

Pre-Conference Workshop
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Physiology of Gilt Reproduction Fertility Management and Diagnosis

母猪繁殖生理学

生育管理与诊断

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Replacement gilts 后备母猪更新

- ~20% of breeding group with annual replacement rates > 50%
- 育种群体中约20%，年更新率>50%
- Time investment to first service (220 d)
- 首次配种时所需时间投入（220天）
- Bred at optimal maturity have improved Longevity and Lifetime pig production[®]
- 在最佳成熟期培育的猪提高了寿命和终身猪产量



Gilt Fertility Challenges

后备母猪生育挑战

- Some % to fail to cycle after 6 weeks of boar exposure (230 d)
- 在接触公猪6周（230天）后，有百分之几的母猪未能发情
- Tool old and heavy when bred => lameness
- 繁殖时太老和太重，使用时会导致跛行
- Culled: 淘汰：
 - Prepubertal 青春期前
 - Silent heat 安静发情
 - Weak heat (hard to detect) 发情微弱（难以检测）



PHYSIOLOGY OF PUBERTY 青春期生理学

Required for normal gilt estrous cycles

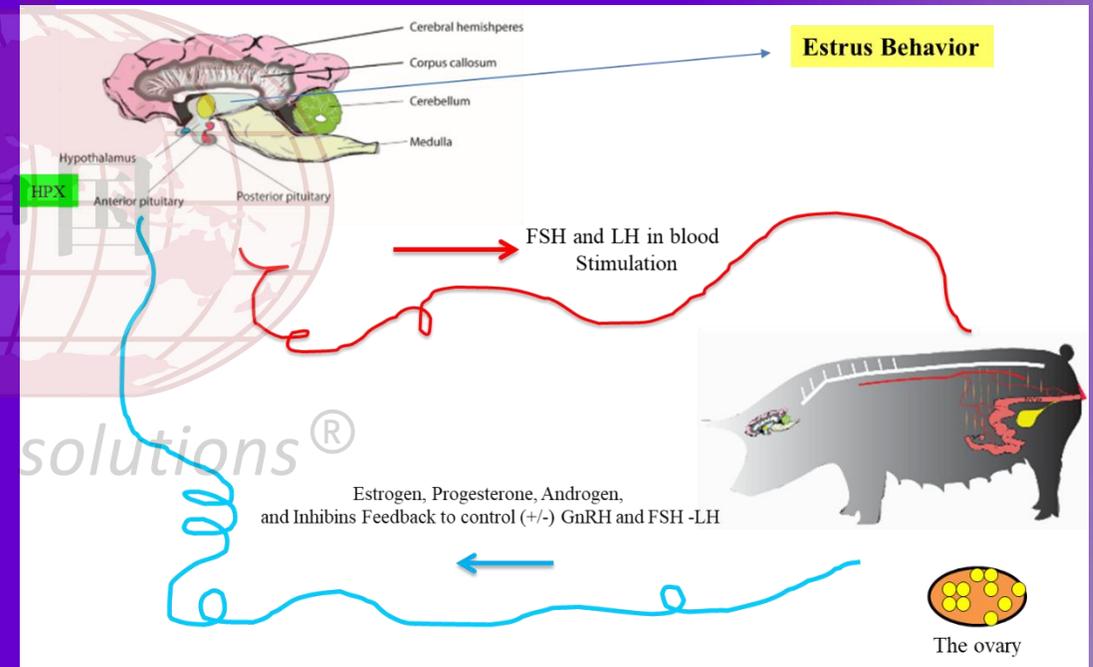
维持正常发情周期所必需

- Maturity of Hypothalamus-Pituitary 下丘脑-垂体的成熟度
 - Estrogen feedback 雌激素反馈
 - GnRH-FSH-LH 促性腺激素释放激素 (GnRH) -促卵泡素 (FSH) -黄体生成素 (LH)

- Brain neural pathways

- 大脑神经通路

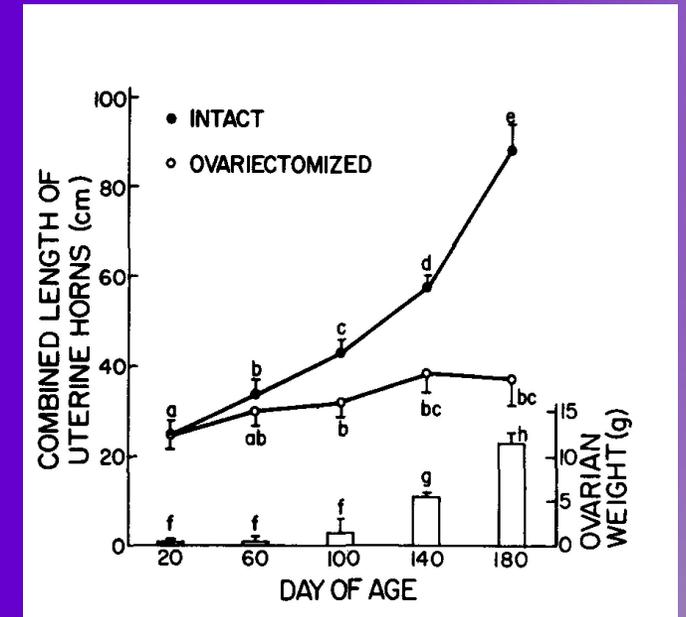
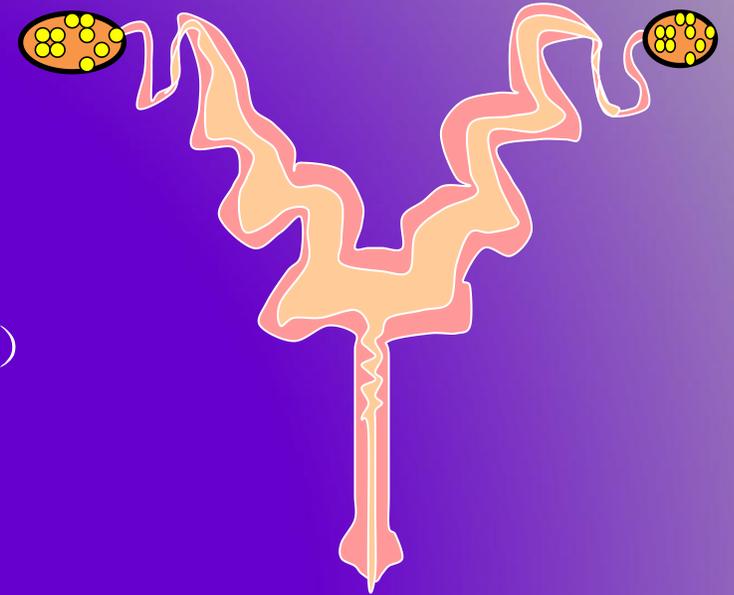
- Normal Estrus Behavior 正常发情行为



