A farrowing rate of 95%: is it achievable?

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Billund, May 2010

Farrowing rate

… is variable between farms

e.g. 86% (77-93%); farrowing rate from 1st insemination on 68 farms with group housing within day 4 from insemination (Van der Peet-Schwering et al., 2009)

… is affected by parity
... is lower in rebreeders

e.g. Hoving et al., unpublished results (47.000 sows, 2001-2006)

parity	% (1st insem)	% (rebreeders)
1	81.2%	73.9%
2	79.9%	78.8%
>2	85.2%	72.8%

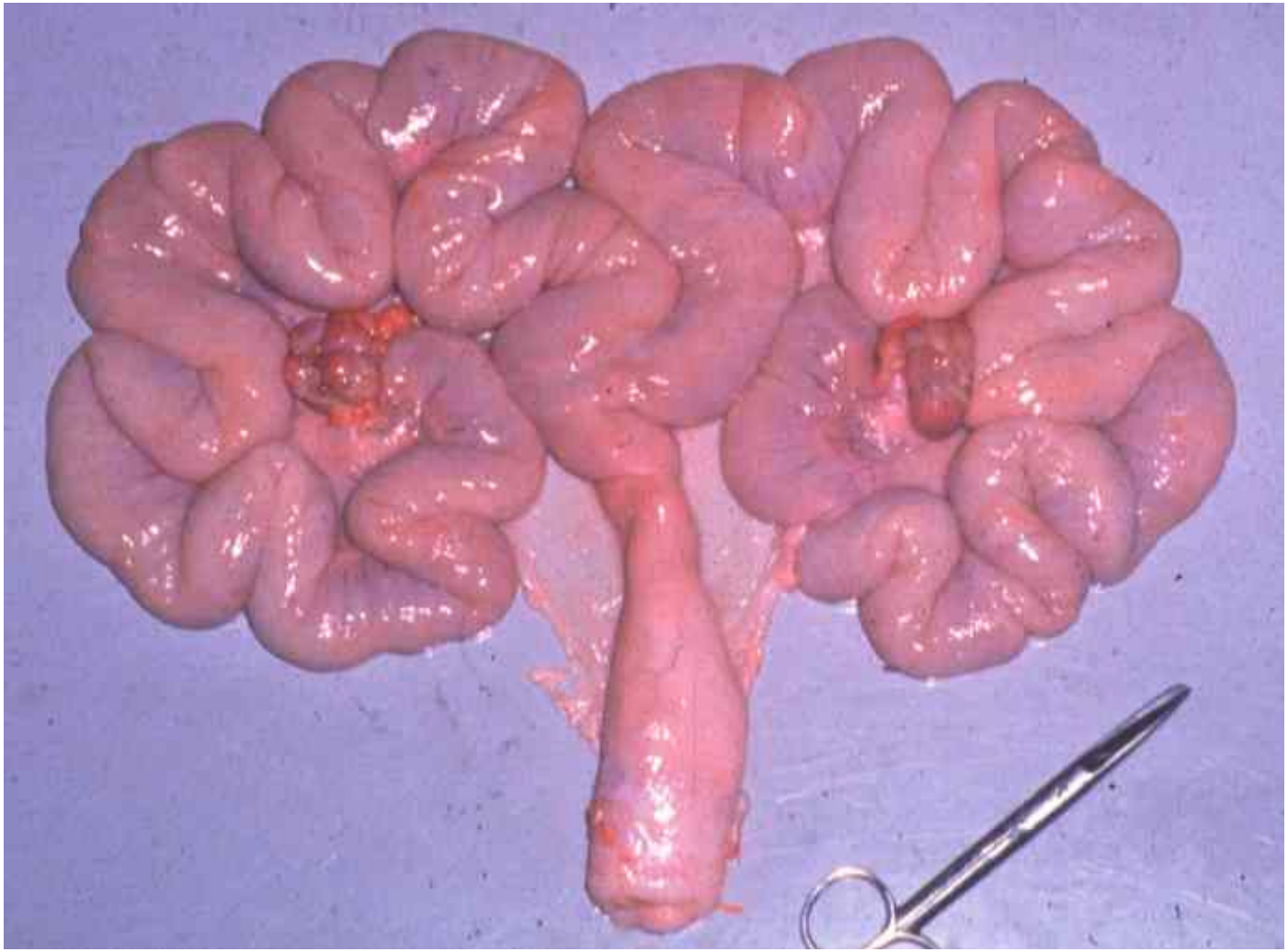
… is repeatable

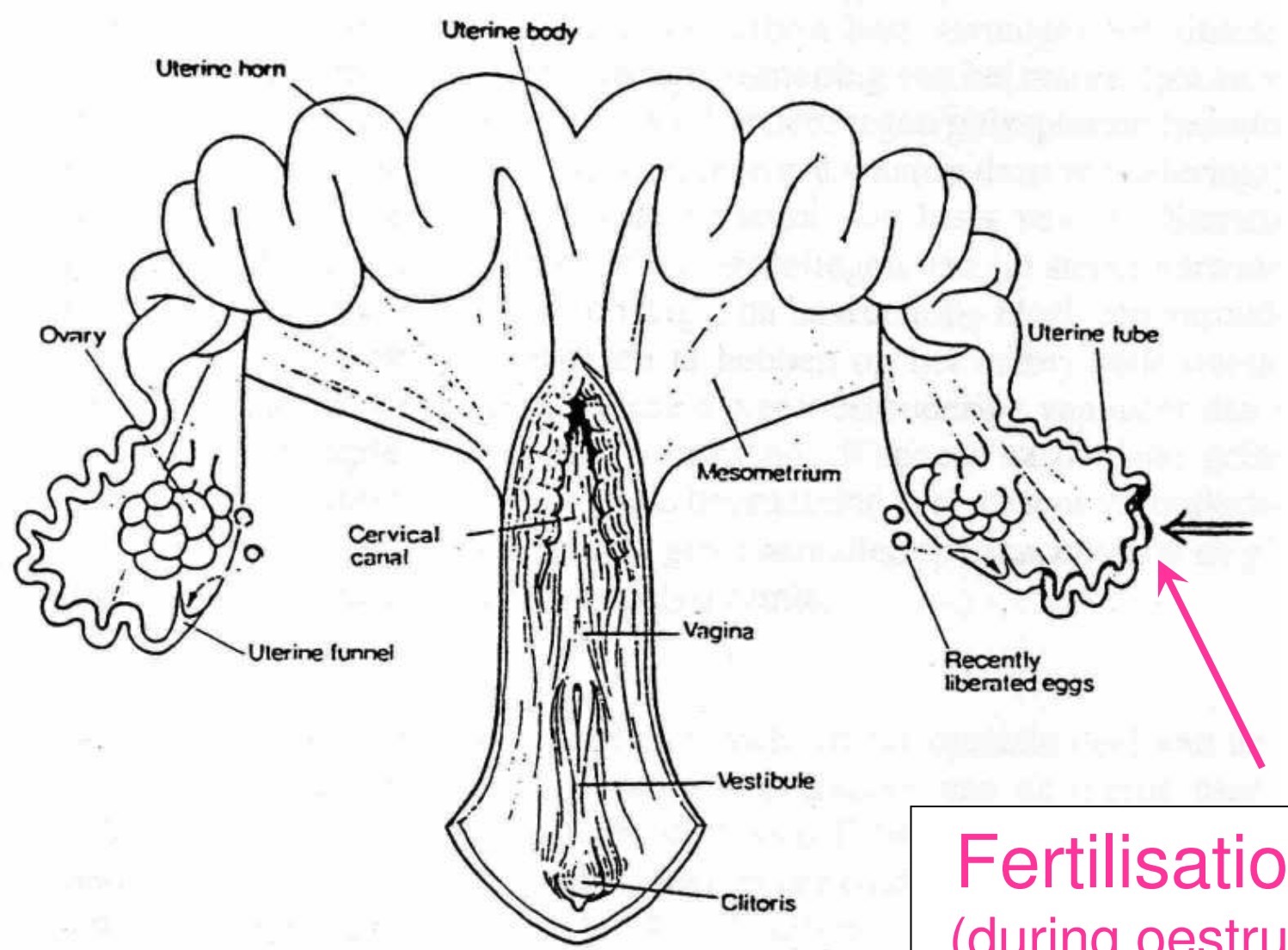
e.g. (Hoving et al., unpublished) rebreeders in parity 2 have a
4.1% lower farrowing rate in parity 3
3.4% lower farrowing rate in parity 4

Contents

- **Embryo development (in short)**
- **Mechanisms of embryo survival**
- **(Ir)regular rebreeding**
- **Factors affecting farrowing rate**
  - Previous lactation
  - Insemination time and quality
  - Stress
  - Nutrition during early pregnancy
  - Season; ‘autumn rebreeders’
  - Group housing?
- **Concluding remarks**

