



**江苏省农业科学院**  
Jiangsu Academy of Agricultural Sciences



# Improving cow fertility by immunization against inhibin and P4 supplementation

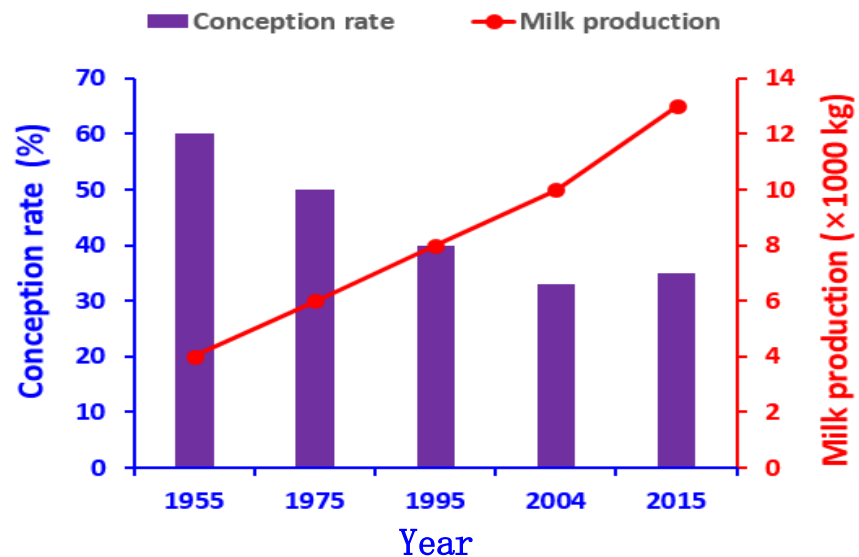
**Dr. Zhendan Shi**

**Institute of Animal Science, Jiangsu Academy of Agricultural Sciences  
Nanjing, 210014, China**

**Contact: [zdshi@jaas.ac.cn](mailto:zdshi@jaas.ac.cn), Phone: +86 13913888894**

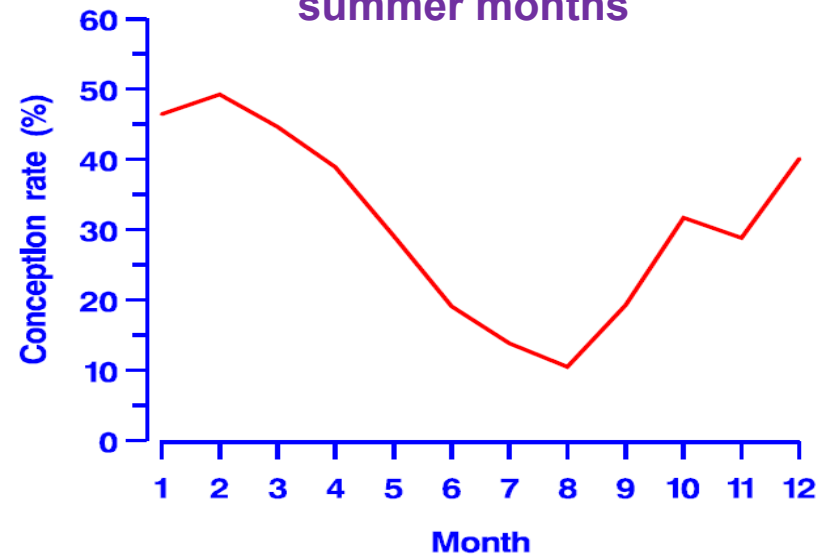
# Chronological and seasonal changes in dairy cow conception rate