Gilt Maturation a Process

后备母猪成熟过程

- Uterus and ovaries grow with age and body (graph)
- 子宫和卵巢会随着年龄和体型的增长而发育（图表）
- Can respond to hormone injections to grow follicles by 140 days but responses not optimal
- 能在140天内对激素注射产生反应以促进卵泡生长，但反应效果并不理想
 - Estrus and Ovulation 发情与排卵
 - Ovulation rate 排卵率
 - Cycle at 21-day intervals 每21天循环一次



Science-driven solutions®



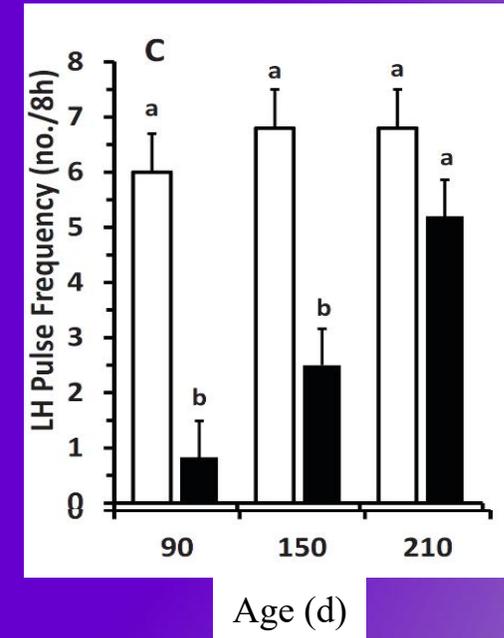
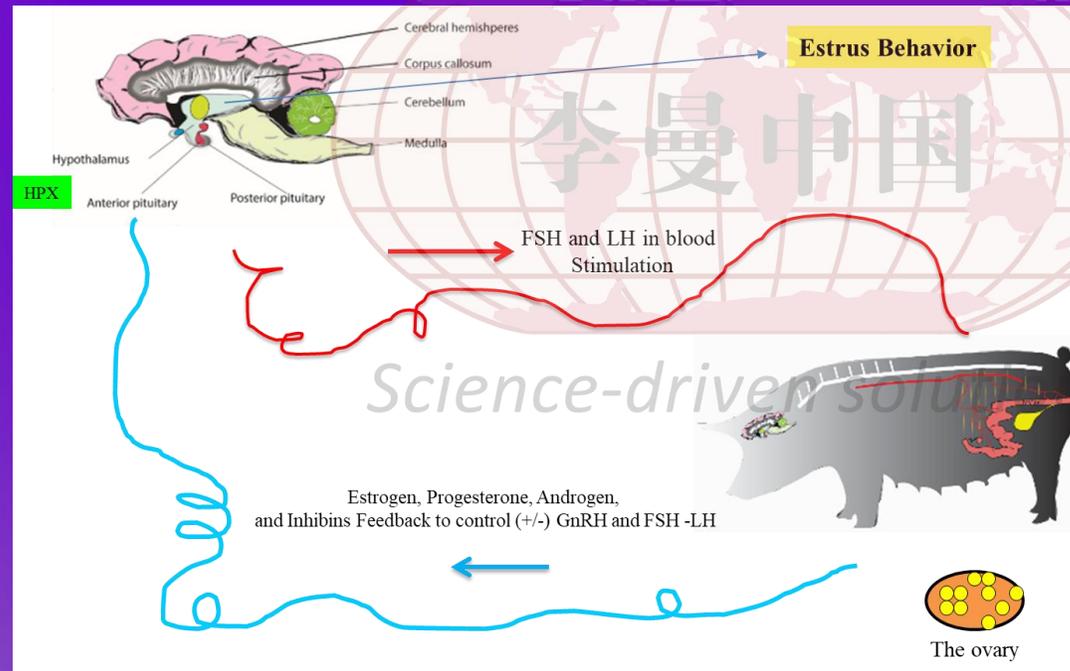
The last to mature is Hypothalamus (HPX)

-response to estrogen feedback-

最后发育成熟的是下丘脑 (HPX)

-对雌激素反馈的反应-

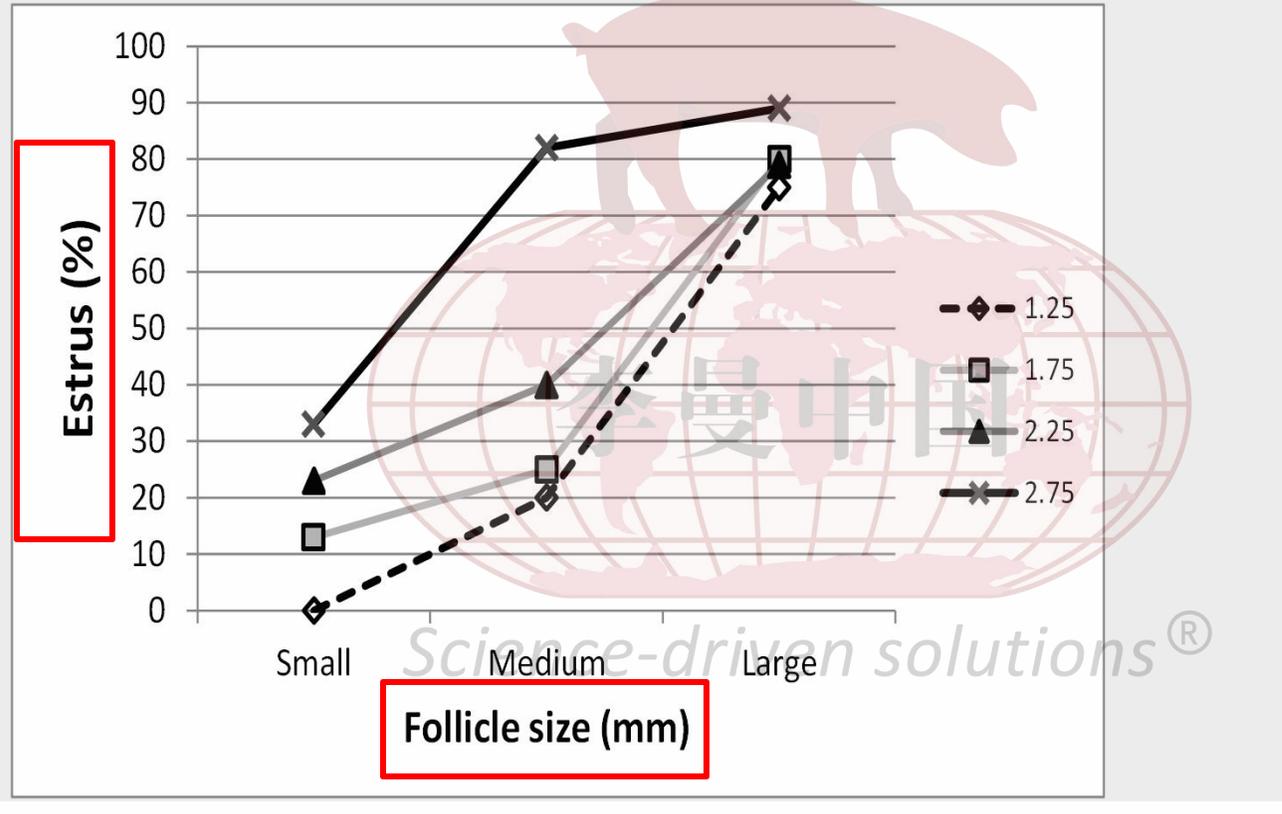
- HPX suppressed by estrogen feedback
- 雌激素反馈抑制HPX
- With maturity: stimulated to release LH by estrogen feedback (Black bars)
- 成熟时：在雌激素反馈的刺激下释放黄体生成激素（黑色矩形框）



