

# MORPHOLOGICAL MARKERS of OOCYTE QUALITY

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Landes- Frauen- und Kinderklinik, IVF-Unit  
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ESHRE Campus  
Tours  
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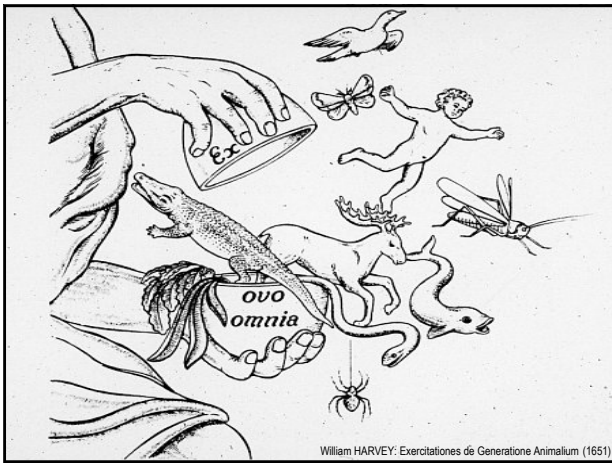
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Labels in image:

- ZP COLOUR
- ZP BIREFRINGENCY
- CYTOPLASM COLOUR
- VACUOLE
- INCORPORATION
- OOCYTE SHAPE
- CYTOPLASM VISCOSITY
- AGGREGATION SER
- REFRACTILE BODY
- ZP THICKNESS
- MEIOTIC SPINDLE
- PVS SIZE
- 1 PB MORPHOLOGY
- PVS GRANULA
- OOCYTE SIZE

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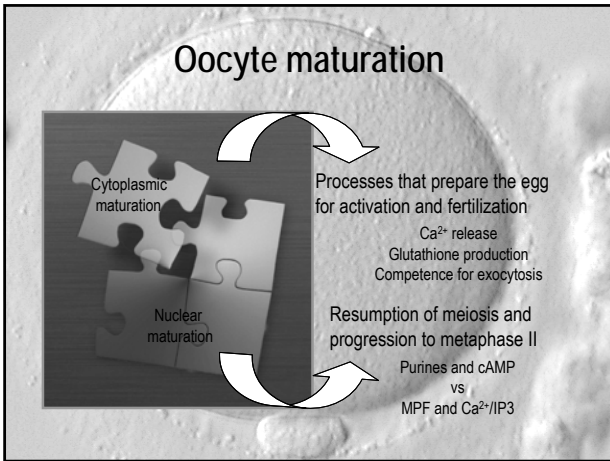
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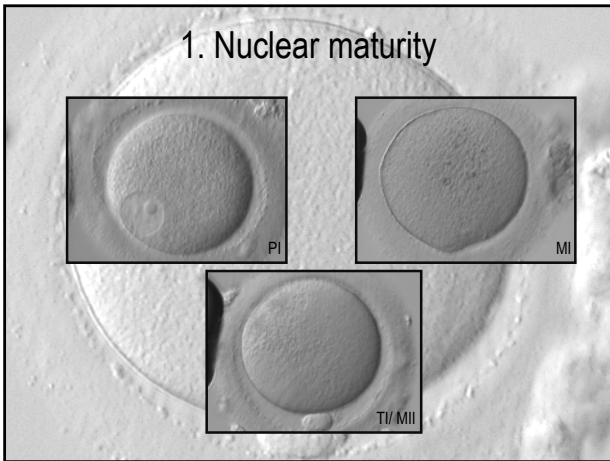
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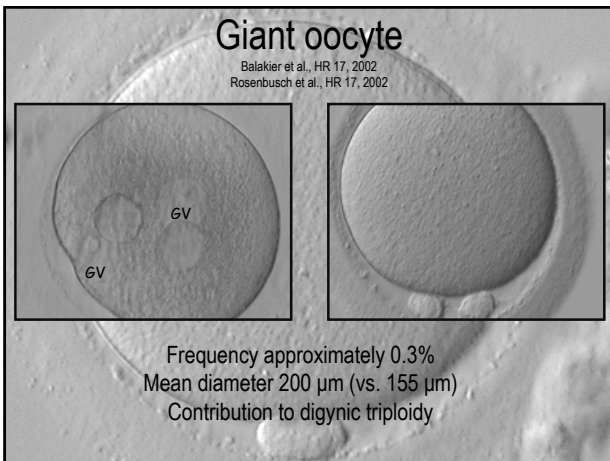
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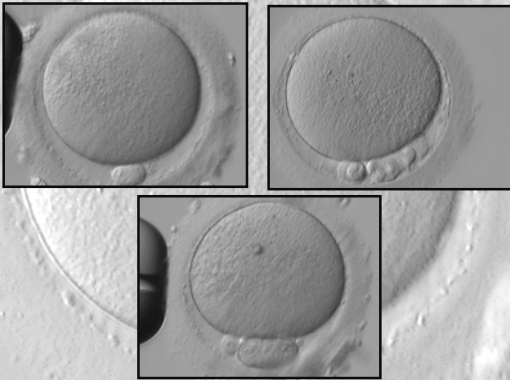


