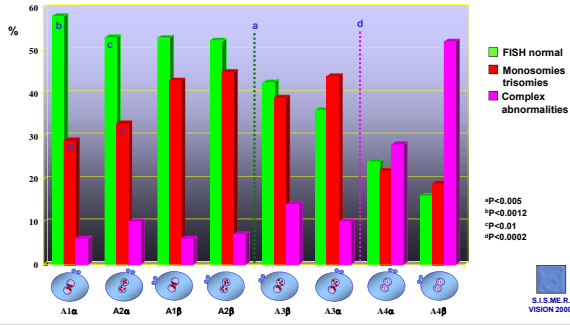
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### Pronuclear configurations and chromosomal status




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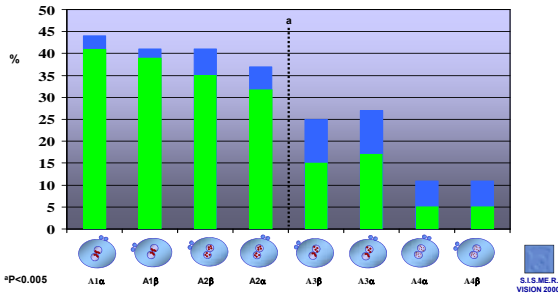
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### Development to morula in relation to pronuclear zygote configuration




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### Clinical results

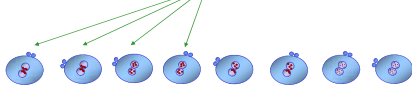
86 gestational sacs with fetal heart beat



44 ← morphology



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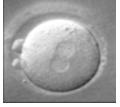

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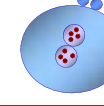
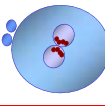
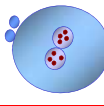
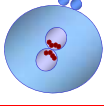
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**Pronuclear configurations**


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Implantation rate



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**Conclusions**

**Zygote morphology**

- Has a significant impact on embryo development and blastocyst formation
- Has an impact on implantation rates
- Is correlated with euploidy / aneuploidy



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