Barb et al., 2010 ARS 122:324-7

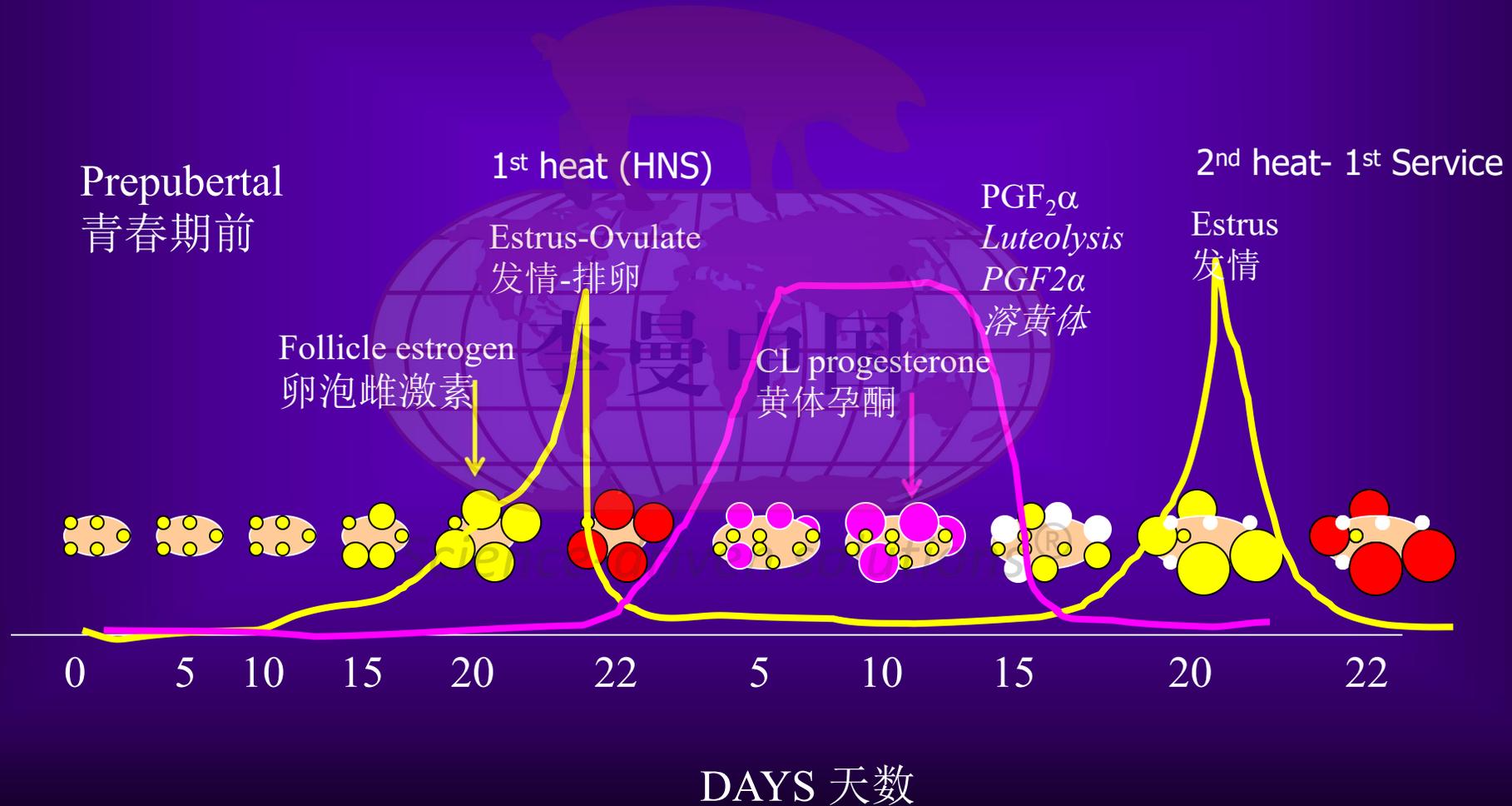
Large follicles linked to Estrus- not vulva size 卵泡大小与发情期有关，而非阴户大小

Figure 1. Average vulval score during the follicle phase in relation to average size of the largest follicles and its relation to expression of estrus in replacement gilts.

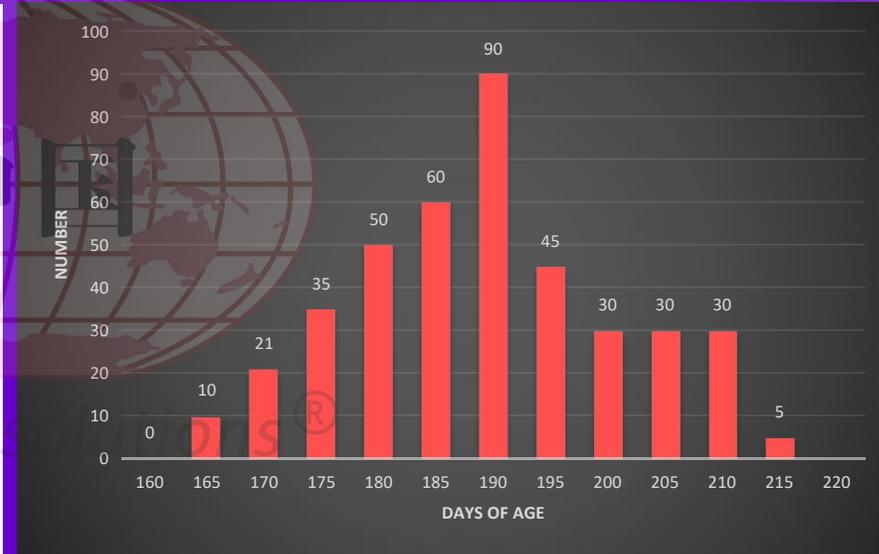
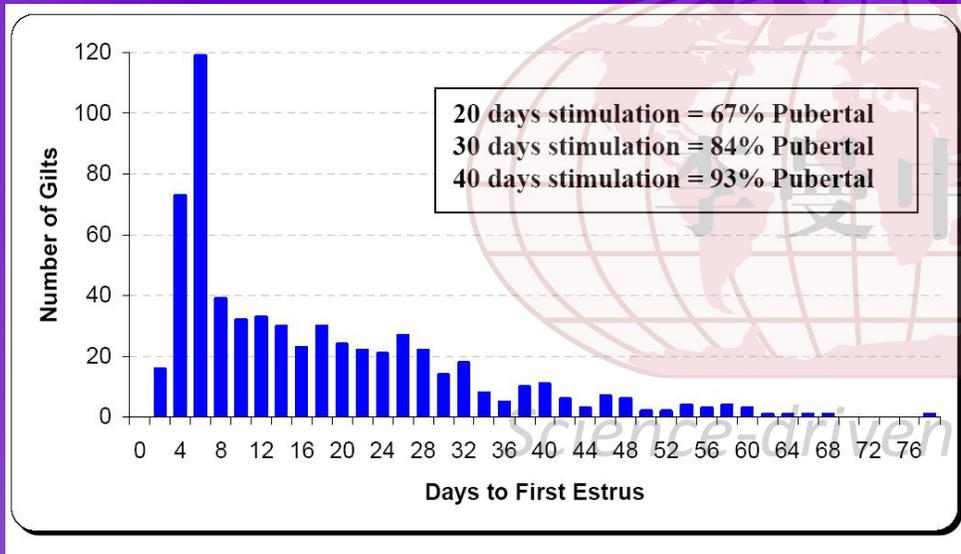