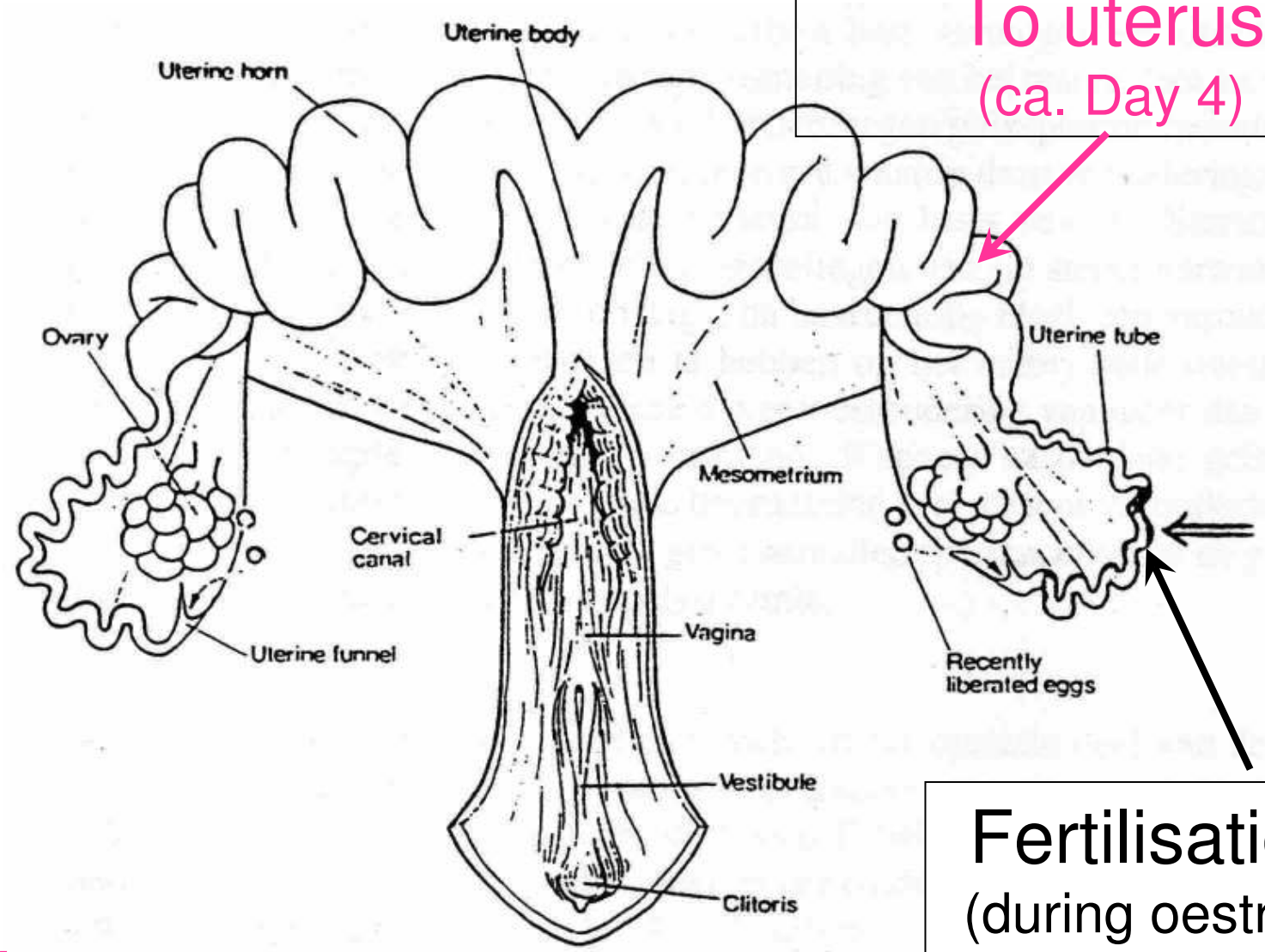
NB No discussion on infectious diseases





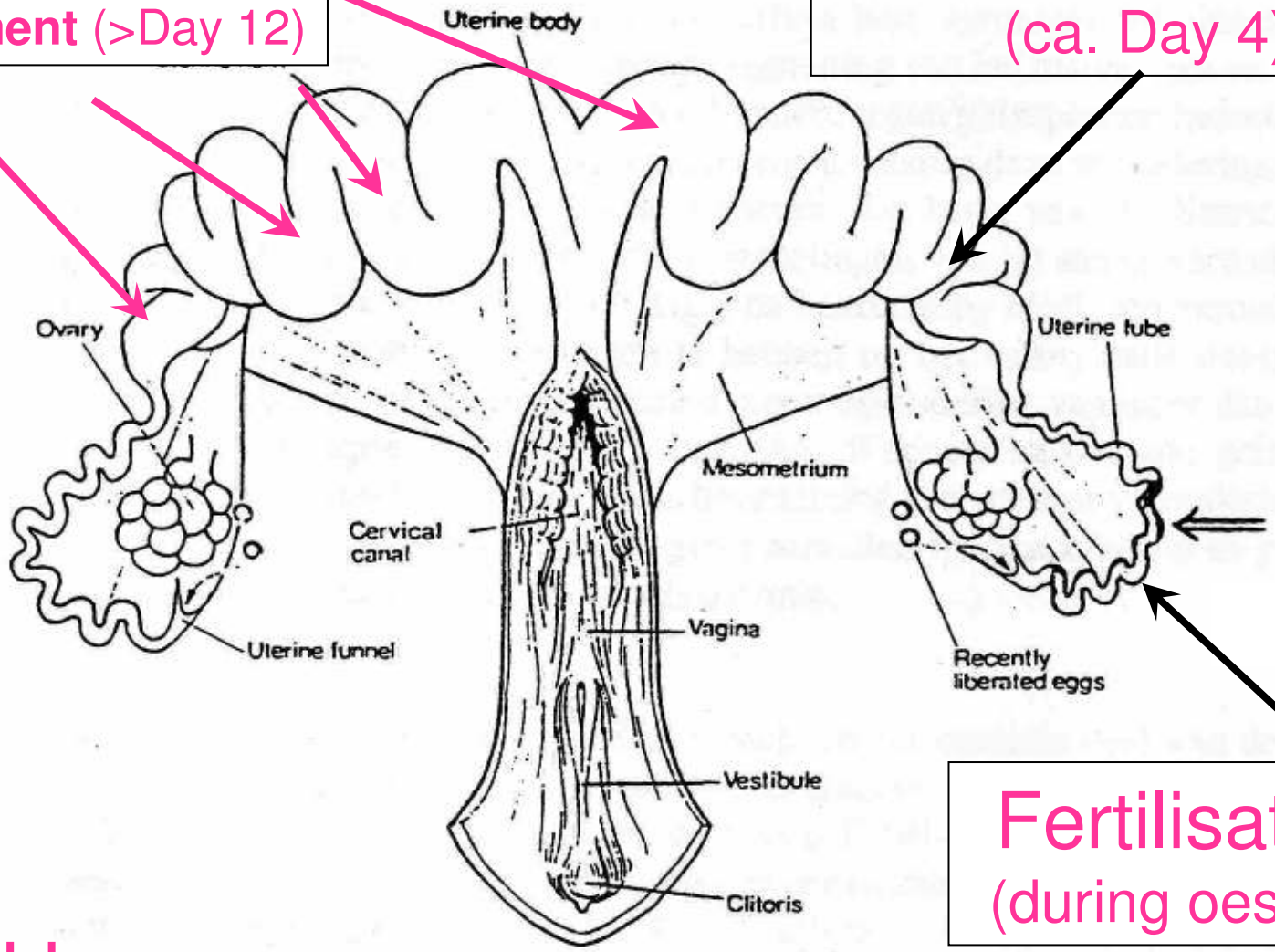
Fertilisation
(during oestrus)

wk1


To uterus
(ca. Day 4)
Uterine body
Uterine horn
Ovary
Uterine tube
Mesometrium
Cervical canal
Vagina
Uterine funnel
Recently liberated eggs
Vestibule
Clitoris
Fertilisation
(during oestrus)
wk1

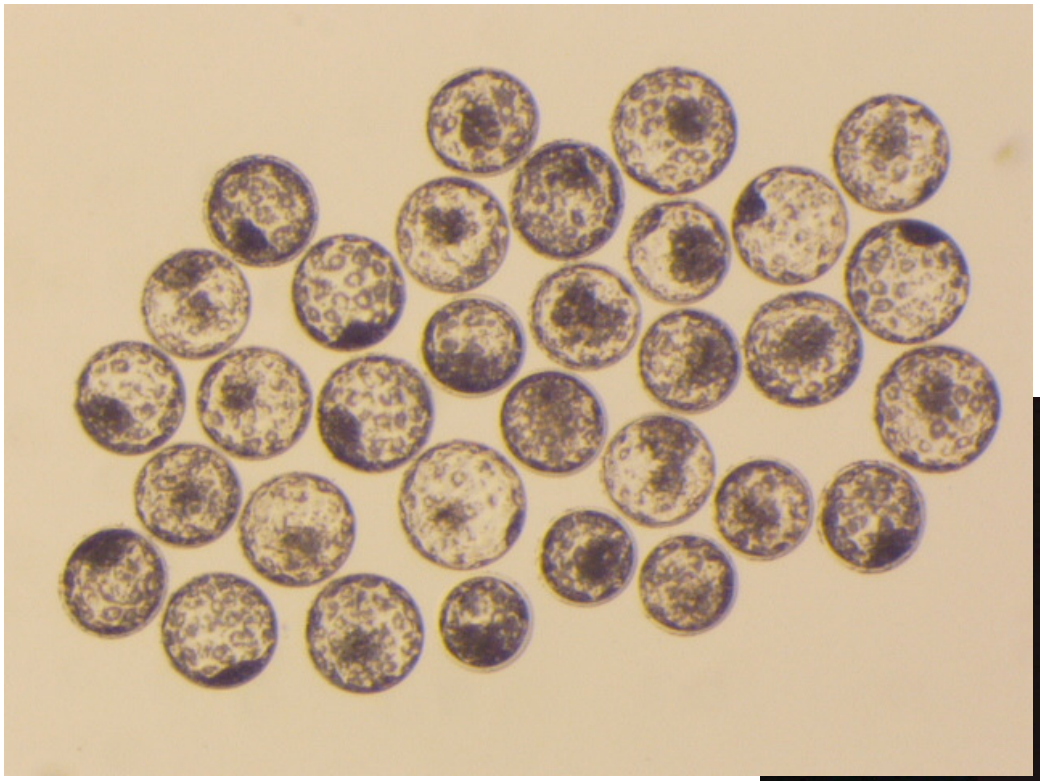
Spreading
(ca. Day 7-11)
Attachment (>Day 12)

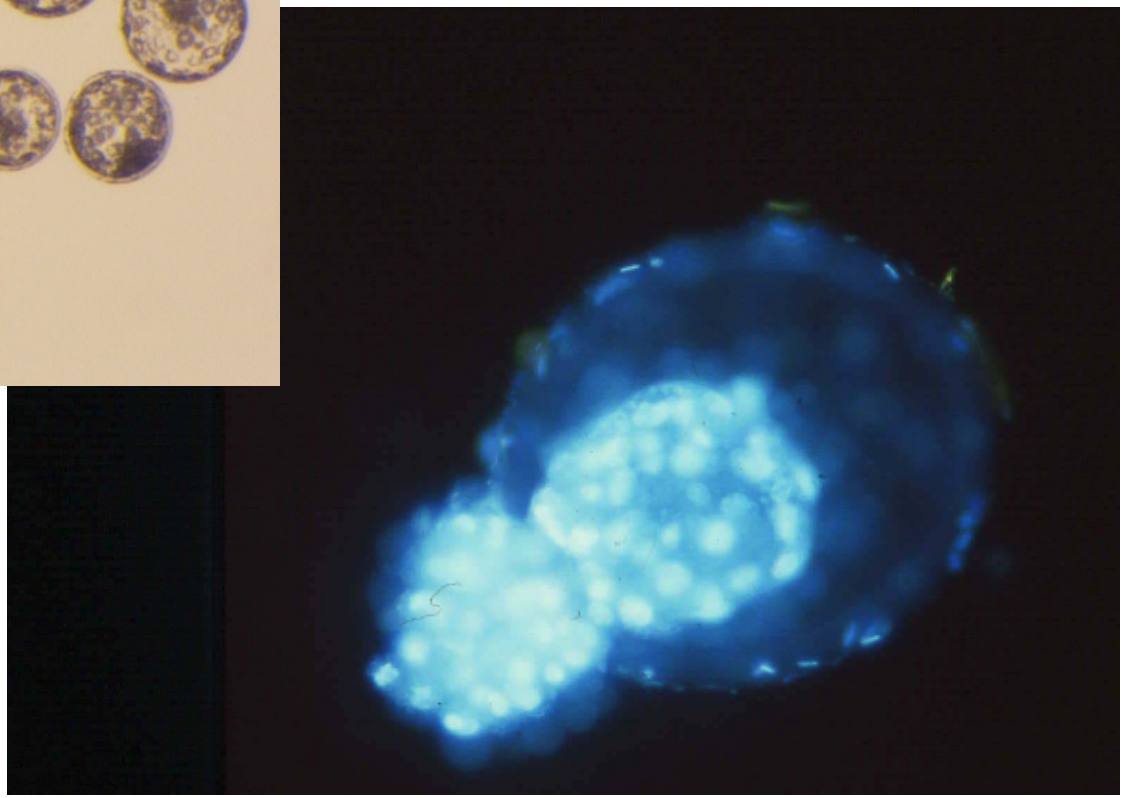
To uterus
(ca. Day 4)