## Chronological changes in conception rate



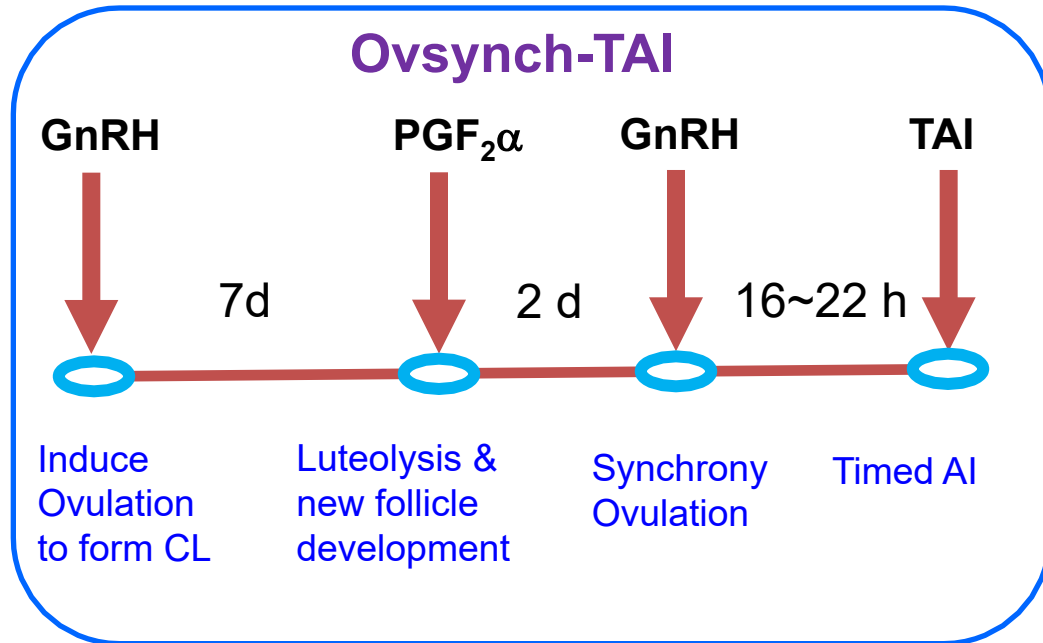
1. Cow fertility has deteriorated significantly from 60% in 1955 to 35%, due to selection for higher and higher milk production.

## Conception decreases in hot summer months

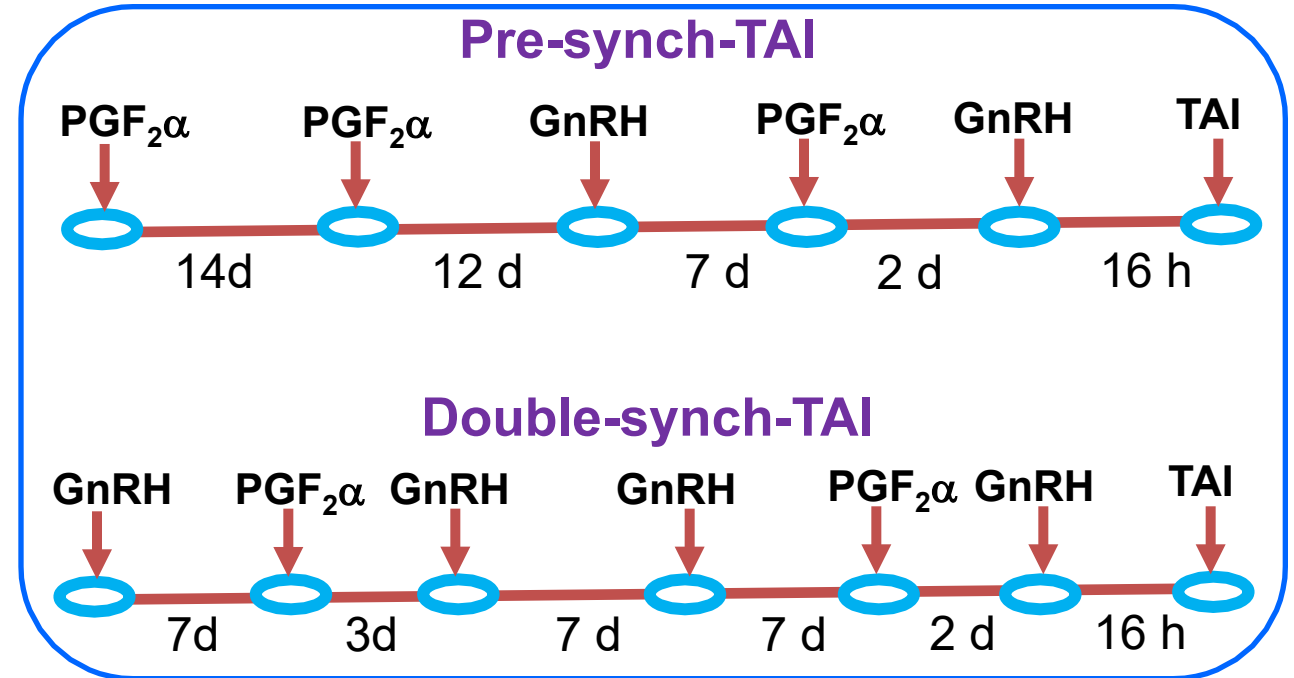


2. Fertility declines in hot summer times due to heat stress that negatively impacts the reproductive system.

# Current techniques for improving cow conception rate



1. The use of Ovsynch-TAI protocol induces cows to ovulate at 70d post partum, also at desired time for timed artificial insemination, and can yield a **conception rate between 30% to 40%**