The Reproductive Cycle of the Gilt

母猪的繁殖周期



Plot your patterns for age at puberty 绘制青春期年龄分布图



Direct boar contact starting d 160
From: Foxcroft, 2004

NPB Res. Project 2016.
53% pubertal by 30 days (190 d)
22% anestrus by d 220 in a 60 d period (n = 406/520)



Gilt Selection 后备母猪选择

Induction of puberty and detection of estrus 诱导青春期和检测发情期

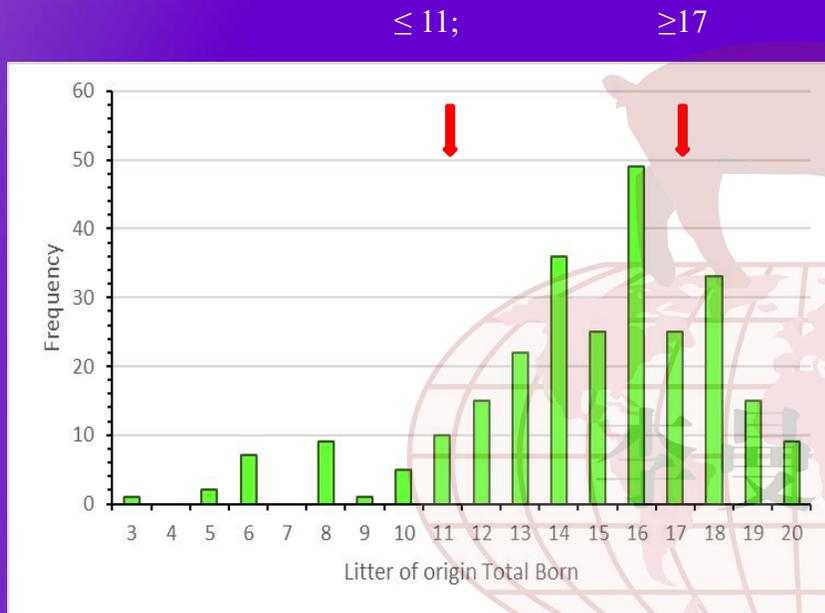
- If practical select from:
- 如果可行，请从以下选项中选择：
 - early puberty dams 早熟母畜
 - Large litter; >1.2 kg birthweight 产仔数多窝；初生重>1.2kg
 - At ~160 days >100 kg or >650 g/day 在约160天时，体重超过100公斤或日增重超过650克
 - Avoid extremes for weight (low/high) 避免体重走极端（过低/过高）
- Induction depends on: 诱导取决于：
 - Gilt age and Boar contact intensity 后备年龄与公猪接触强度
 - Contact time-Proximity to boar/pheromone 接触时间-与公猪/信息素的接近程度



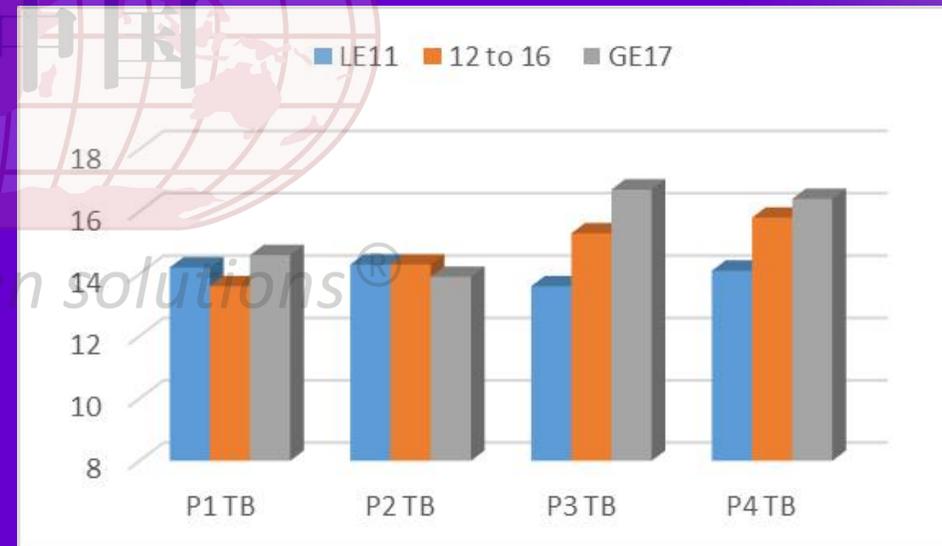
Avoid Low extreme 避免低极端

Gilts from smaller litters tend to show lower lifetime fertility

小窝产下的后备母猪往往表现出较低的终身繁殖力



	LE11	12 to 16	GE17	
n	35	147	82	
Birthweight (kg)	1.73	1.48	1.52	<0.0001
P3 Total Born	13.6x	15.3y	16.7z	0.001
Lifetime pigs	57.7	59.5	62.2	0.07



Gilt Housing and Group Size

后备母猪舍和和组群大小

- Boar Exposure and group size 公猪暴露与群体大小
 - Larger groups need more time or boars
 - 较大的群体需要更多的时间或公猪
- Grouping 分组
 - Puberty can “sometimes” be improved in gilts by sequential moving, mixing, and boar exposure (~ 10 d)
 - 通过顺序移动、混合和公猪接触（约10天），可以“有时”改善后备母猪的青春发育
 - **BUT : repeated mixing causes problems in feed intake, increased stress and injury as a result of social order establishment each time**
 - 但是：反复混养会导致采食量问题，每次建立社会秩序时都会增加应激和损伤



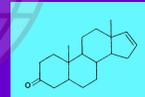
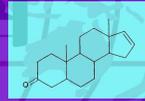
Important Boar Stimuli 重要的公猪刺激因素