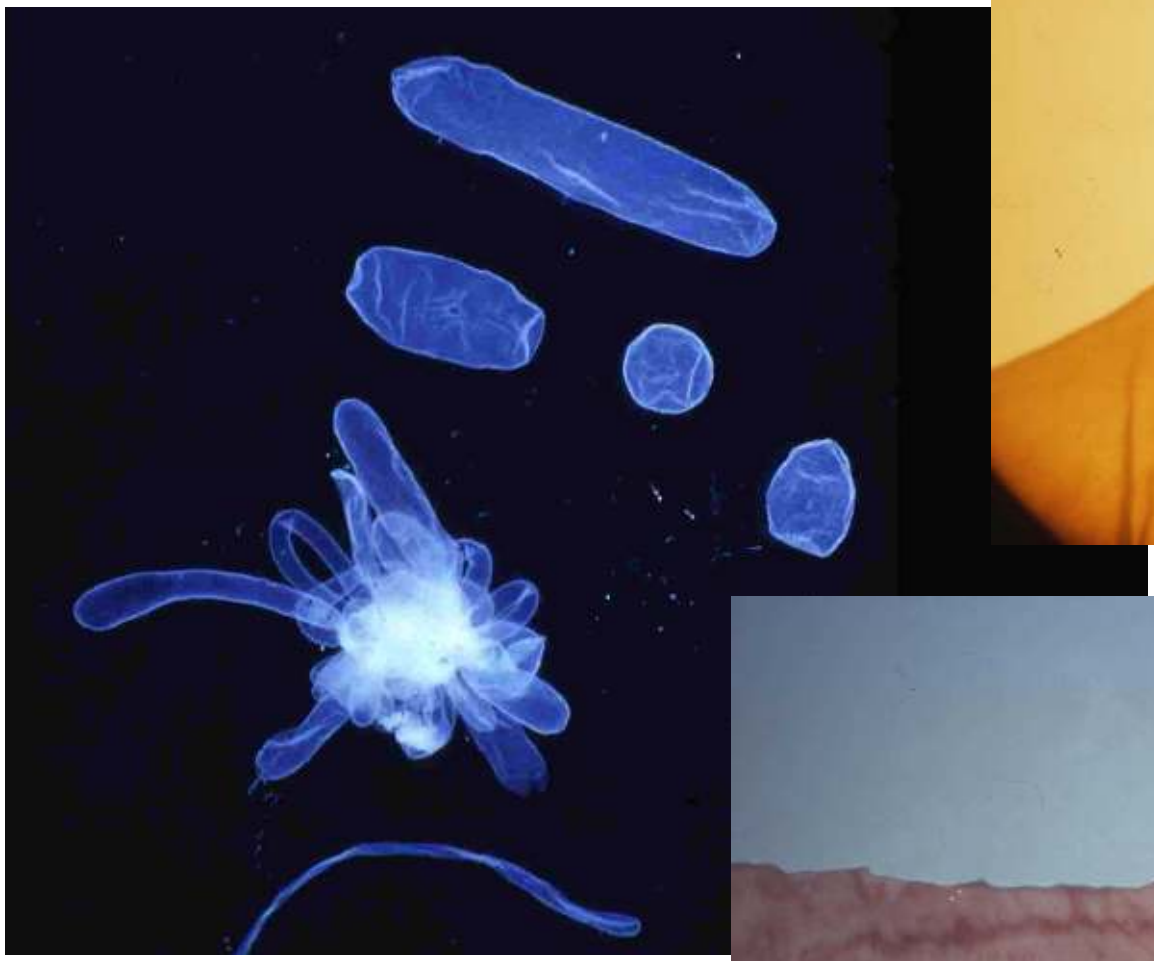
Fertilisation
(during oestrus)