2. Pre- or double-synch protocol induces more times of ovulations and form more numbers of corpora lutea, so to secrete more P4 to support follicle development, with **conception rate near 50%**

# Conception requires 3 interrelated reproductive events

## 1. Sound developing follicle

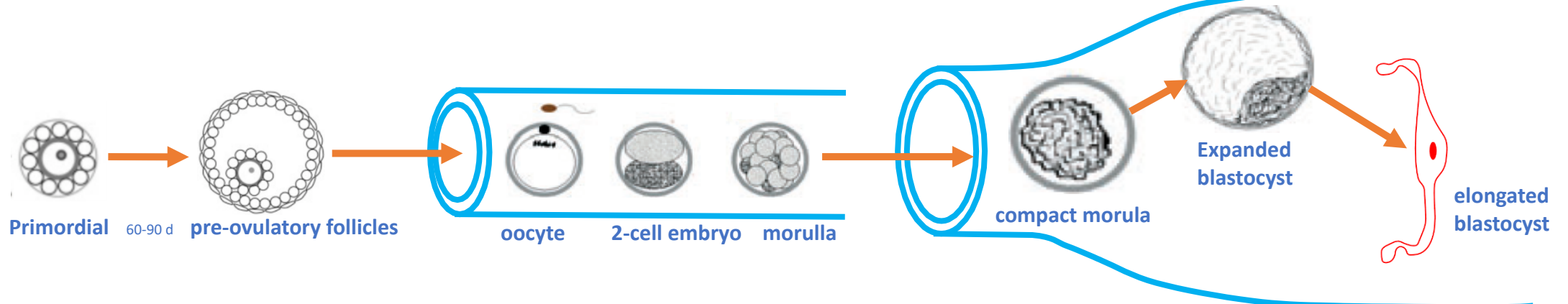
- Secretion of E2 for good estrous behavior, better reproductive tract environment for gamete fertilization
- High quality oocyte and corpus luteum following ovulation