-to induce standing in 1st Estrus Gilts-

-诱导首次发情母猪站立-

<u>Some recent work by our lab</u>	<u>我们实验室最近的一些工作</u>	
Back pressure alone	仅背压	0%
Fenceline boar	围栏公猪	50 %
Boar vocal + Pheromone	公猪叫声+信息素	0%
Boar vocal + Pheromone + Back pressure	公猪叫声+信息素+背压	75 %
<u>Fenceline boar + back pressure</u>	<u>围栏公猪+背压</u>	<u>75-100%</u>

Pheromone helper 费洛蒙助手



Troubleshooting Puberty failures

青春期发育障碍的排查与解决

- Gilt 后备母猪
 - Plot estrus by start of BE (age) 通过开始公猪暴露（年龄）来绘制发情期
 - Reproductive tracts 生殖道
- Technical procedures 技术程序
 - Records for days of week (holidays/weekends) 每周工作日（节假日/周末）的记录
 - People 人们
 - Observe procedures (differences in Contact time/back pressure) 遵守程序（接触时间/背压差异）



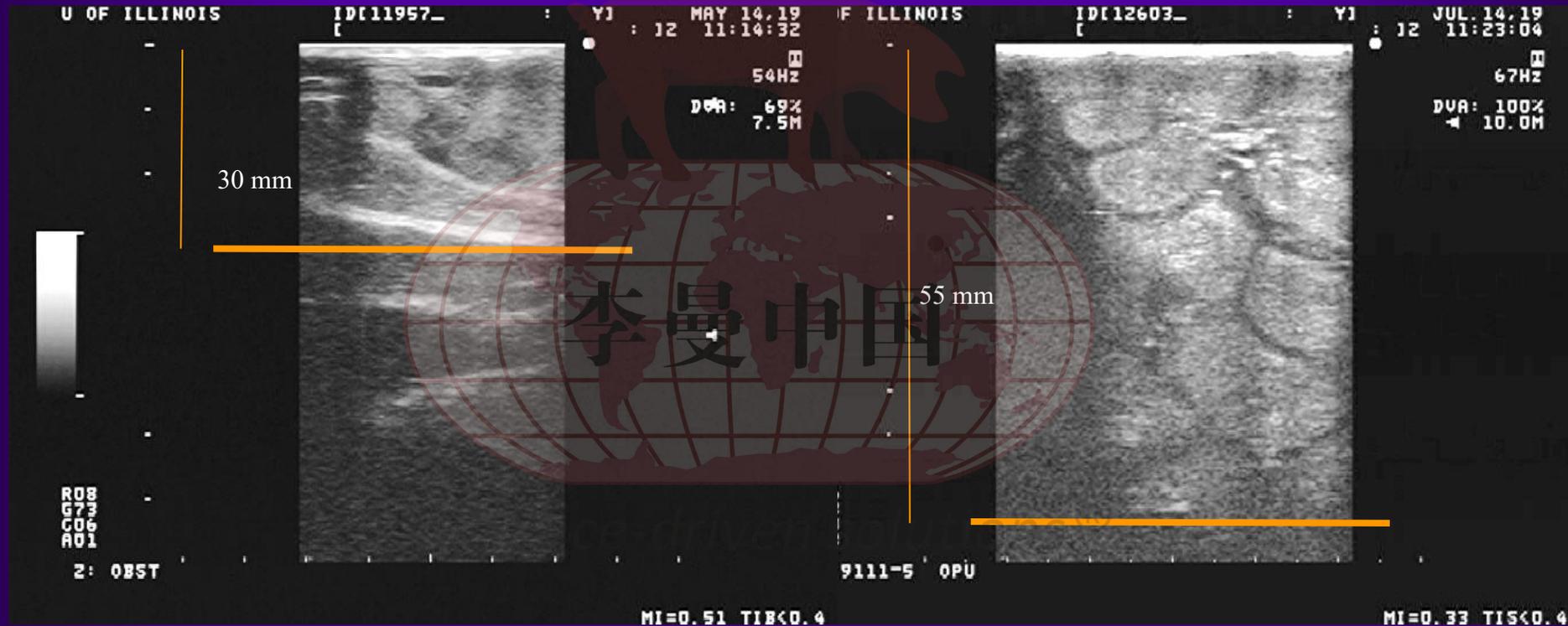
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Diagnostic Tests 诊断测试

- Slaughter check for CL
- 黄体的屠宰检查
- Ultrasound for ovaries uterus
- 卵巢和子宫的超声检查
- Progesterone test
- 黄体酮测试



Small or Large Uterus 小子宫或大子宫



For Anestrus or Non-Cycling Gilts 对于乏情期或非发情周期的母猪

NO Puberty POSSIBILITIES 无青春期可能

- Immature - Delayed puberty (start ~170 d):
- 发育不全 - 青春期延迟（开始时间约170天）：
 - By 60 days (230 days of age) 到60天大（即230天龄）
 - By 80 days (250 days of age) 到80天大（即出生后250天）
 - By 110 days (280 days of age) 到110天（即280天大）
 - ± vulval swelling ± 外阴肿胀



- Mature/Immature

- 成熟/不成熟

- Ovulated but no estrus observed (Silent heat) 排卵但未观察到发情（隐性发情）
- Weak Heats 弱发情
- Irregular intervals 发情间隔不规则



Proportion of anestrus gilts with immature ovaries can change with age

卵巢未成熟的乏情母猪比例会随年龄变化

	n	210-230 days	230-280 d
No Heat	66	40-50%	40-80%
Weak	30	80%	90%

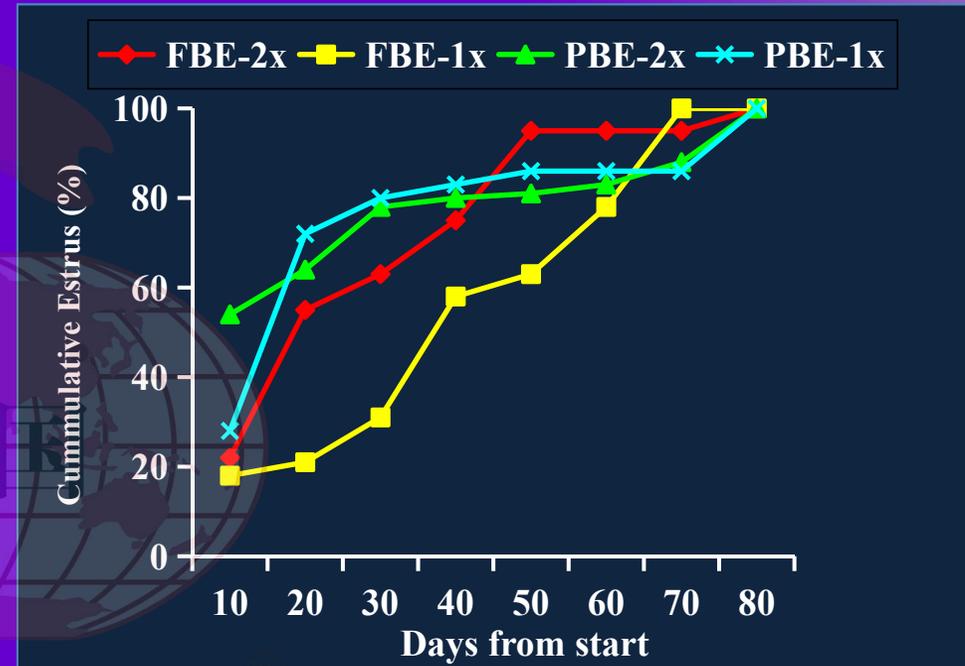
- Estrus response in gilts following a 4-6 weeks of boar exposure
- 小母猪在接触公猪4-6周后的发情反应