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### First polar body morphology



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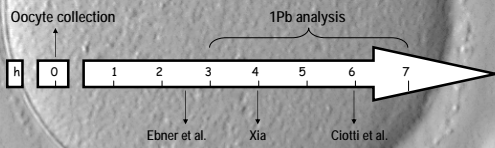
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### First polar body and outcome

Xia, HR 12, 1997  
Ebner et al., F&St 1999, HR 2000, HR 2002  
Ciotti et al., HR 19, 2004

Since first polar body has a short half-life time it is thought to be an indicator of postovulatory age of the oocyte



Morphology of polar body has nothing to do with chromosomal situation of the gamete

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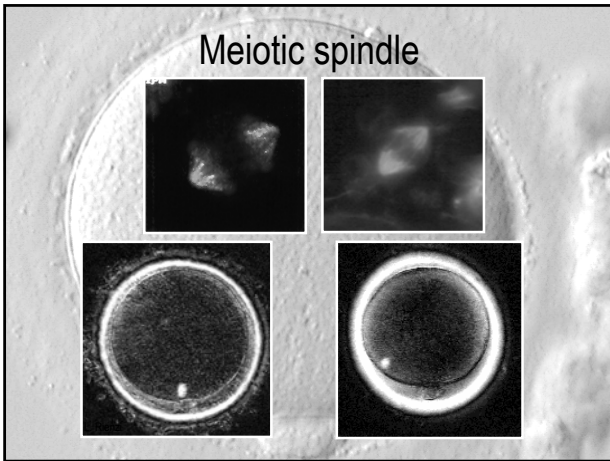
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### Birefringent spindle and outcome

Author	spindle positive	spindle near Pb	Fertilization		
			spindle	none	
Wang et al., 2001	327/533 (61.4)	61 (18.7)	61.8%	44.2%	↔
Wang et al., 2001	1266/1544 (82.0)	nd	69.4%	62.9%	↔
Cooke et al., 2003	115/124 (92.7)	35 (30.4)	70.4%	nd	
Moon et al., 2003	523/626 (83.6)	252 (48.2)	84.9%	75.5%	↔
Rienzi et al., 2003	484/532 (91.0)	254 (52.5)	74.8%	33.3%	↔
Cohen et al., 2004	585/770 (76.0)	nd	70.6%	62.2%	↔
Konc et al., 2004	320/428 (74.8)	31 (9.7)	73.4%	nd	