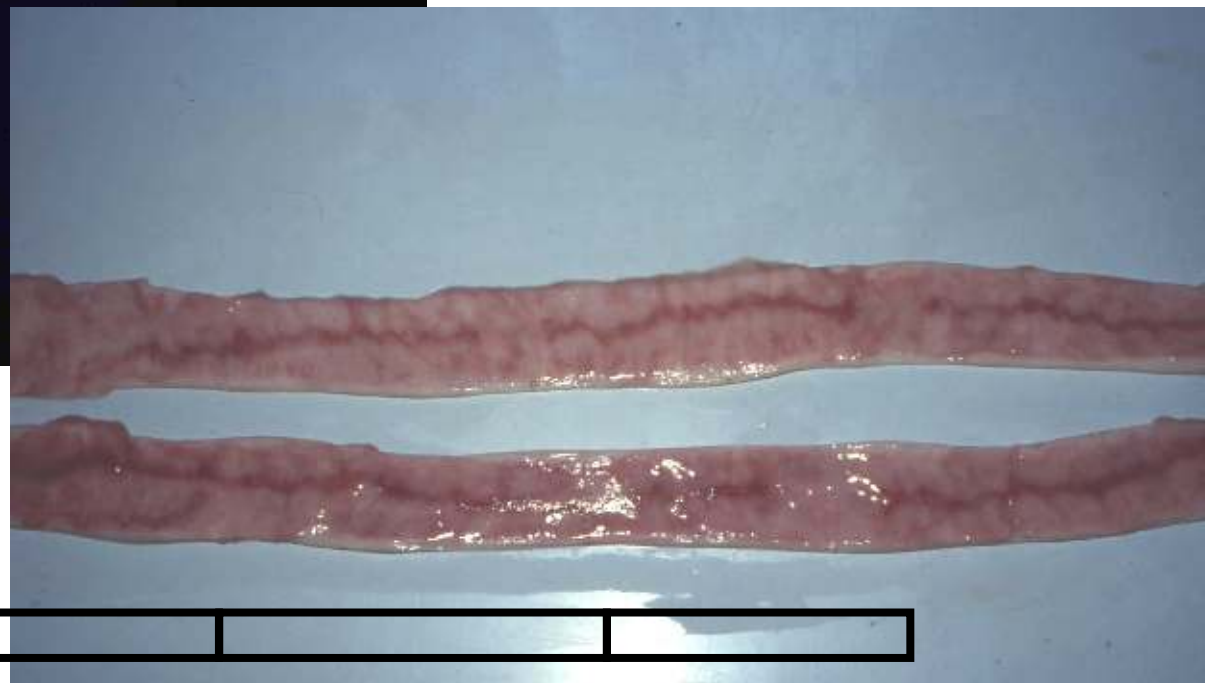
Day 6: hatching





Day 10-12

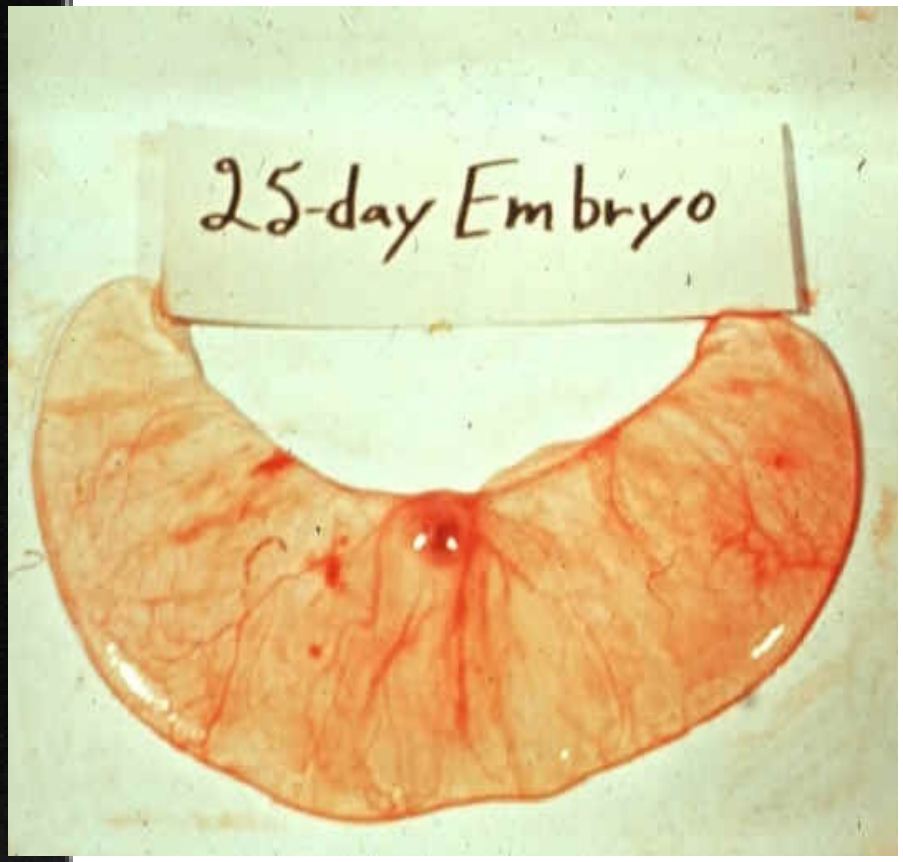




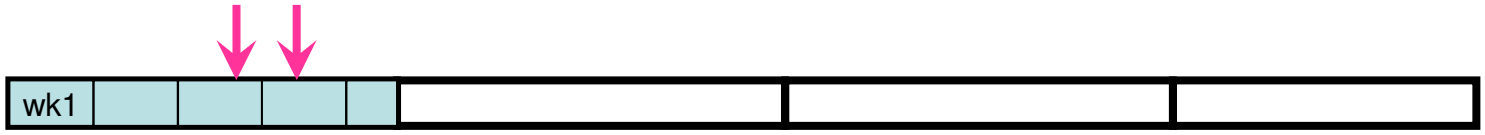
1 cm

Day 25

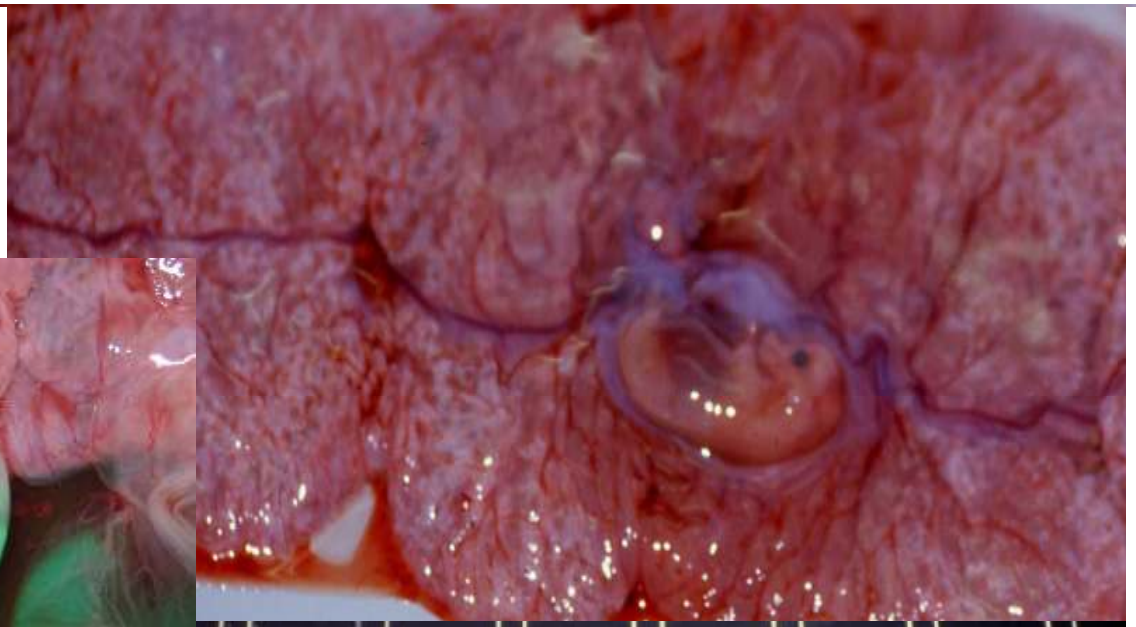

Zeugnr.:50_, dag 22
Scanner: Jennifer de Olde
LU-Wageningen
198 1 198

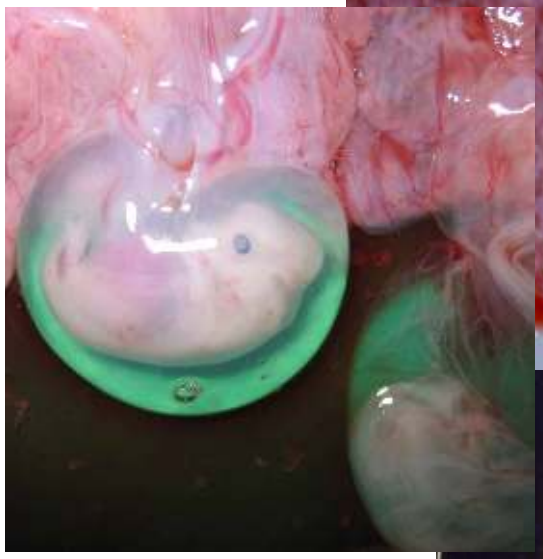

25-day Embryo

1 cm

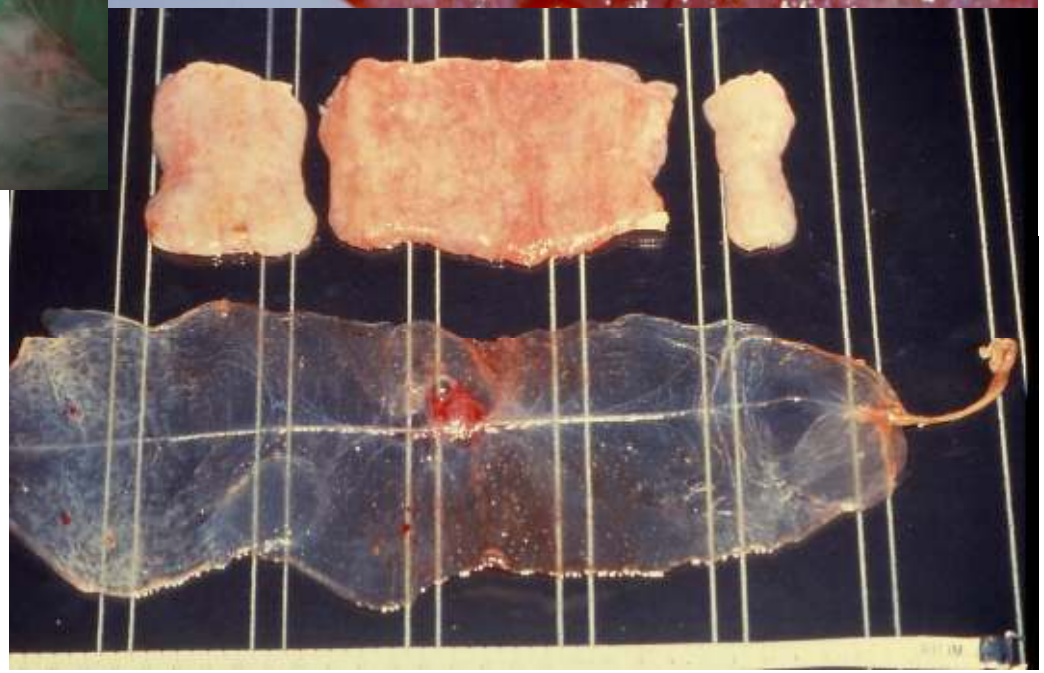

wk1

Day 35



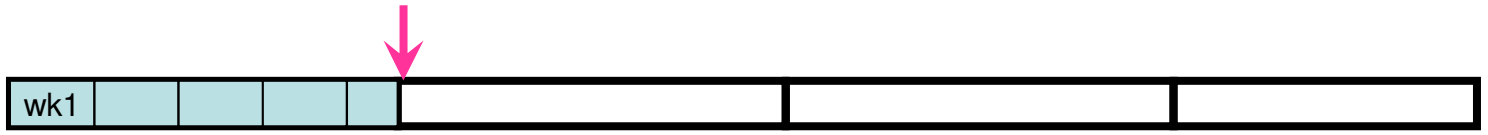


Embryo in placental tissue in uterus

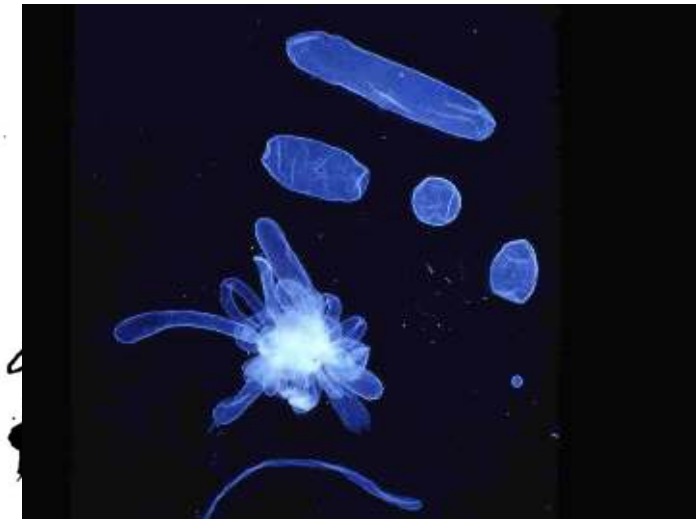


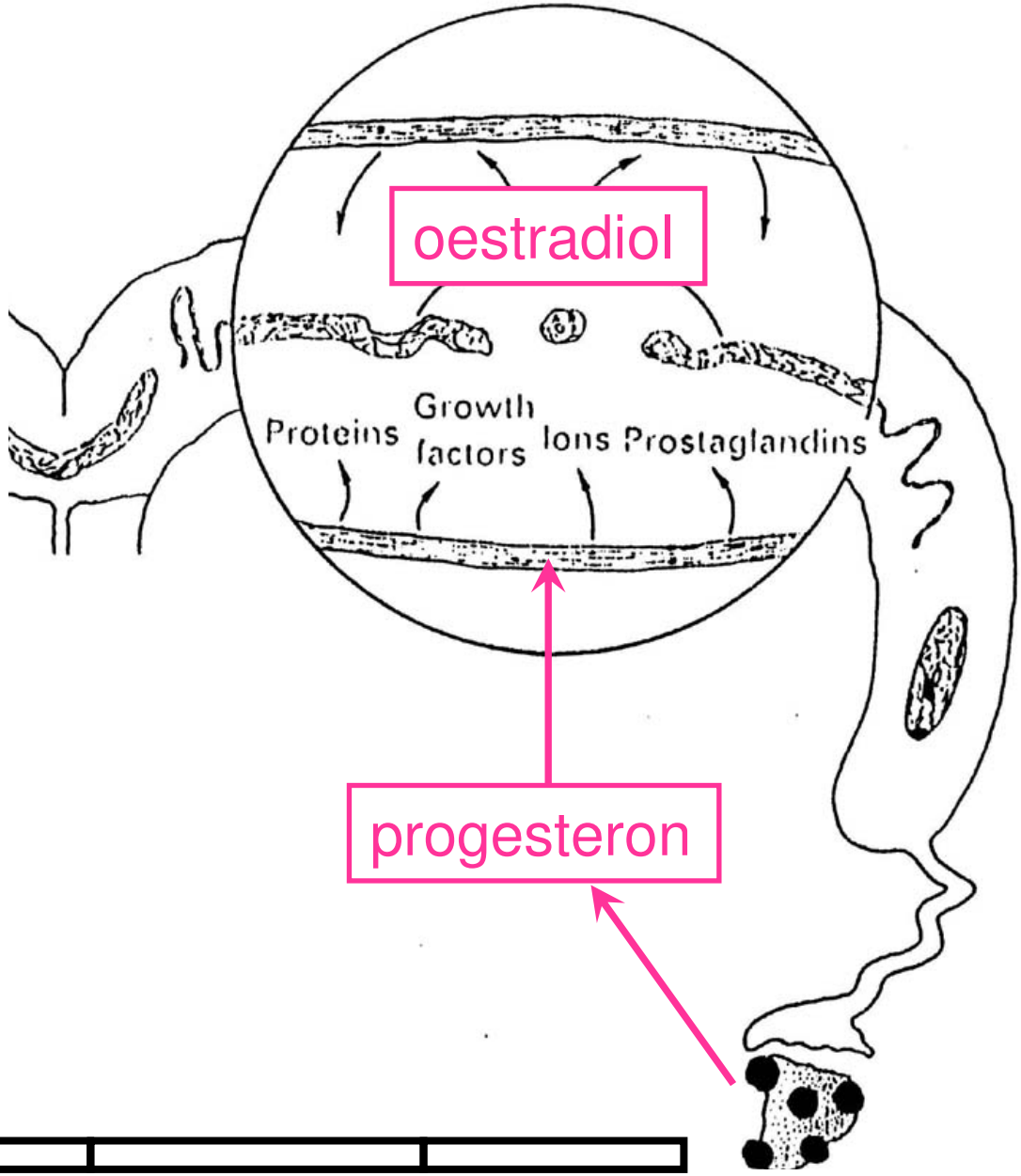
uterus

placenta



Embryos uniform + synchronous with uterus (esp. Day 10-14)