- [Stancic et al., 2011 Therio. 76:1022-6](#)
 - In gilts (n=175) not detected by 240 days of age
 - 在240日龄前未检测到的后备母猪 (n=175)
 - 61% cyclic (1 or 2 cycles) and 39% prepubertal
 - 61%为周期性 (1个或2个周期), 39%为青春期前



Consider changes in Boar Exposure 考虑公猪暴露情况的变化

- Fenceline 2x/d 围栏线2x/d
- Physical 物理的
- Gilt to Boar pen 后备母猪到公猪栏
- Rotate boars 公猪轮换
- Use Multiple boars 使用多头公猪
- Increase duration of exposure
延长暴露时间
- Avoid Refractory behavior
避免过激行为

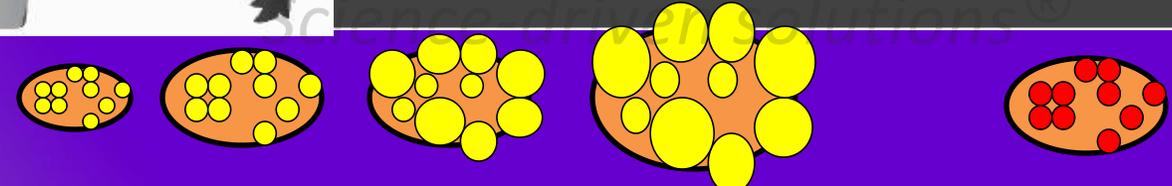
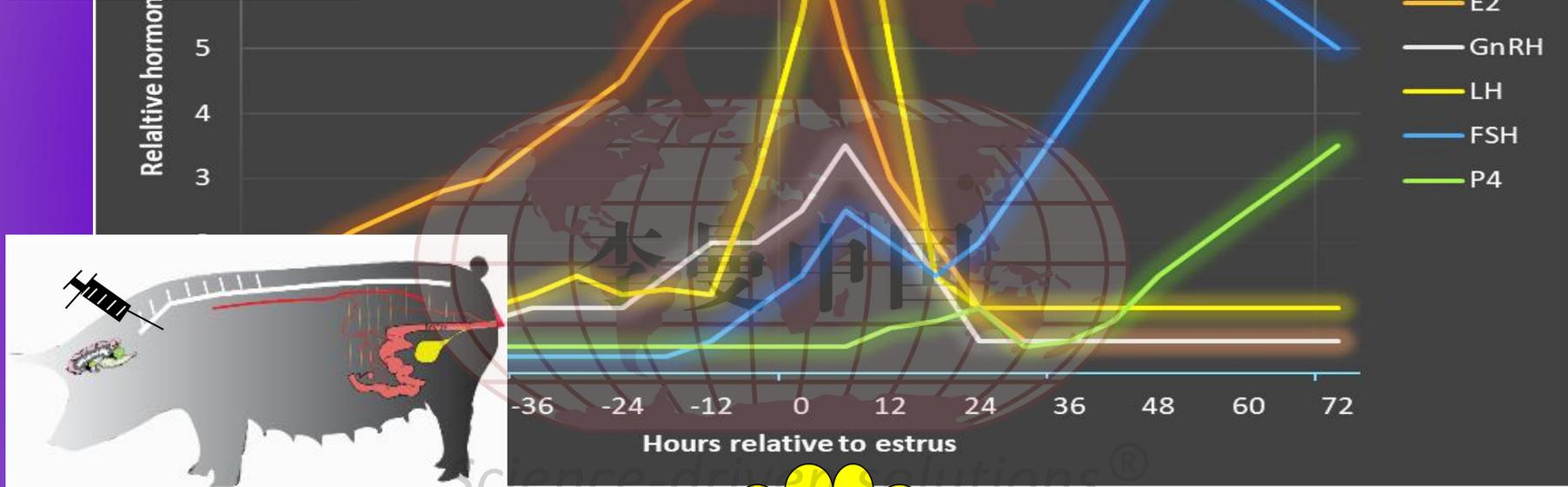


160 d exposure, 10 min/day
Zimmerman et al., 1998; Neb. Swine Report



PG600 can induce follicles in prepubertal gilts

PG600可诱导青春期前母猪卵泡发育



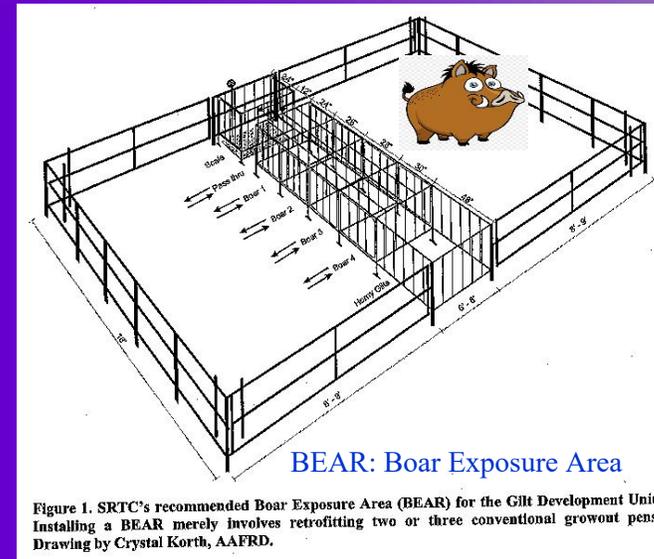
Soede et al., 1994 (E2, LH, P4); Knox et al., 2001 (FSH), Jonas 1975; and Schillo 1985 GnRH)



Changing Boar Intensity + PG600
改变公猪强度 + PG600

Fenceline with added + Physical (15 min/d)
带有额外+物理属性的围栏线（每日15分钟）

PG600 for anestrus gilts in week 3 -confirmed prepubertal
PG600用于第3周末发情母猪——确认处于青春期前



	n ²	Treatment 治疗			SE	TRT P-Value
		FBE	+ PBE			
Age at boar exposure (d)	269	184.6	184.4	0.3	0.59	
Estrus in week 1, %	307	27.5	38.3	3.8	0.04	
Estrus in week 2, %	206	26.1	37.6	4.6	0.08	
Estrus in week 3 ³ , %	Control	61	47.8	40.3 ^x	5.6	0.50
	PG600	74	56.4	81.8 ^y	7.8	0.04