nd: no data available

↔ P<0.001  
↔ P<0.05

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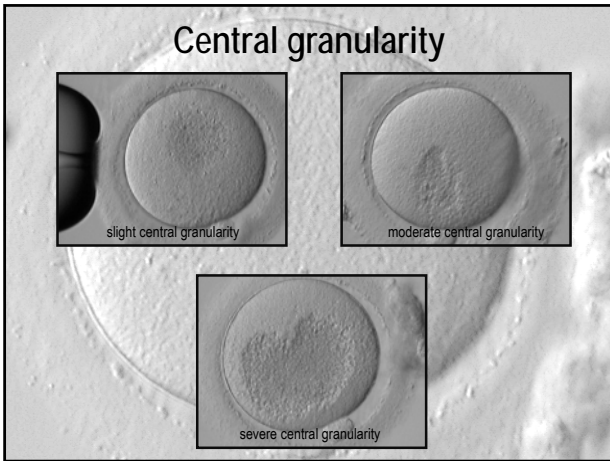
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### Relationship between central granularity and pregnancy outcome

Kahraman et al., HR 15, 2000

- Anomaly was observed in 8% of the cycles (35% of the eggs were positive)
- Fertilization rate, embryo quality were inconspicuous
- Ongoing pregnancy rate was 12.8% (from slight form of CG), the implantaion rate 4.3%
- PGD in 44 blastomeres from impaired embryos revealed that 52.3 % were in fact aneuploid

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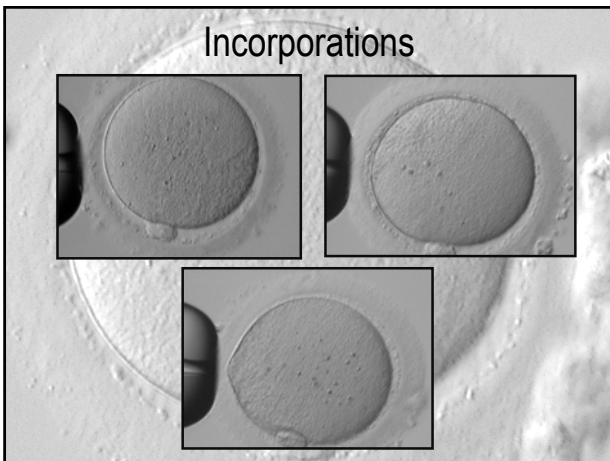
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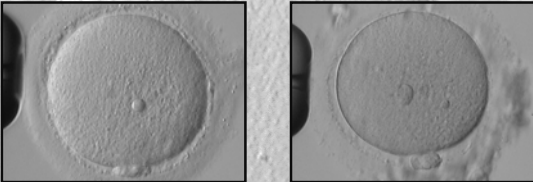
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### Refractile bodies

Otsuki et al., JARG 24, 2007



Viewed by transmitted electron microscopy, the refractile bodies showed the conventional morphology of lipofuscin inclusions and consisted of a mixture of lipids and dense granule materials

Larger lipofuscin inclusions (>5 μm) were associated with significantly reduced fertilization and unfavorable blastocyst development

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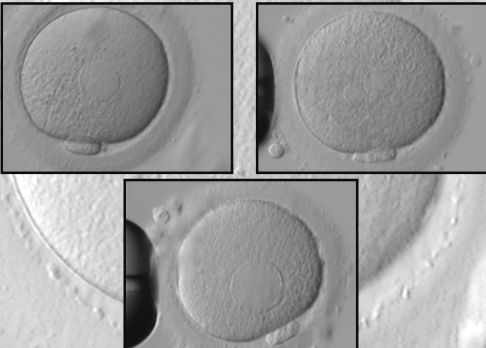
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### Aggregation of smooth endoplasmic reticulum




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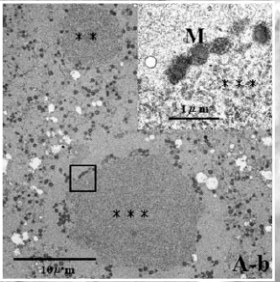
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### Relationship between sER clusters and outcome

