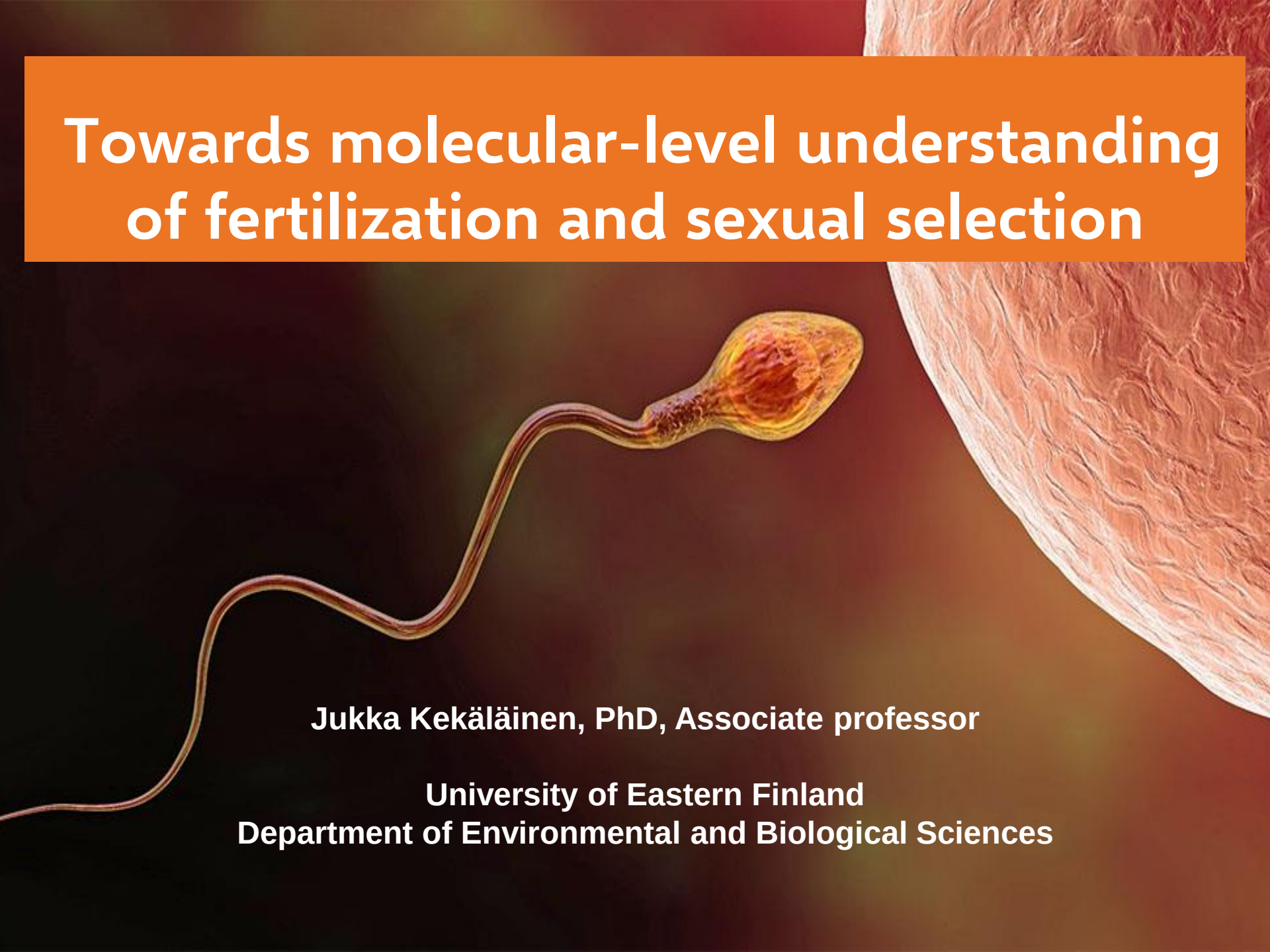
Towards molecular-level understanding of fertilization and sexual selection