## 2. Quality oocyte & embryo

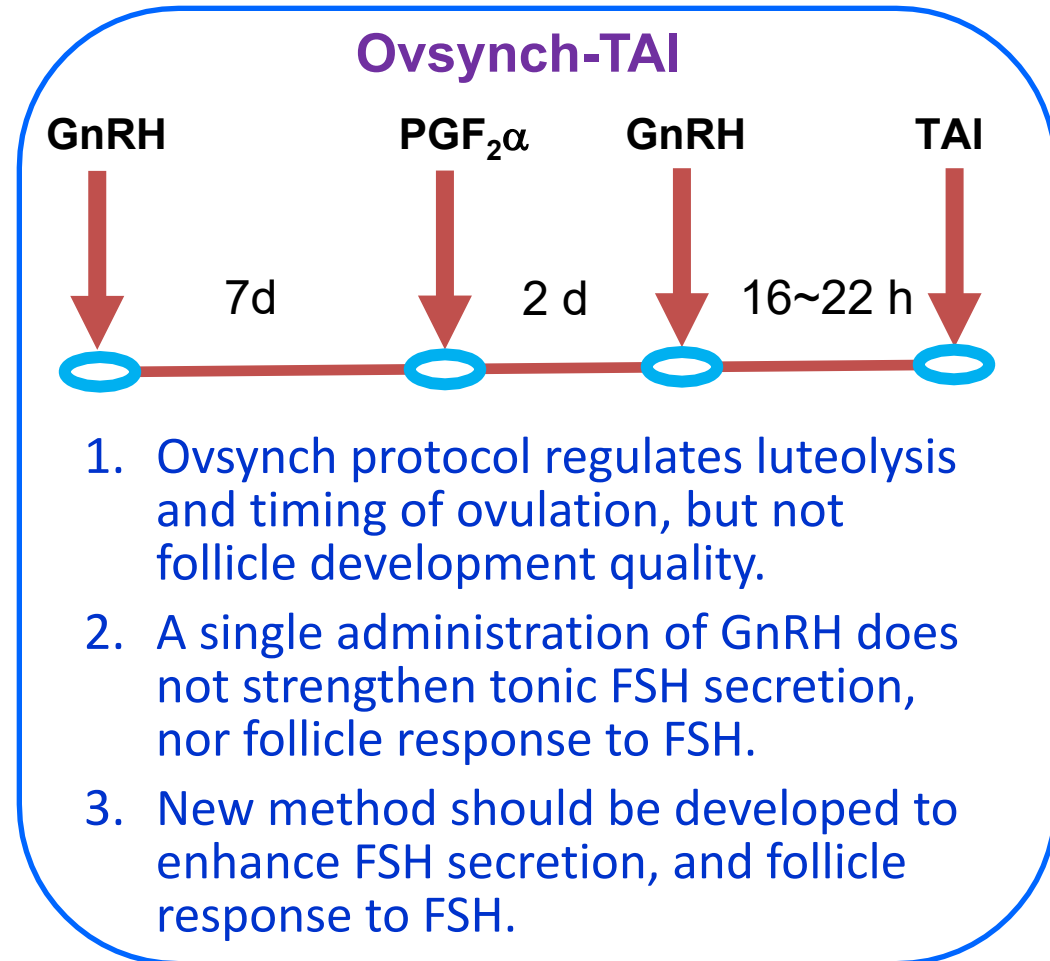
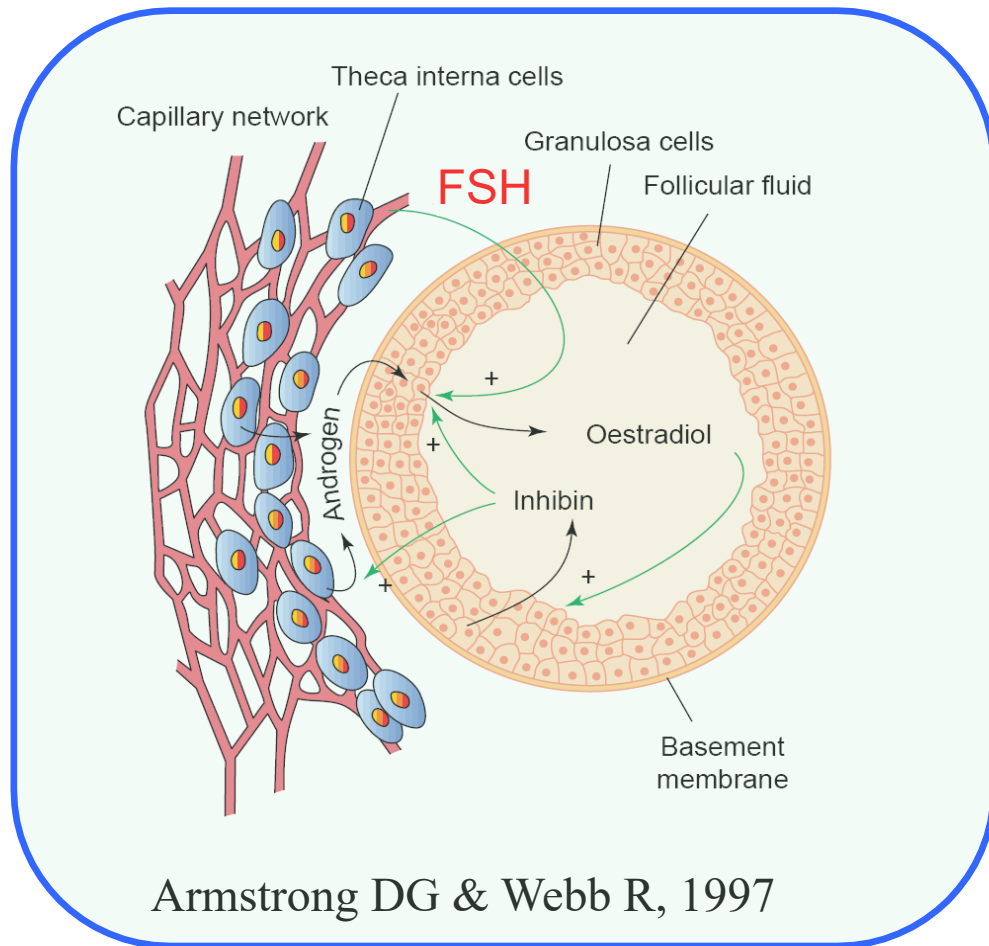
- Oocyte quality affects embryo development quality and conceivability.
- Embryo quality and conceivability also affected by corpus luteum quality and P4 secretion.