Ebner et al., RBM 16, 2008; Otsuki et al., HR 19, 2004

- 6.2 to 9.4% of the cycles affected
- To our experience less than 2% of oocytes are affected (25% in pos cycles)
- Only MII oocytes
- Normal fertilization if rupture of sERC is avoided
- At lightmicroscopical level not all sERCs can be seen (2-9μm)!
- Blastocyst formation was 18%




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## Relationship between sER clusters and outcome

Ebner et al., RBM 16, 2008;

- No relation to stimulation protocol, age, endometriosis but to E<sub>2</sub>, dose of gonadotrophins, duration of COH
- sERC presence resulted in a disastrous outcome
  - IR, PR no difference
  - Biochemical pregnancies 58% vs 22% (P<0.01)
  - Take-home baby rate 42% vs 78.% (p<0.001)
  - Increase in obstetric problems (33% vs. 5%) and lower birth weight (2500g vs. 3100g)
  - 2/6 stillbirths (not to forget one Beckwith-Wiedemann syndrome in the Otsuki paper)

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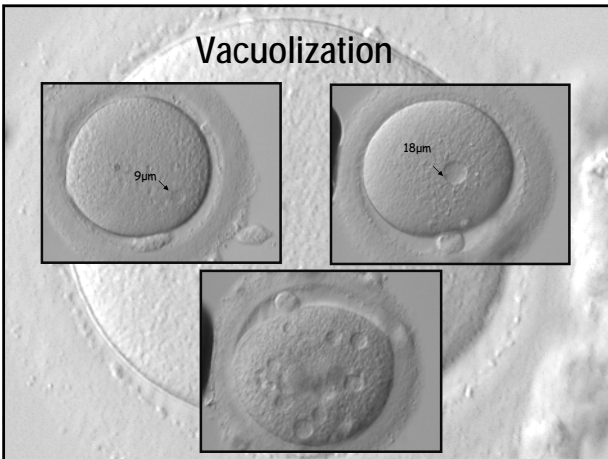
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## Vacuolization



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## Formation of vacuoles

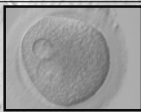
Vacuoles are membrane-bound cytoplasmic inclusions filled with fluid that is virtually identical with perivitelline fluid



Vacuoles can arise spontaneously around extrusion of the first polar body  
Van Blerkom, 1990



Vacuoles can form from preexisting vesicles derived from the ER or GA  
El Shafei et al., 2000



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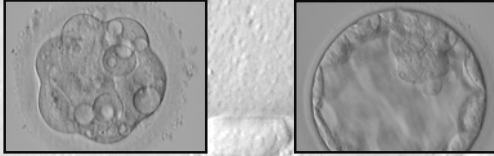
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## Occurrence and developmental consequences of vacuoles

Ebner et al., F&St 83, 2005

- 47 out of 1198 MII-oocytes showed at least one vacuole (3.9%)
- In 66% of these affected oocytes a singleton vacuole was observed
- Fertilization rate was influenced negatively (48.9% vs 65.3%)
- A threshold was found above which fertilization did not occur (14  $\mu$ m)
- Vacuolized oocytes had a blastocyst formation rate of only 12.5% compared to unaffected gametes (48.6%) ( $p < 0.05$ )



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## Perivitelline space granularity

Hassan-Ali, HR 13, 1998



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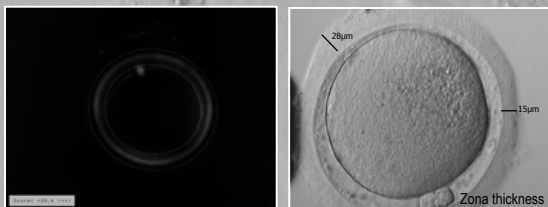
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## Zona pellucida dysmorphisms