Sufficient space

Many oocytes + good fertilisation + synchronous

↓

many embryos Day 14

↓

little space

↓

small placenta

↓

nutritional limits through placenta

↓

foetal mortality + small piglets

Factors affecting embryo survival
(affecting both farrowing rate and litter size)

- Quality of oocytes
- Quality of uterus
- Fertilisation rate
- Quality of embryos
- Number of embryos at Day 11-13

Regular returns

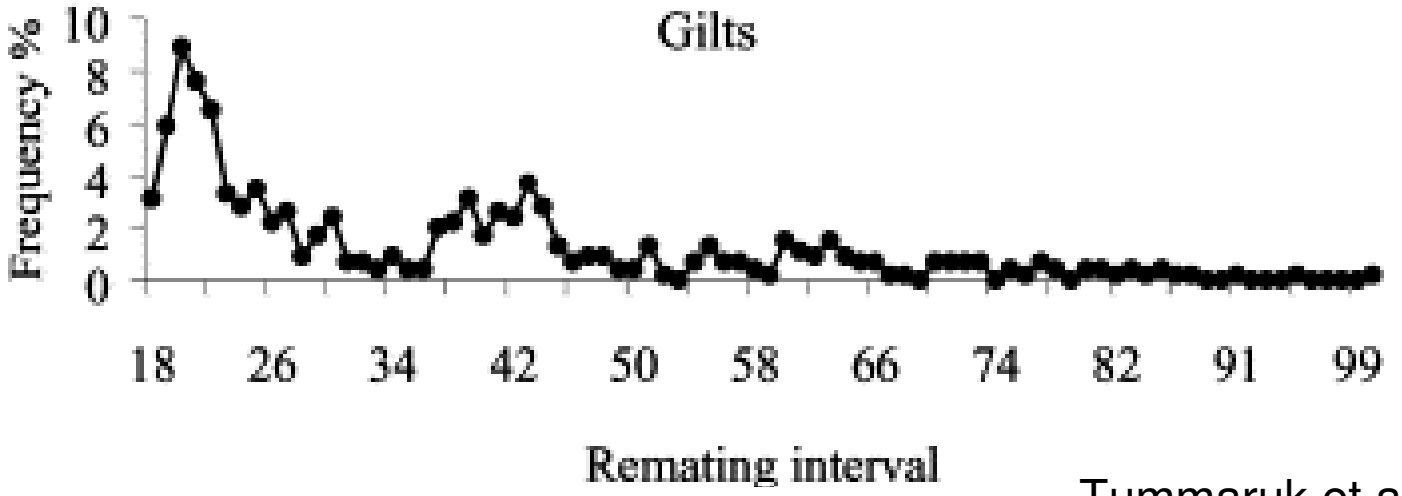
Litter size

- Embryo uniformity at Day 11-13
- Embryo-uterine synchrony Day 12-18
- Uterine crowding Day 20-115

Irregular returns

Litter size

(Ir)regular rebreeders



Tummaruk et al., 2001

Regular rebreeders

- Day 18-24 or Day 39-45; >50%

Irregular rebreeders

- esp. Day 24-35 [e.g. 'autumn rebreeders']
- 'Other; scattered

Factors affecting embryo survival
(affecting both farrowing rate and litter size)

- **Quality of oocytes**
- **Quality of uterus**
- **Fertilisation rate**
- **Quality of embryos**
- **Number of embryos at Day 11-13**
- Embryo uniformity at Day 11-13
- Embryo-uterine synchrony Day 12-18
- Uterine crowding Day 20-115

Regular returns

Litter size

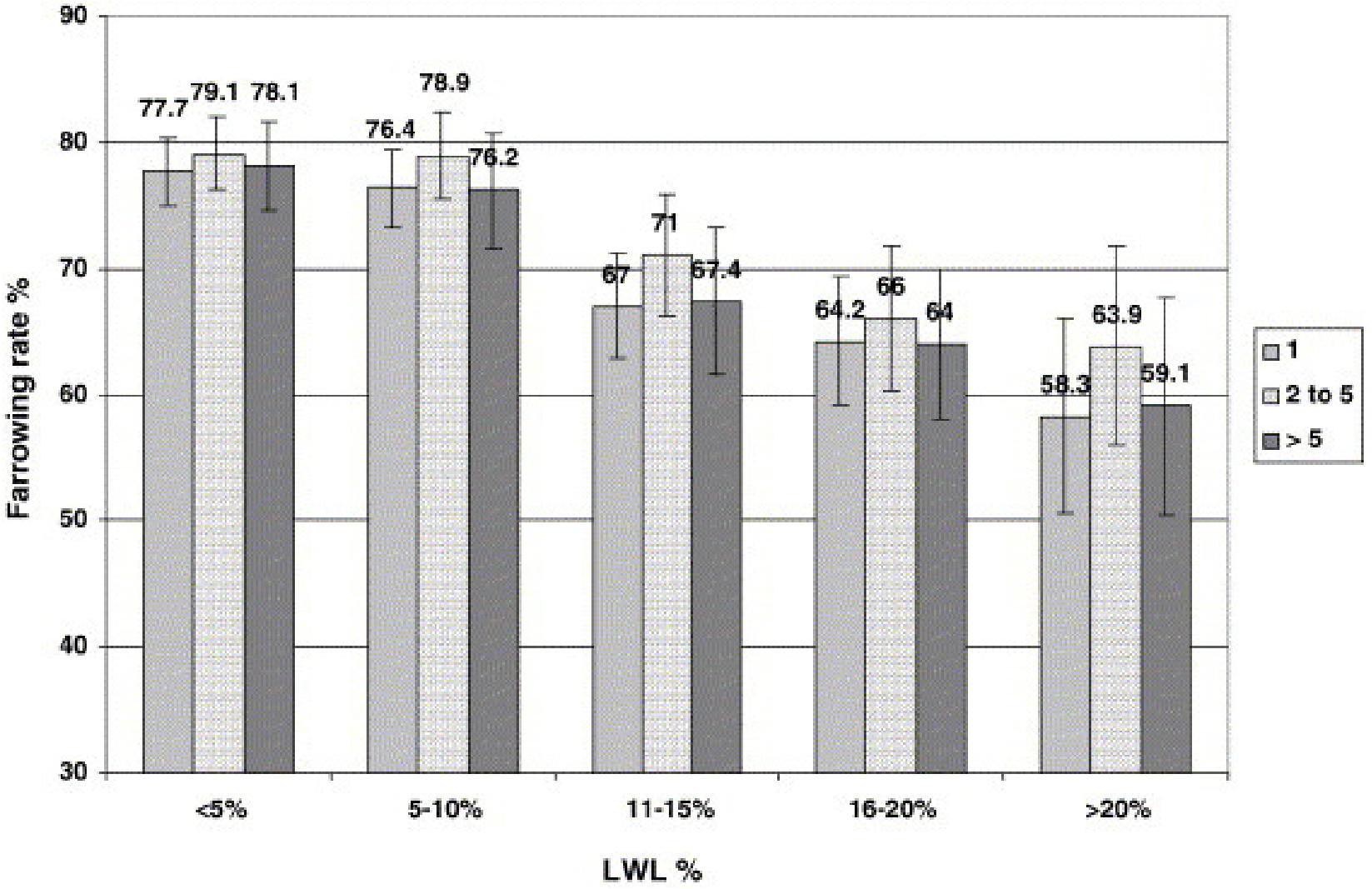
Irregular returns

Litter size

Factors affecting farrowing rate

- **Previous lactation**
- Insemination time and quality
- Stress (during early pregnancy)
- Nutrition during early pregnancy
- Season; ‘autumn rebreeders’
- Group housing?

Lactation weight loss affects FR%...