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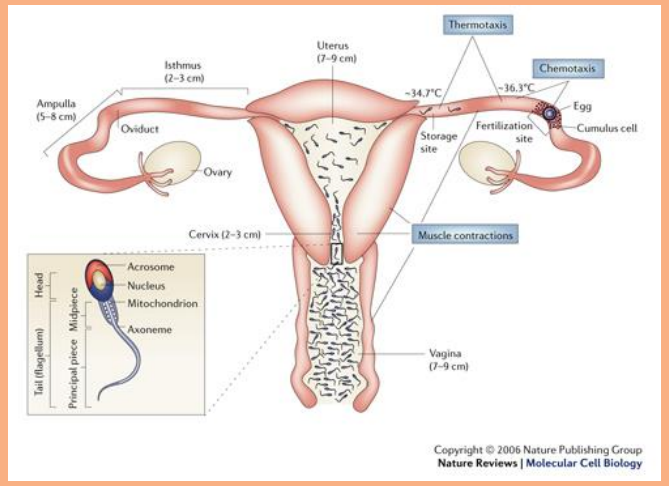
Fertilization

- Fertilization = one the most enigmatic biological processes
- Strongly dependent on the biochemical interactions between:

  A) Sperm and oocytes
  B) Sperm and female reproductive tract



- Traditional view: completely unbiased process
  → random fusion of gametes
- Additional function in mate choice: gamete-mediated mate choice, GMMC: Kekäläinen & Evans 2018, *Proc. R. Soc B*)

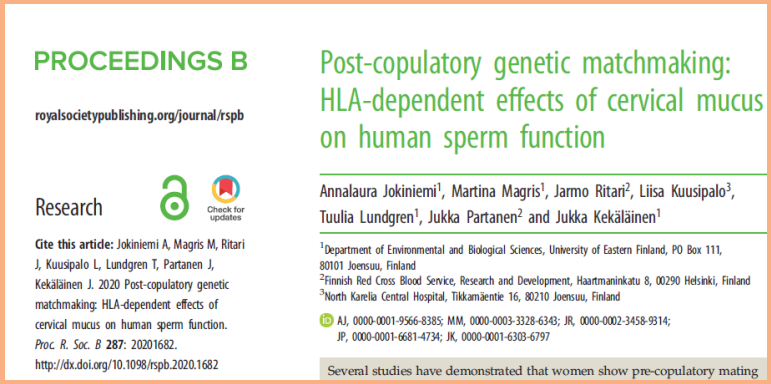
  → fertilization may be far from random process
- GMMC known to occur in some externally fertilizing species
- Mechanistic basis of GMMC unclear
- Could GMMC occur in humans???

Gamete-mediated mate choice in humans

- Initially up to ca. 900 million sperm → only one cell can fertilize the oocyte
  = **Extremely strong selection force**

- Jokiniemi et al. 2020a, 2020b: Female reproductive tract (FRT) secretions likely bias fertilization success towards the sperm of immunogenetically compatible males

  = Favour sperm of human leucocyte antigen (HLA) dissimilar males



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Research

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Post-copulatory genetic matchmaking: HLA-dependent effects of cervical mucus on human sperm function

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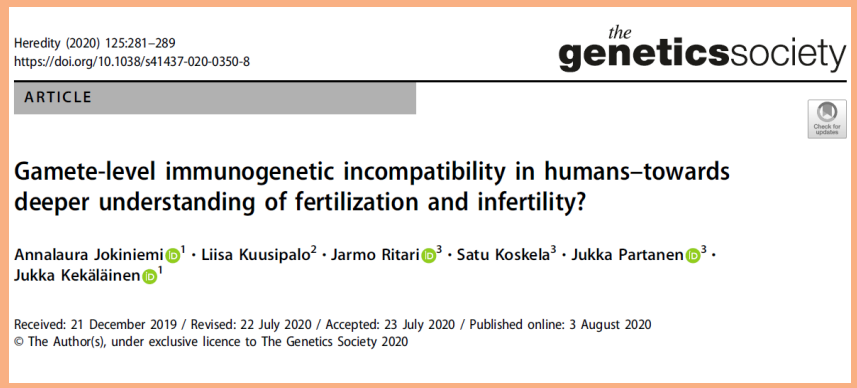
Several studies have demonstrated that women show pre-copulatory mating



Heredity (2020) 125:281–289
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ARTICLE

Gamete-level immunogenetic incompatibility in humans–towards deeper understanding of fertilization and infertility?

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- Sperm motility and viability in FRT strongly dependent on male-female combination

→ Male that is compatible with some female(s) often incompatible with other(s)

- How FRT mediate demonstrated GMMC in humans?