## 3. Sound developing C. Luteum

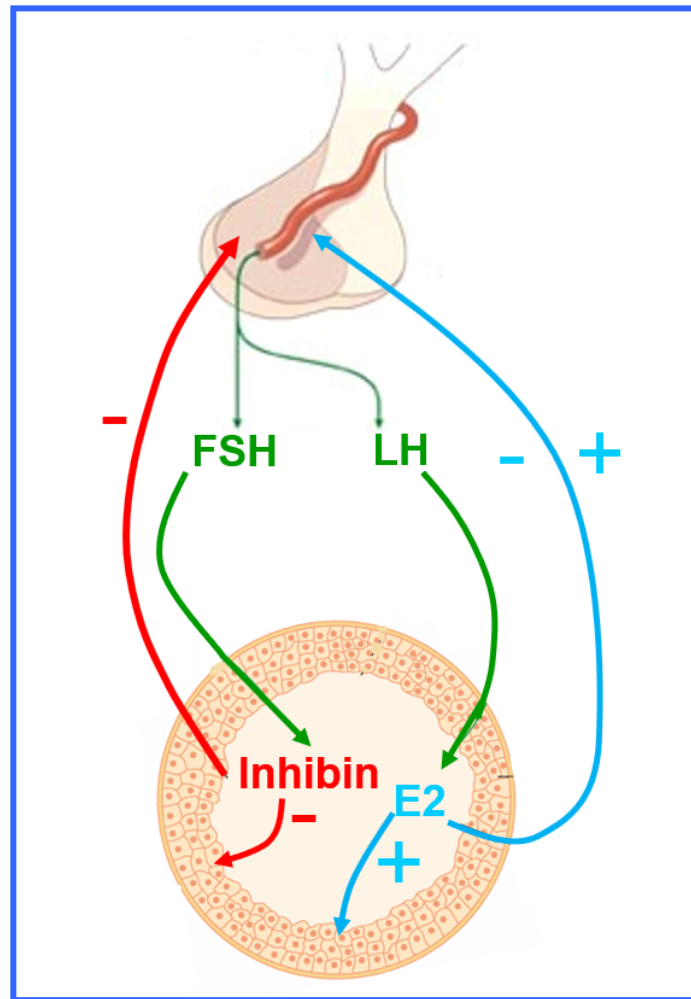
- A good CL after ovulation that secretes P4 to supports embryo development and implantation.
- A good embryo prevents luteolysis by secretion of interferone  $\tau$ , to form a permanent CL.



# Limitations of Ovsynch protocol in improving fertility



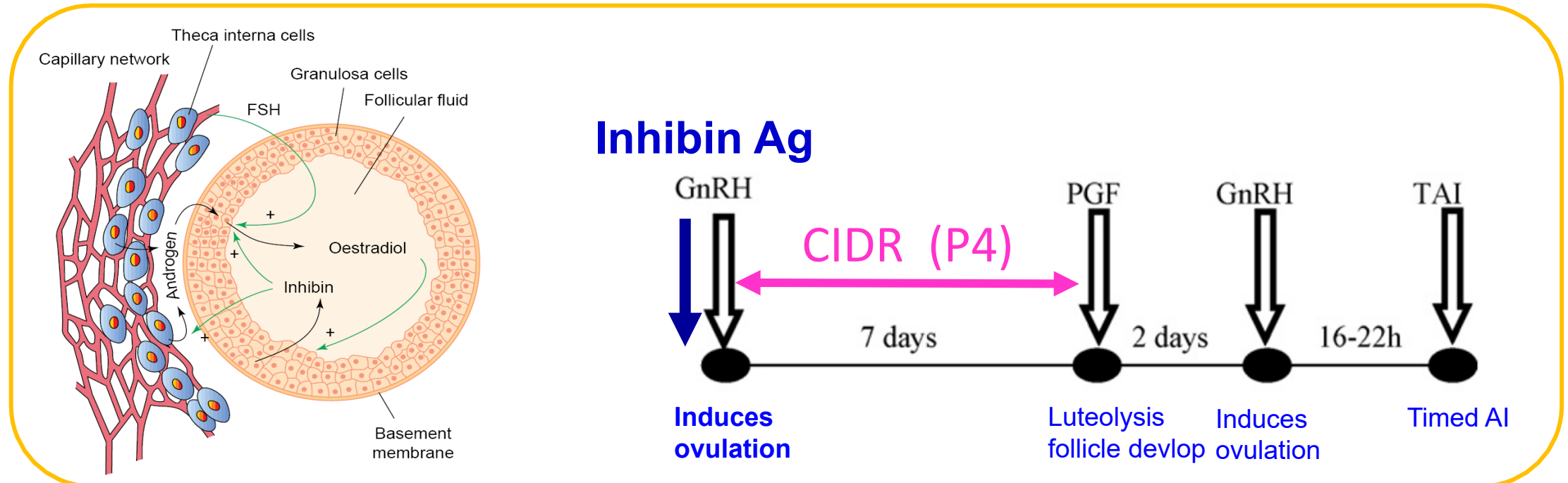
# Inhibin negatively regulates FSH secretion and follicular development