Thaker and Bilkei (2005)

.. Lactation feed intake affects embryo survival

		WOI (d)		# oocytes		Embryo surv.(%)	
	wean	H	L	H	L	H	L
King and Williams, 1984	d32	**7.6**	**19.9**	14.4	13.5	70	72
Kirkwood et al., 1987	d35	**4.3**	**5.8**	18.1	18.6	**83**	**68**
Kirkwood et al., 1990	d28	**6.0**	**8.9**	17.6	17.7	**83**	**72**
Baidoo et al., 1992	d28	5.9	7.5	16.2	16.7	**85**	**64**
Zak et al., 1997 L: wk1-3	d28	3.7	5.6	**19.9**	**15.4**	**88**	87
L: wk4	d28		5.1		**15.4**		**64**
Zak et al., 1998	d28	**4.2**	**6.3**	14.4	15.6	83	72
Quesnel and Prunier, 1998	d24	5.7	5.9	19.2	20.7	-	-
Van den Brand et al., 2000	d22	5.1	5.7	**18.1**	**16.4**	68	68
Terletski et al., 2004 [1]	d21	6.6	6.7	**18.6**	**16.7**	64	69
Vinsky et al., 2006 [2]	d21	5.3	5.4	18.3	18.2	**79**	**68**
Edmonton, unpubl.	d21	5.7	5.5	18.5	17.5	**65**	**78?**

NB H ~ 80-90% of ad libitum; L ~ 40-60% of ad libitum

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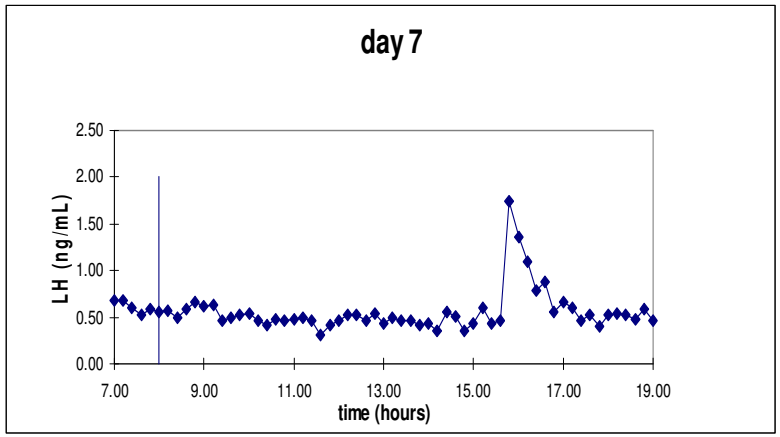
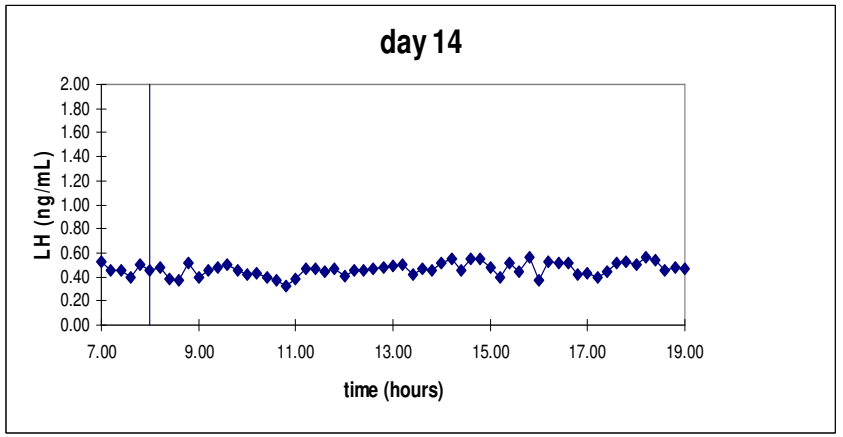
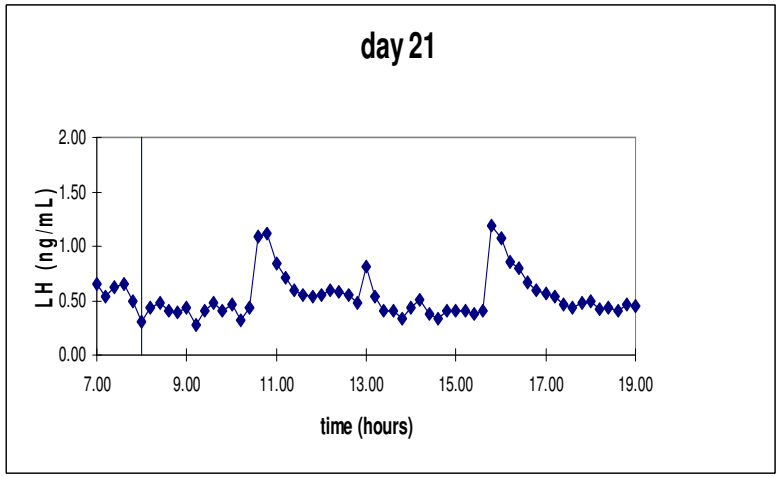
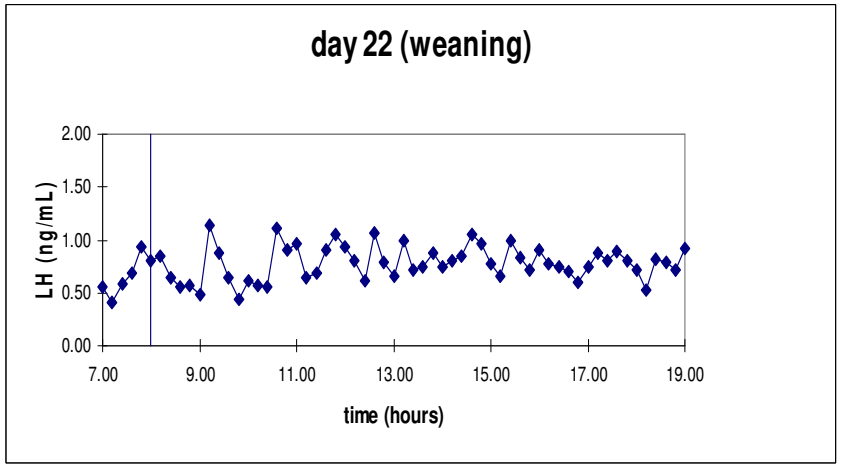
LH-pulsatility restores during lactation









Kemp et al. 1995

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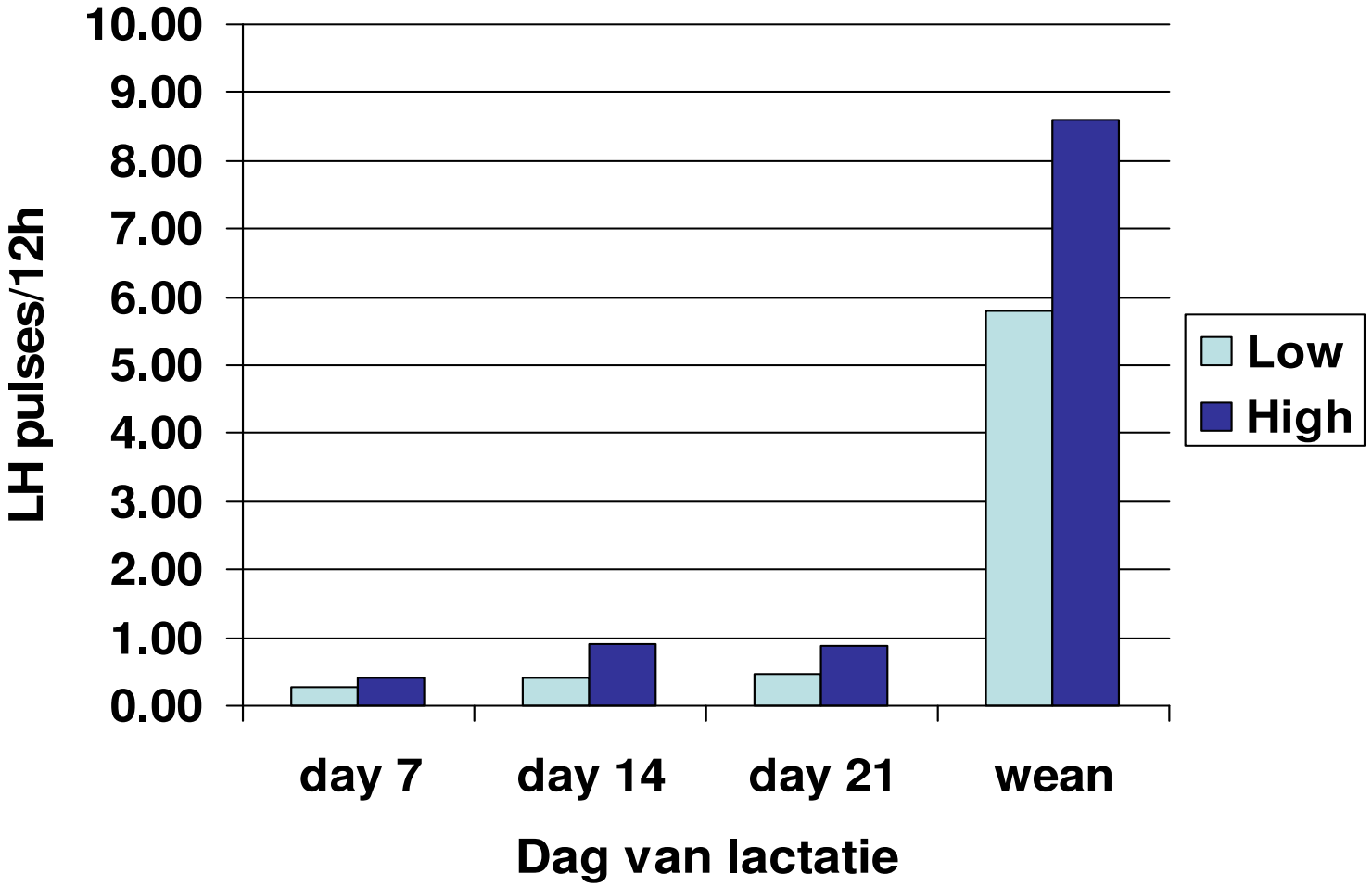
LH-pulsatility is affected by feed intake



67 MJ/DE (high) or 50 MJ/DE (low) per day

Van den Brand et al, 2000

Lactational feed intake affects follicles

	Ad lib	50% ad lib
# LH pulses/6h before weaning	1.5 a	0.2 b
# Follicles larger than 4mm		
day of weaning	2.5 x	0.2 y
2 d after weaning	12.2 x	6.8 y

ab $P<0.05$, xy $P<0.10$

Quesnel et al., 1998

Thus, lactational weight loss affects:

=> Follicle development during lactation

=> number of follicles

=> oocyte quality => embryo quality

=> follicle quality => CL quality (=uterine quality)

⇒ Litter size

⇒ Farrowing rate

Stimulating follicle development during and after lactation

Feed intake lactation

- gilts:sufficient weight at farrowing
- moderate body condition at farrowing
- moderate temperature (above 16^0C: -0.18EW/^{0}C)
- good water intake

Weaning management

- number of piglets

(- lactation length?)

After weaning

- sugar-rich diets (insulin-stimulation)
- Intensive boarcontact

Factors affecting farrowing rate

- Previous lactation
- Insemination time and quality
- **Stress** (during early pregnancy)
- Nutrition during early pregnancy
- Season; ‘autumn rebreeders’
- Group housing?