Shen et al., HR 20, 2005 ; Montag et al., RBM 16, 2008



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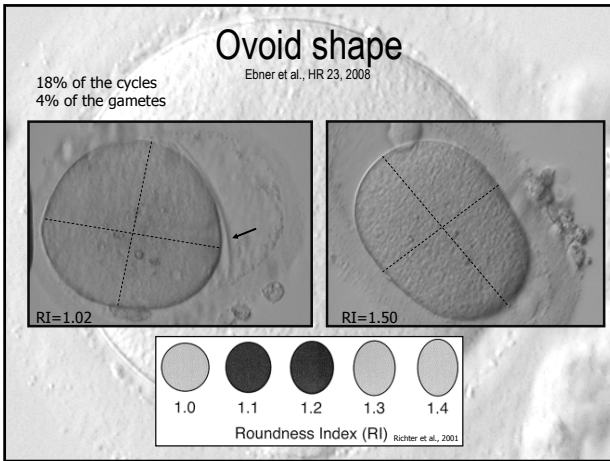
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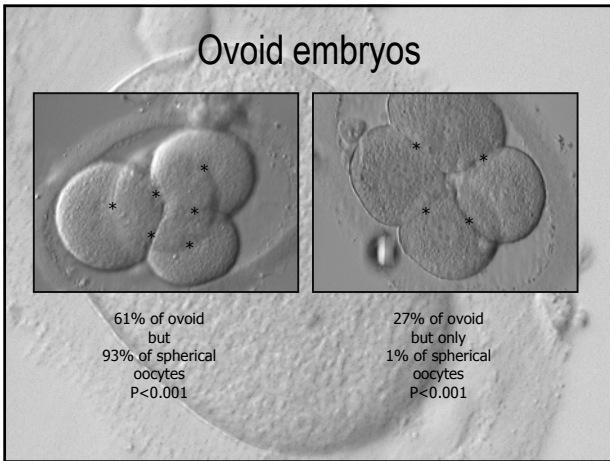
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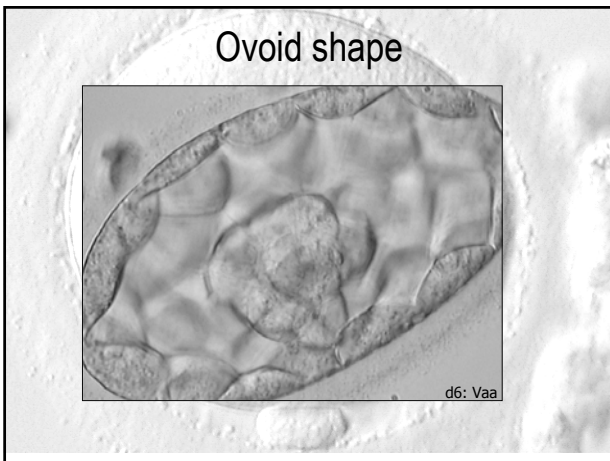
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## Conclusion

- The developmental fate of an oocyte is strongly dependant on the quality of the follicle ( $O_2$ , apoptosis)
- Controlled ovarian hyperstimulation recruits follicles of different qualities
- Either nuclear or cytoplasmic maturation may be affected both of which can influence oocyte morphology
- Potential negative predictors are aggregation of sER, vacuolization, dense central granulation and undetectable meiotic spindles

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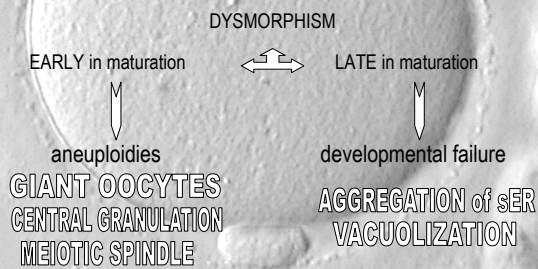
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## Conclusion II

In the context of oocyte morphology and outcome Van Blerkom and Henry (1992) suggested a interesting hypothesis



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Thanks for your



attention!

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