1. Immunization against inhibin enhances FSH secretion by the pituitary gland
  - Medan et al., 2004; Li et al., 2011; Liu et al., 2013
2. Immunization against inhibin enhances granulosa cell proliferation and E2 secretion
  - Jimenez-Krassel et al., 2003; Liu et al., 2015; Cai et al., 2015
3. Immunization against inhibin enhances oocyte maturation and early embryo development quality
  - Li et al., 2011; Liu et al., 2013; Yan et al., 2015

# A new protocol to enhance follicular development: inhibin immunization + Ovsynch + CIDR

1. Immunization against inhibin enhances follicular development, E2 secretion, and oocyte quality, but harms luteal P4 secretion.
2. CIDR provides P4 and bypasses the harmful effect of inhibin immunity to P4, so to enhance oocyte and embryo development qualities.



## Results on inhibin immunization + P4 on TAI cow CR

Exp. + location (heat stress degree)	Treatments		Conception rate (%)	twin rate (%)
Guangzhou, April mild heat stress	control	Ovsynch	21.3 (10/47)	—
	Inhibin immunize		38.0* (19/50)	—
Guangzhou, July severe heat stress	Control	CIDR+Ovsynch	8.1 (5/57)	—
	Inhibin immunize		43.9* (25/62)	—
Dongying, August mild heat stress	Control	CIDR+Ovsynch	26.7 (4/15)	0
	Inhibin immunize		64.7* (11/17)	0
Dongying, April no heat stress	Control	CIDR+Ovsynch	44.2 (19/43)	0
	Inhibin immunize		71.1* (32/45)	15.6 (5/32)

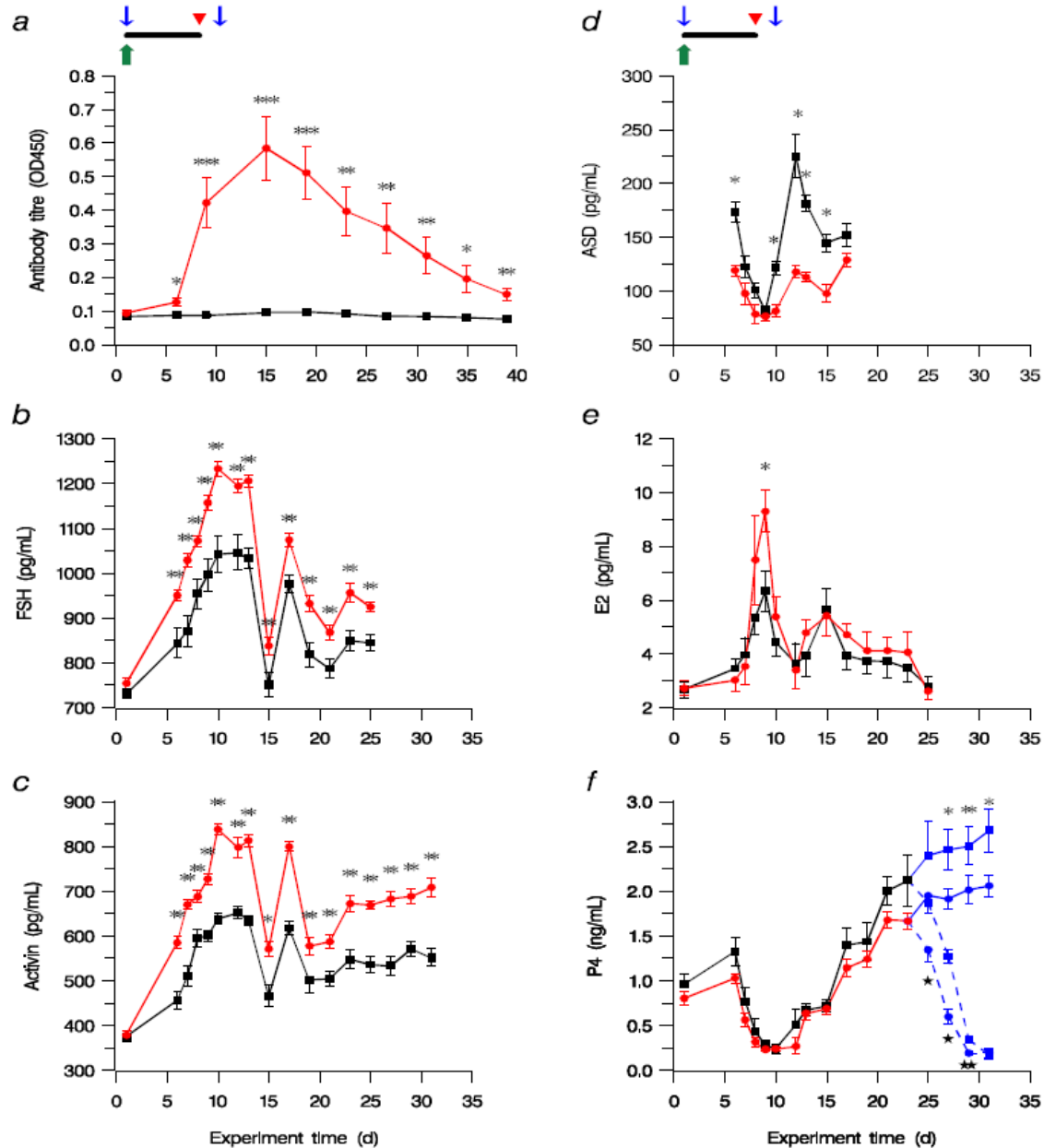
# The logistic regression model of Conception rate