Stress

- Stress factors

e.g. mixing
moving
fighting for rank order
insecurity/uncertainty/fear
(including contact with man)
feeding system
indoor climate

Stress

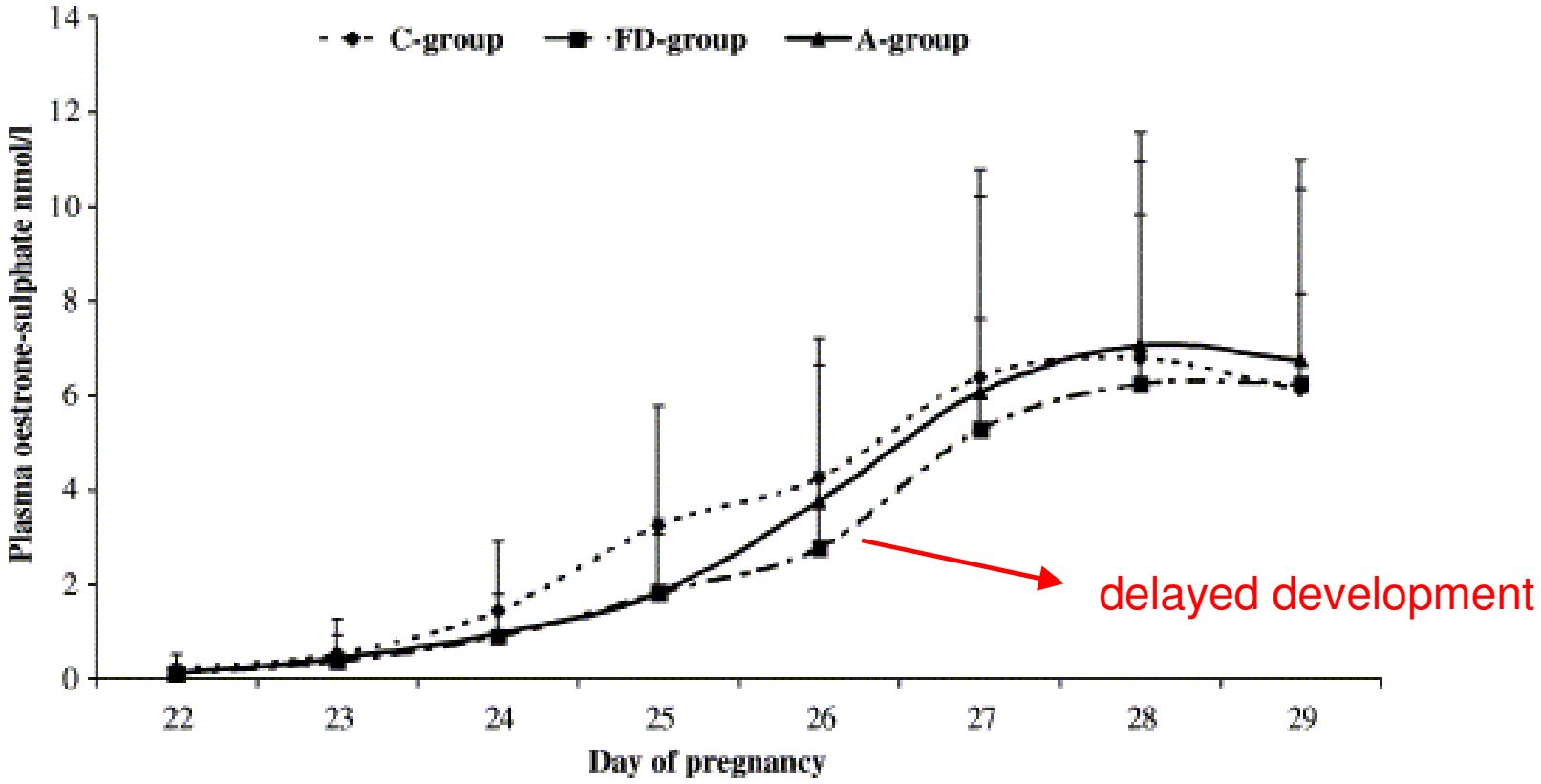
• Stress hormones influence reproductive processes, e.g.
(Turner, 2005; Mwanza et al., 2000;Brandt et al., 2007; Razdan et al., 2002)

- oestrous behaviour and ovulation
- hormone levels: LH-surge, P4, E2, PGFM, insulin
- pressure in oviduct, transport of embryos (Day 3)
- embryo development (Day 3, Day 14)

• Intensity, duration (chronic?) and timing of stressful factors determine the consequences for fertility

• **Most critical period: Day 7-21 of pregnancy**

Stress effects on embryo development



Oestrone-sulphate in plasma

C=Control, FD=food-deprived (D13+14), A=repeated ACTH (D13+14)

Razdan et al., 2004

Establishing groups during pregnancy

	Stable (groups of 13)	Dynamic (groups of 52)			
		week 0	week 2	week 4	p
Rebreeders					
Total	6,2	7,5	8,8	10,2	NS
Litter size					
Alive	11,9	12,5	12.0	11,8	P<0.05
Dead	0,8	0,7	0,7	0,9	P<0.05

Van der Mheen et al, 2003

Stress in group housing

⇒ Group housing (2013; NL within 4 days)

Mixing involves stress, but need not lead to fertility problems (keep all stress factors under control)

- peaceful introduction in the group

- sows need ‘space’ to establish rank order

- avoid agression around feeding station and lying areas

- create security for sows

Factors affecting farrowing rate

- Previous lactation
- Insemination time and quality
- Stress (during early pregnancy)
- **Nutrition during early pregnancy**
- Season; ‘autumn rebreeders’
- Group housing?

Feeding level early pregnancy

Farms with group housing (180-1000 sows) (Kongsted, 2004):

⇒ Sows with higher increase in backfat during early pregnancy had a higher farrowing rate

⇒ Sows with high feed intake (eating in more than 20% of observations during feeding) have higher litter size and farrowing rate

Possible mechanism:

1. through rank order / stress effects
2. through metabolic effects
   e.g. IGF-1 => uterine secretions (?)

Feeding level early pregnancy (sows)

Feeding level (kg)*	1.0	2.4	3.8
#sows	428	427	419
Total born	14.9a	1.5.1a	**15.4b**
Farrowing rate	86.4	88.5	86.9 **(?)**
Culling before farrow	5.2	3.1	1.9

- From Day 3 to Day 30 after insemination

* Additionally, some straw was supplemented

Sorensen and Thorup, 2003

Feeding level early pregnancy

Ensure sufficient daily feed intake in sows

- .. during first month of pregnancy
- .. submissive sows
- .. sows with low body condition

NB Feeding stations: daily check of visits

NB In **gilts**, a high feeding level may be detrimental

Day 0-15 (Jindal et al., 1996)

2.6 kg (2M) => Day 30: 66% survival

1.9 kg from Day 1 => Day 30: 86% survival

1.9 kg from Day 3 => Day 30: 77% survival

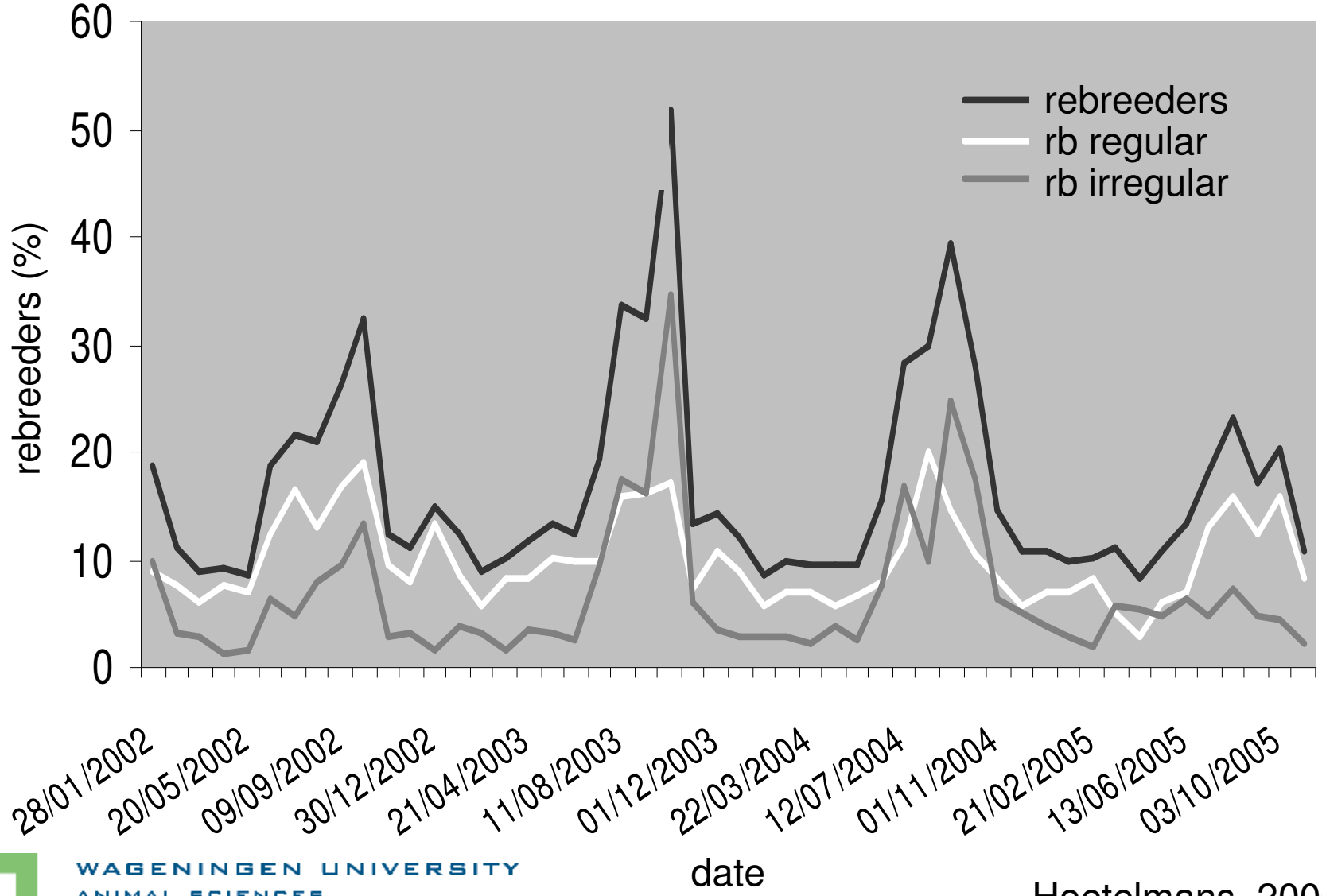
Day 0-7 (Quesnel et al., 2010)

4 kg vs 2 kg in first week => Day 27: 85% survival

Factors affecting farrowing rate

- Previous lactation
- Insemination time and quality
- Stress
- Nutrition during early pregnancy
- **Season; 'autumn rebreeders'**
- Group housing?