Funded by National Pork Board NPB 17-139



PG600 for anestrus gilts PG600用于未发情母猪

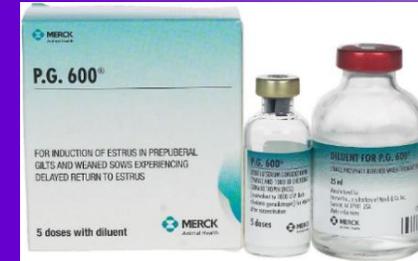


- With CL
- 使用黄体
 - Grow follicles but do not show estrus in 5 days
 - 卵泡发育，但5天内未发情
 - but express estrus 8-17 d later without problems
 - 但8-17天后可顺利表达发情期
- Prepubertal gilts 初情期前后备母猪
 - express estrus in 5 days and cycle again in 21 days
 - 5天内发情，21天后再次发情

PG600 on farms with delayed puberty

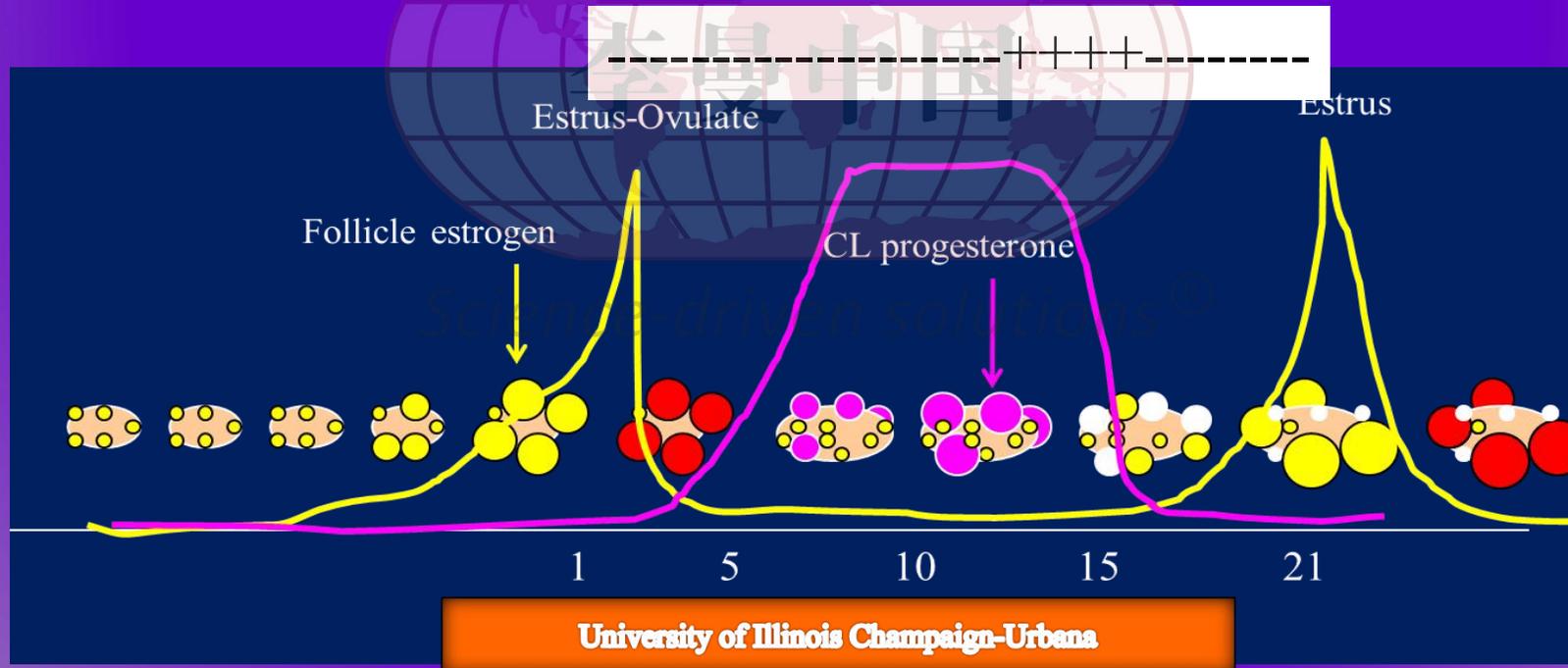
PG600在青春期延迟的农场上的应用

- Diagnosed Prepubertal Gilts (2 farms)
- 经诊断的青春期前后后备母猪（2个农场）
 - Most delayed puberty gilts ($\geq 75\%$) on both farms grew large follicles in 4 days
 - 两个农场中大多数 ($\geq 75\%$) 性早熟延迟的后备母猪在4天内都长出了大卵泡
 - But estrus expression/detection differed by farm (30 vs. 75%)
 - 但发情表现/检测因农场而异（30% vs. 75%）
 - Approach works best with earlier intervention (more prepubertal)
 - 早期干预（青春期前）效果最佳



Can silent heat gilts be induced into estrus? 不发情的母猪能被诱导发情吗？

- YES是
 - $\text{PGF}_2\alpha$ (Lutalyse) destroys a d 12-15 CL $\text{PGF}_2\alpha$ (律胎素) 可破坏第12-15天的黄体
- PROCESS 过程
 - Silent heat gilts could be in week 1-3 of cycle so will use a sequence 静默发情的母猪可能在发情周期的第1-3周，因此将使用一个顺序
 - WEEK 1 inject and check for heat- 第1周注射并检查是否发情-
 - WEEK 2 inject remainder and check for heat 第2周：注入剩余部分并检查是否发情
 - ~70% express a strong Estrus to injection 1 or 2 ~70%的动物在注射1或2后表现出强烈的发情反应
 - Works best with older gilts 最适合用于老后备母猪



SYNCHRONIZE GILTS FOR BREEDING

同步后备母猪以进行繁殖

- Works well
- 运作良好
 - Random cycling gilts 随机循环的后备母猪
 - Batch system scheduling 批次系统调度
 - Can be used with OvuGel to reduce delayed ovulation and apply SFTAI
 - 可与OvuGel一起使用，以减少排卵延迟，[®]并应用SFTAI