$$\ln \left( \frac{CR}{1-CR} \right) = -0.83 - 0.78xHS + 0.56xP4 + 1.31xImmuning$$

HS has 3 levels of comfortable (0), mild (1) and severe (2)

Independent variables	Estimate	P Value
Intercept	-0.83	0.01
Heat stress	-0.78	0.04
P4 supplement	0.56	0.00
Immunization against inhibin	1.31	0.00

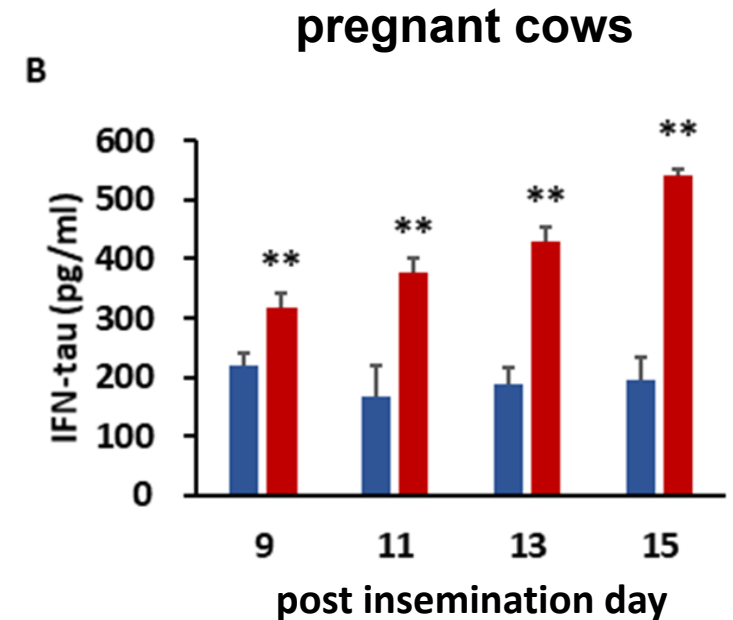
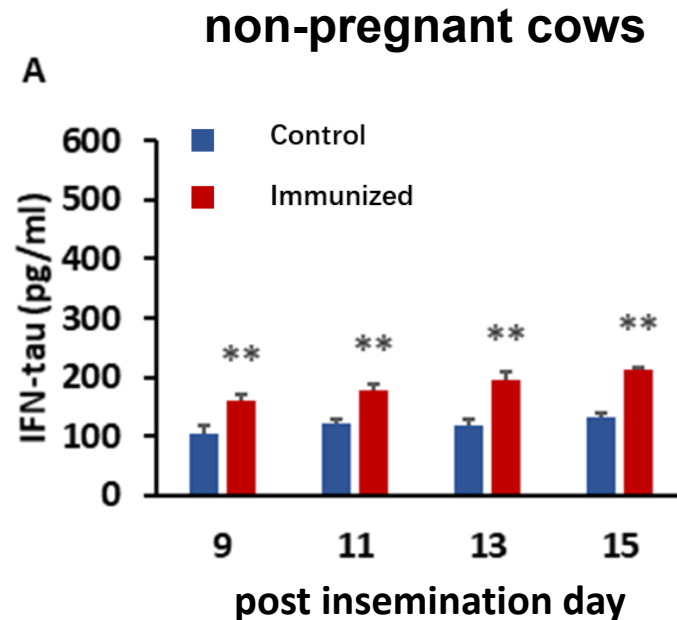
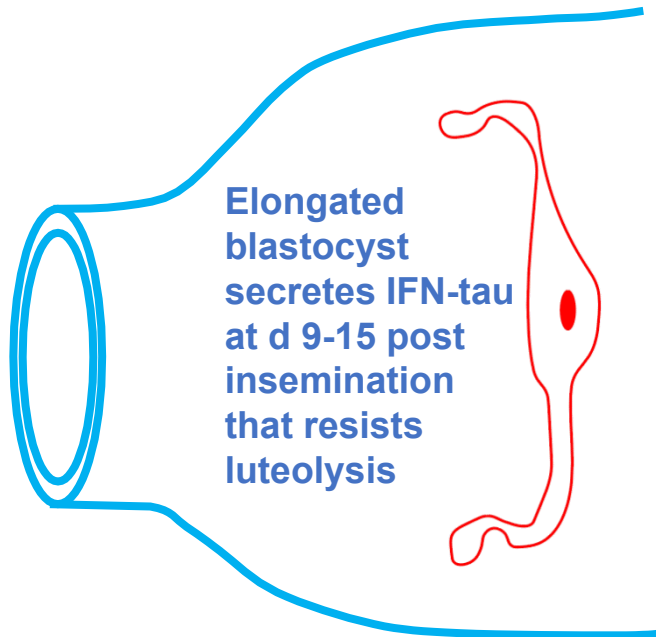
# Effects of immunization against inhibin on hormone secretions