Molecular-mechanisms of gamete-mediated mate choice

- In somatic cells DNA is compacted by histones ('DNA packaging proteins') → RNA transcription possible

- In sperm, histones are replaced with protamines → denser packaging of DNA → DNA unavailable for transcription

→ Mature sperm are believed to be transcriptionally and translationally inert cells

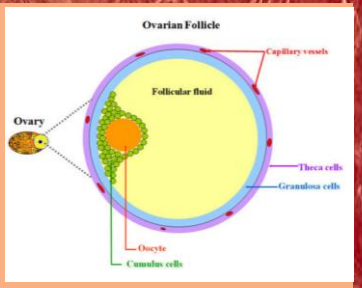
- However: many components of RNA transcription machinery are present in sperm

- Sperm also retain ca. 15% of histones → these chromatin areas available for transcription?

- Could sperm transcriptional (and translational) machinery also be reactivated in FRT?

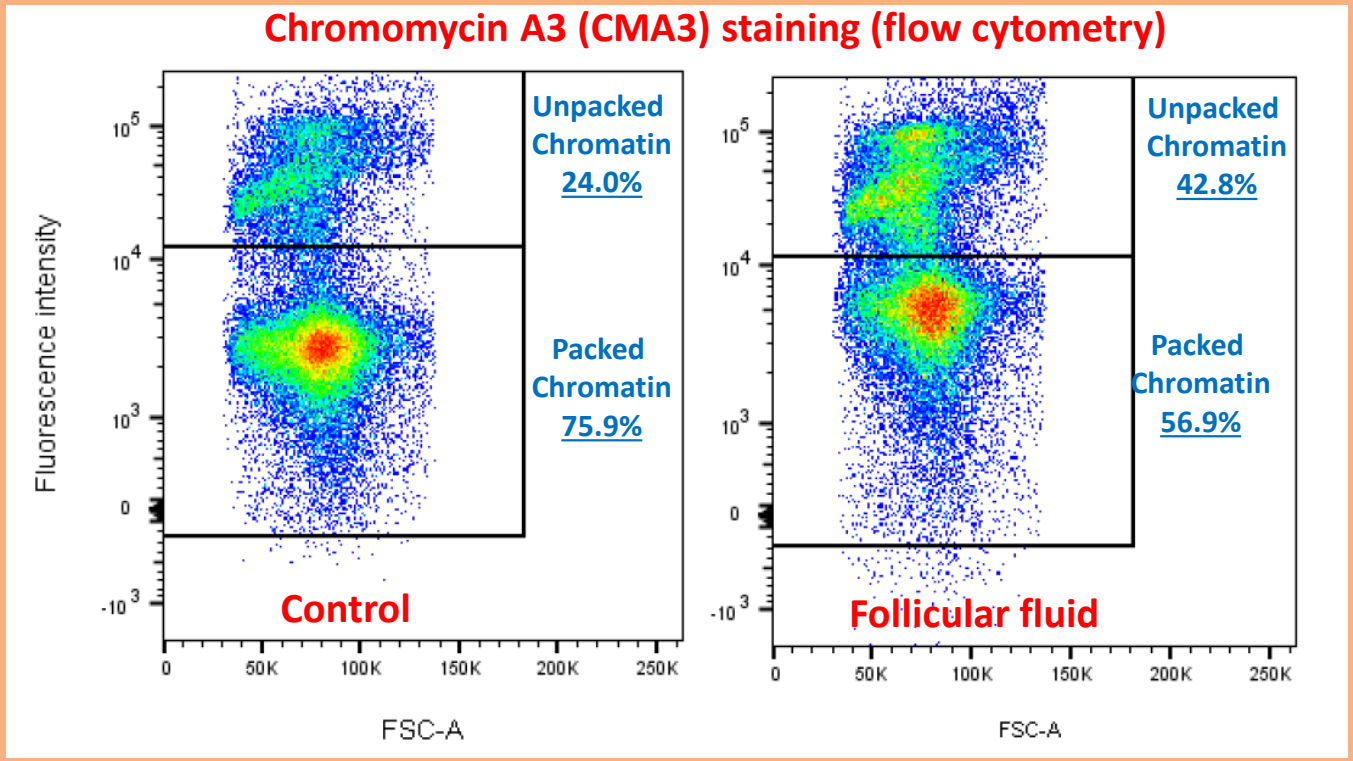
- **AIM: Investigate if females could selectively regulate sperm gene expression and protein synthesis and thus bias fertilization towards the sperm of particular/compatible males.**