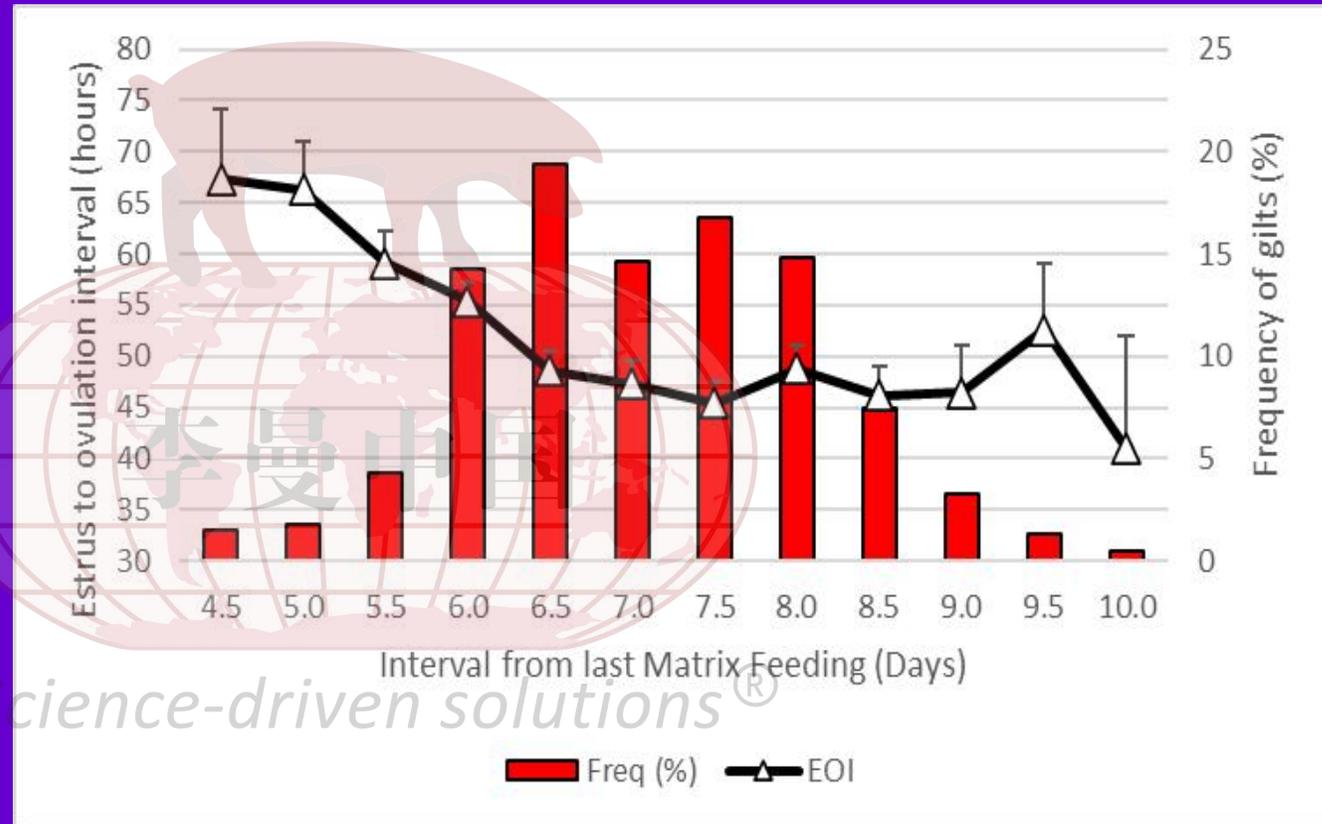


Interval from Altrenogest to estrus 从烯丙孕素到发情期的间隔

- affects estrus to ovulation interval-

-影响发情至排卵的间隔时间-

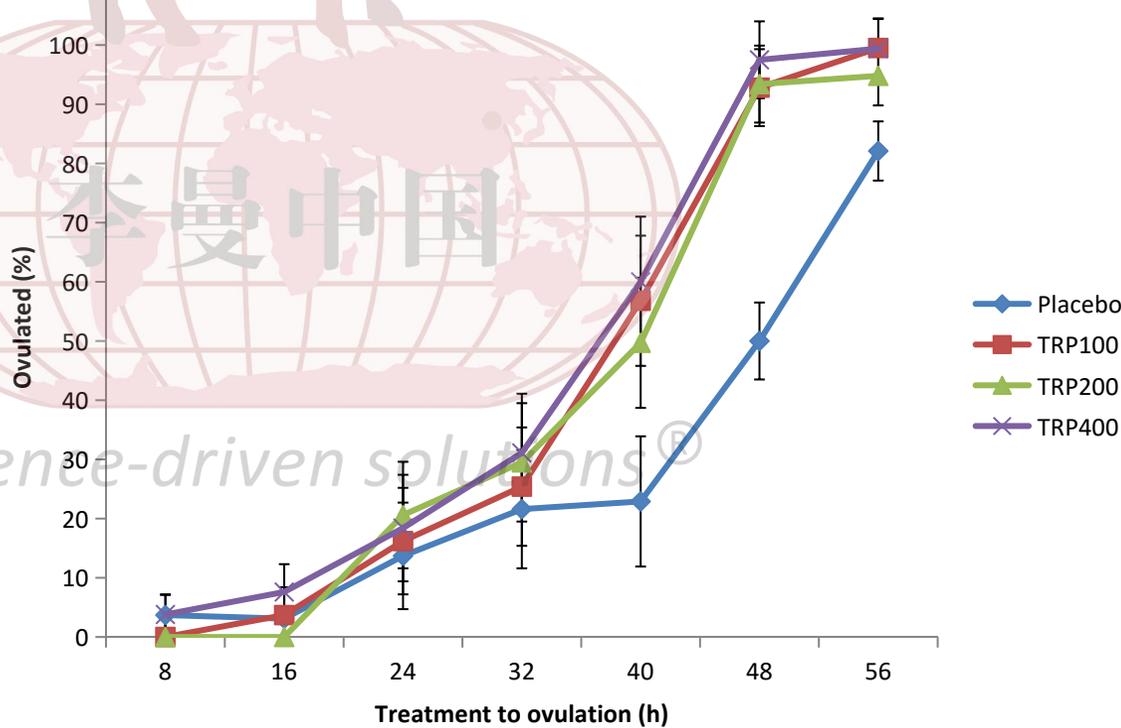
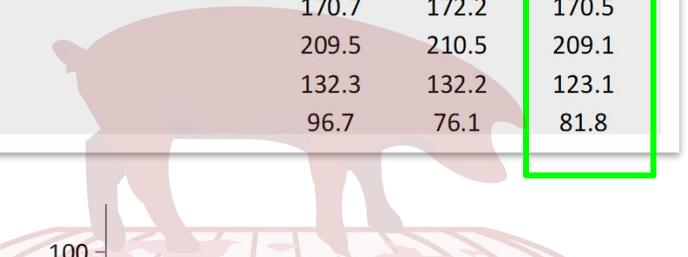
$r^2 = -0.2, (P < 0.001)$



OvuGel at 120 h can advance and synchronize ovulation for AI

120小时的OvuGel可促进并同步人工授精（AI）中的排卵

	Control	TRP100	TRP200
n	23	20	21
Age at first estrus (d)	170.7	172.2	170.5
Age at last Matrix feeding (d)	209.5	210.5	209.1
Weight at last Matrix feeding (kg)	132.3	132.2	123.1
Gilts expressing estrus (%)	96.7	76.1	81.8



Opportunities for Gilts 后备母猪的机遇

- Checklist gilt selection for induction
- 诱导后备母猪选择检查清单
- Optimize boar effect
- 优化公猪效应
- Plot puberty patterns
- 描绘青春期发育模式
- Use early problem intervention
- 采用早期问题干预
- Synchronize to breed
- 同步繁殖



Thank you for your attention!
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