Remember to turn on zoom

Put in your pods
Start recording
Share Screen!

Week 14 — Thursday, 2 December

- **FCQs**: you have until Monday the 6th December to complete your FCQ for the course
- **Dossiers**: questions can be answered with 3 to 4 (max) sentences
  - If you address questions and make sense you have earned an A
  - We will answer questions about dossiers next Thursday (9th December); you have until **Tuesday the 14th of December** to complete your dossiers.
  - Exam 2 scores should be returned to you by Monday, the 13th of December.
- **Review Sessions**: I will hold a review session Monday from 4 to 6PM in my office (or if necessary in the room across from the Porter elevator).
  - Brian and Chhavy review to tomorrow / Zach review
- Today: Finish up organoids
- **Review** Core course concepts and principles and their application / pre-exam 2 review
  - Big topics (in class group work):
    - Communications & Cooperation (Brian)
    - Cellular responses (Zach)
    - Asymmetries and Axes (Chhavy)

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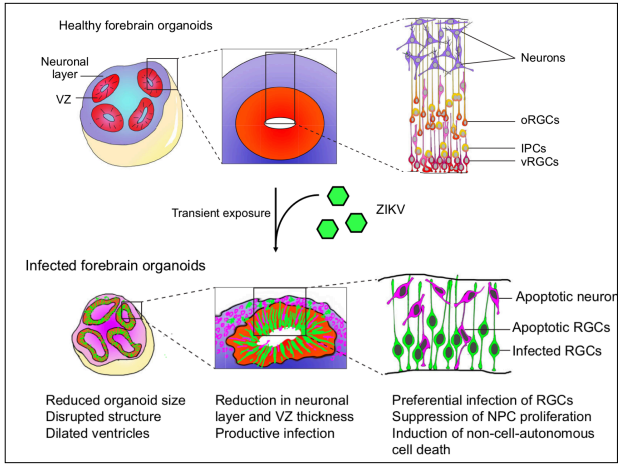


Anti-Scientific & anti-vax propaganda (1926 and today)

Bioliteracy blog

- do citizens have a "right" to avoid vaccination (or decide for their children, or to place other at risk?
- Is avoiding vaccination an example of social cheating?

Fetal alcohol syndrome

~3–5% of women drink heavily throughout pregnancy

Can result in

- reduced brain volume
- malformations of the corpus callosum.
- less common - effects to vasculature development.
- language problems and attention deficits were most common.

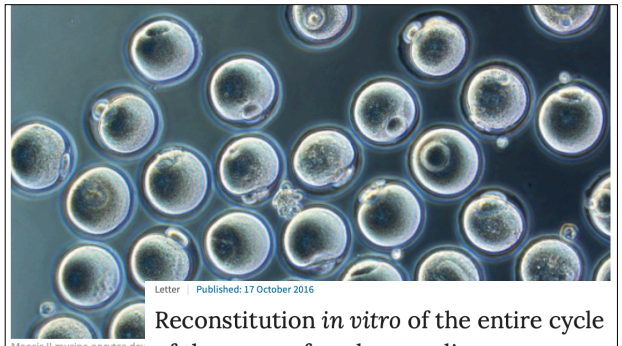
- Influences the activation of the calcium/ calmodulin-dependent protein kinase II (CaMKII) enzyme which phosphorylates and **destabilizes active beta-catenin**.

Why is it difficult to study FAS?

- strictly limited to self-report and data collection
- unethical to host a study in that includes knowledge of pregnant women consuming (high levels) of alcohol.
- conflict of protecting embryonic life, while retaining the privacy and dignity of the patient contributing to the study.

Types of germ line "defects" to correct …

- general infertility (failure to form functional gametes)
- maternal (mitochondrial) defects
- zygotic defects directly linked to disease
- insert alleles associated with "desirable traits"
- "repair" alleles associated "undesirable traits"
- avoid future disease (immunity to HIV infection)



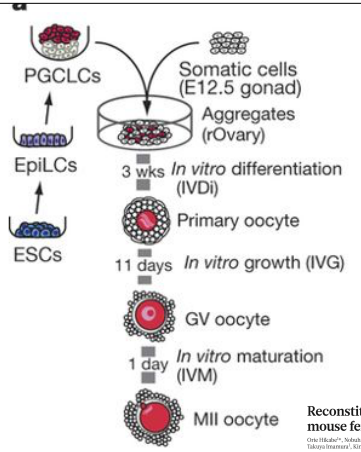
Meosis II murine oocytes dev
KATSUHIKO HAYASHI, KYUSHU

Letter | Published: 17 October 2016

Reconstitution *in vitro* of the entire cycle of the mouse female germ line

Orie Hikabe, Nobuhiko Hamazaki, Go Nagamatsu, Yayoi Obata, Yuji Hirao, Norio Hamada, So Shimamoto, Takuya Imamura, Kinichi Nakashima, Mitinori Saitou & Katsuhiko Hayashi

Nature **539**, 299–303 (10 November 2016) | Download Citation



A schematic of in vitro oocyte production

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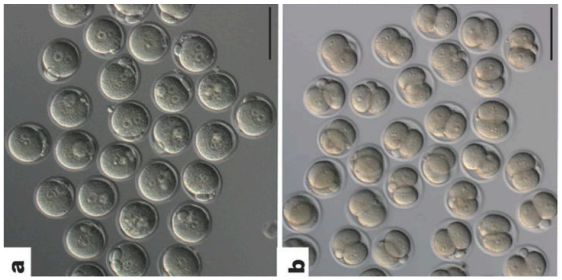

Fertilized eggs (a) and 2-cell embryos (b) from IVF using BVSCH ESC-derived MII oocytes.