Preliminary results



1. **Could follicular fluid treatment decondense sperm chromatin?**

- Does FF affect sperm protamin concentration (Chromomycin A3 staining)?
  → High CMA3 staining = low protamin concentration (less condensed chromatin)

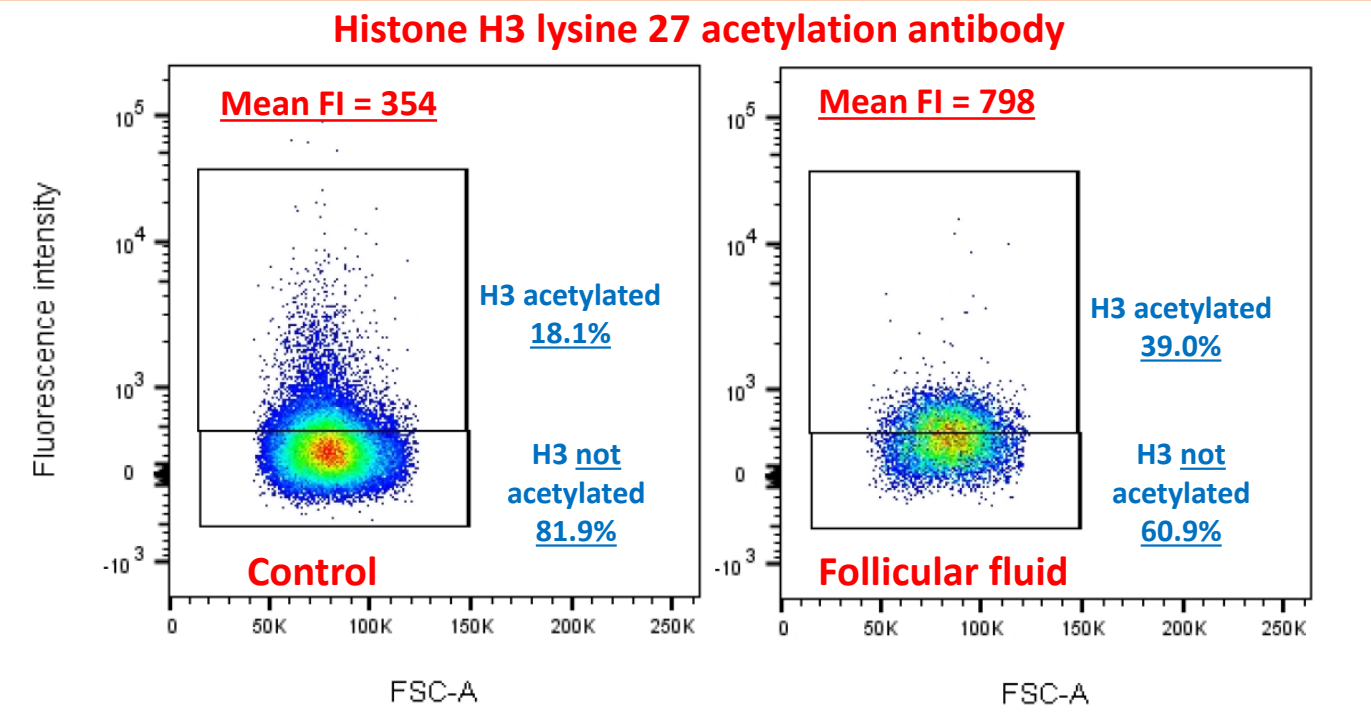


→ Follicular fluid increase availability of sperm chromatin for transcription?

Preliminary results (2)

2. Could follicular fluid induce acetylation of sperm histones?

- Histone acetylation alters accessibility of chromatin and allows DNA binding proteins to interact with chromatin → activate gene transcription
- Histone acetylation usually occur in amino acid lysine and especially in histone protein H3 → Does FF induce acetylation in histone H3 lysine 27 residue?



→ Follicular fluid prepares sperm chromatin for transcription?

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ANY QUESTIONS?

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