Autumn rebreeders 2002-2005



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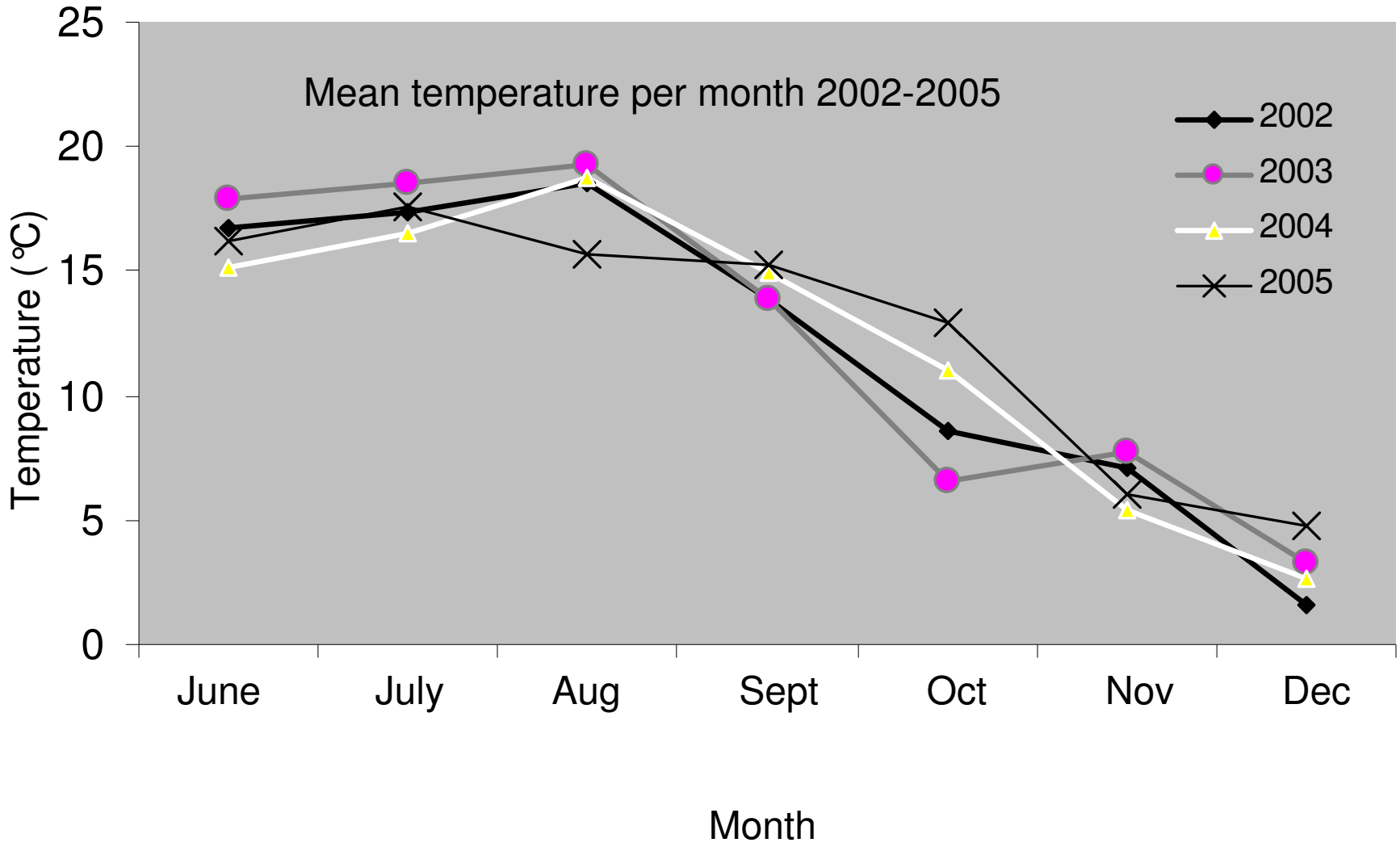
Hoetelmans, 2006

Autumn rebreeders 2002-2005



(Hoetelmans, 2006)

Autumn rebreeders

	Problem farm		
	No	Yes	
Number of farms	12	14 (=54%)	
Poor indoor climate	0%	43%	Geudeke, 2004
BCS onset of pregnancy	3.0±0.2	2.7±0.6	
BCS 2mo of pregnancy	3.8±0.4	3.3±0.6	
Group housing	33%	79%	
Number of farms	56	40 (=42%)	
Group housing (within 3d from insem.) - ESF+straw: **12.5%** (1 of 8) - other systems: no effect	32%	60%	Geudeke, 2008

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Autumn rebreeders: mechanism?

(Peltoniemi et al., 2000 - ….)

- It's 'nature'; sows of wild boar do not show oestrus in autumn
  - Change in oestrous behaviour?
  - Lower progesterone due to lower LH release?
- Light or Temperature?
  - In 'hot' summers ; lower feed intake lactation
  - Cold nights in autumn?

NB Most "Multi-stressor" !

Conclusion ‘autumn rebreeders’

- Risk seems higher in group housing systems
  - Ensure good indoor climate (especially at temperature changes in autumn)
  - Ensure good body condition of sows (feed intake lactation!)
  - Ensure good feed intake during wk2+3 of pregnancy (→ LH)

Factors affecting farrowing rate

- Previous lactation
- Insemination time and quality
- Stress
- Nutrition during early pregnancy
- Season; ‘autumn rebreeders’
- **Group housing?**

Group housing

Project: Succes factors and risk factors for group housing (Van der Peet-Schwering et al., 2009)

- 68 farms with group housing within 4 days
  - Reproduction (farrowing rate, litter size,..
  - Welfare (e.g. skin lesions, claw problems)
- systems: ESF (n=34), ESF+straw (n=20), free access stalls (n=6), trough feeding (n=7)
- detailed interview/enquiry + measurements

Success factors for farrowing rate

	25% lowest	25% highest
Farrowing rate parity 1	**<83,2 %**	**>90,9 %**
Space allowance during pregnancy (m^2 / sow)*	2.1	2.6
"management skills" (structure, consistency, strict schedule, taking measurements, ..)	50%	76%

* required: 2.25 m^2 for groups >40, -10% for groups >40

Van der Peet-Schwering et al., 2009

In conclusion

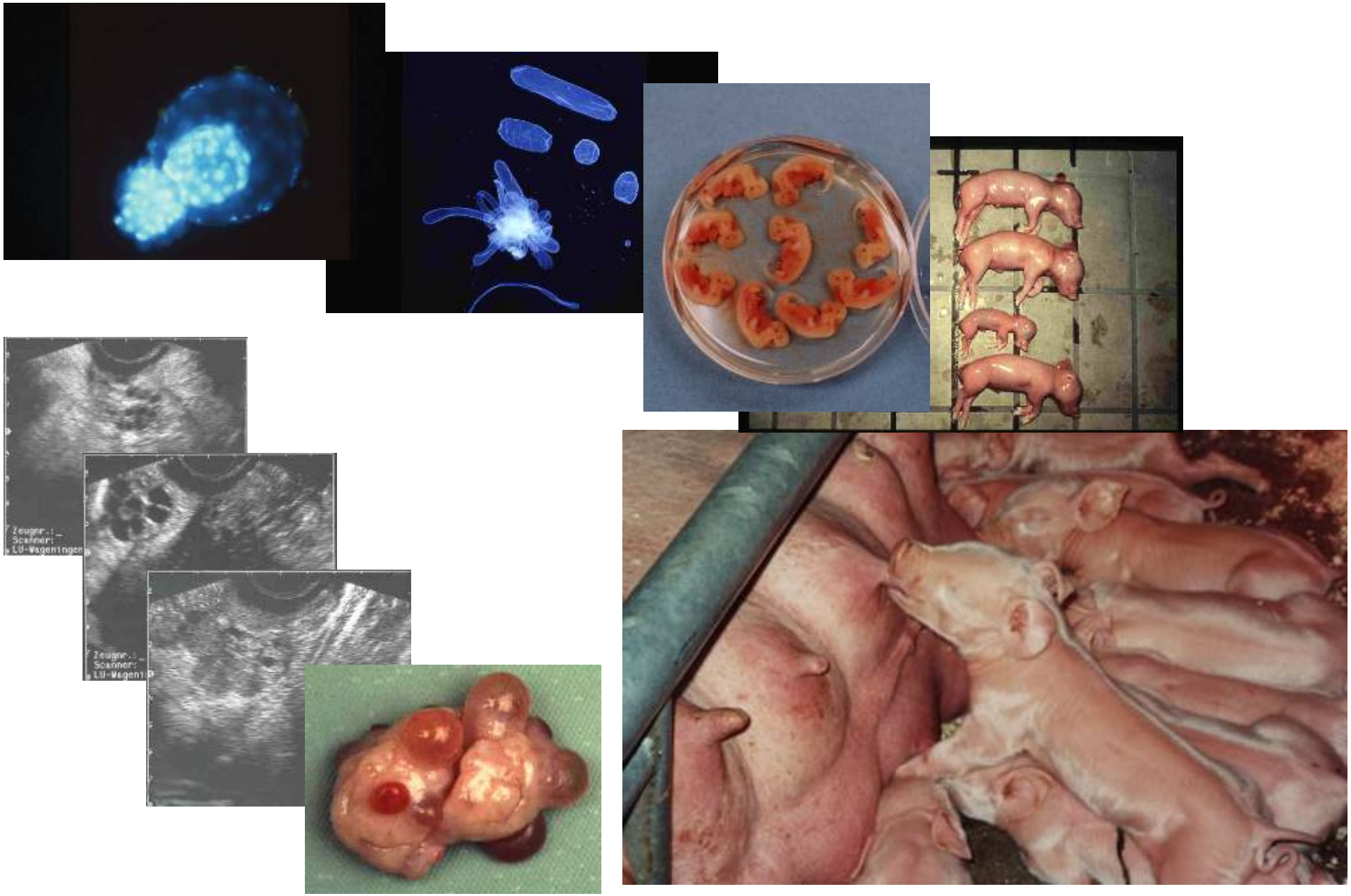
First month of pregnancy and preceding lactation period are crucial for litter size and farrowing rate

- **Avoid high lactational weight losses (keep < 10-12%)**
- **Ensure good timing + hygiene of insemination**
- **Avoid or control stressful circumstances [stress accumulates!]**
- **Ensure sufficient feed intake during early pregnancy**
  - Adjust the level of feed (and protein) to the individual needs of sows

Final remark

It’s not the farm but the farmer that is the key to success ..

- management skills
- individual needs of sows



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