1. Anti-inhibin antibody increased rapidly to high titres at end of Ovsynch protocol or ovulation, disappeared on day 35 after ovulation.
2. Immunization increased blood concentrations of FSH and activin, and E2 concentrations at oestrus peak by 50%.
3. P4 concentration gradually rose after ovulation, and continue to increase in pregnant cows, but decreased to nadir in non-pregnant cows.
4. Immunization against inhibin decreased plasma concentrations of androstenedione and P4.

# IFN-tau sustains high conception rate in immunized COWS

1. In both pregnant or not cows, IFN-tau was detected in blood at days 9-15 post insemination, and was always higher in immunized cows.
2. Immunization against inhibin enhanced embryo development quality and IFN-tau secretion, which should resist luteolysis and facilitate embryo implantation.



# Conclusion

- 1. Incorporation of immunization against inhibin into the current Ovsynch-TAI protocol, can enhance ovarian follicle development, and leads to early embryo development quality and conception rate. The efficacy is more substantial when P4 or CIDR is provided.**
- 2. This new method can constitute a simple and effective technique for improving cow fertility.**

# Acknowledgements



**Dr. Chen Fang**  
**JAAS**



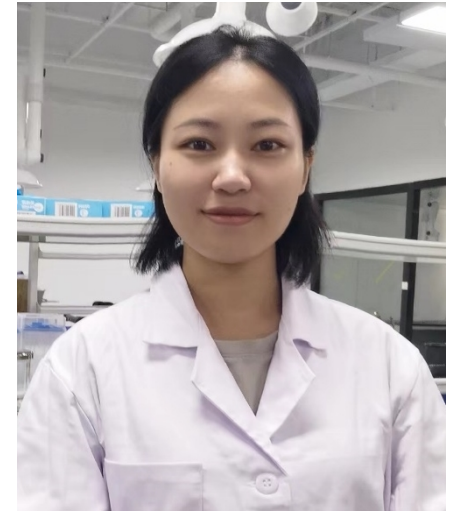
**Dr. Guo Rihong**  
**JAAS**



**Dr. Li Hui**  
**JAAS**



**Mr. Mei Cheng**  
**Austasia Dairy**



**Miss. Lu Jinghui**  
**Henan Ag Uni**

**Thank you for your attention**

**Questions**