Reconstitution *in vitro* of the entire cycle of the mouse female germ line

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The 6 mice, derived from from BVSCH18 ESC-derived MII oocytes, at 4 weeks after birth

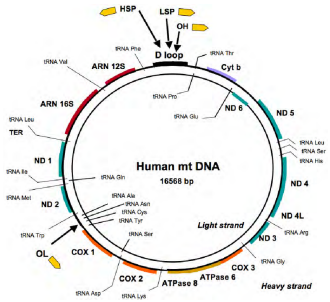
Reconstitution *in vitro* of the entire cycle of the mouse female germ line

Orie Hikabe[1*], Nobuhiko Hamazaki[1], Go Nagamatsu[1], Yayoi Obata[1], Yuji Hirao[1], Norio Hamada[1,3], So Shimamoto[1], Takuya Imamura[1], Kimichi Nakashima[1], Mitinori Saitou[2,4,5,6] & Katsuhiko Hayashi[1,7*]

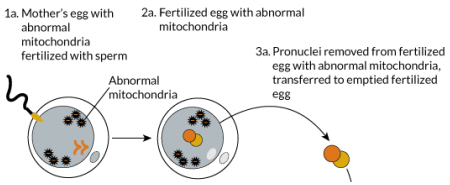
Maternal fertility effects due to dysfunctional mitochondria.

Q: why do mitochondria have a genome?

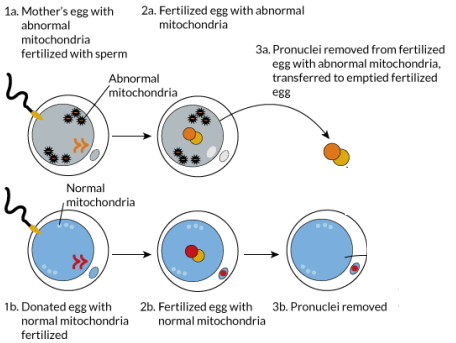
- mitochondrial genome is hyper-mutable compared with nuclear DNA
- high levels of (mutagenic) reactive oxygen species (ROS)
- mtDNA is replicated more frequently
- little non-coding mtDNA (compared to nuclearDNA)
- SO mutations are more likely to have a pathological impact.



like the **Gurdon** experiment in frog



like the **Gurdon** experiment in frog



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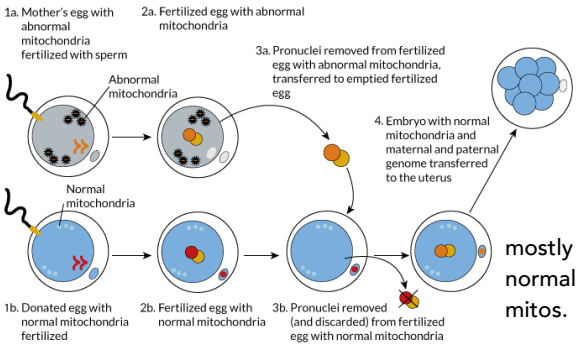

mostly normal mitos.

Opinion: Three-Parent Embryos—A Slippery Slope?

The use of pronuclear transfer to treat infertility must first be backed by evidence it can work in cases where parents seek to avoid mitochondrial mutations.

Jun 14, 2018
JOHN D. LOIKE, ALAN KADISH

Who are the parents of the child born from three DNA donors?

- do parents have a "right" to re-engineering their children?
- **To ponder**: what might be the long term socio-political and economic implications of the "unregulated" genetic engineering of babies?

MCDB 4650/5650 - Developmental Biology FALL 2021 REVIEW
Summary of key ideas and their application (in developing system)

Communications & Cooperation

Common systems ← Signaling systems and their effects (common features)

Common systems → Wnt, Shh, BMP, Notch → Outcomes

Signaling systems and their effects (common features) → Adaptive, Developmental

Adaptive → Where are they used, for what purposes?

Examples from model systems (why best / initially revealed in that system)

Useful methods (How were they used, what can they tell you)

Molecular noise ← **Types of cellular responses** → reversible vs (effectively) irreversible)

Molecular noise → a means to "make initial decisions" monitor environment

Types of cellular responses → Threshold effects → Network behaviors → Saka & Smith as a paradigm

Network behaviors → Feedback interactions → Quorum effect vs morphogen gradient

MCDB 4650/5650 - Developmental Biology FALL 2021 REVIEW
Summary of key ideas and their application (in developing system)

Asymmetries

Emerging, Maternally-established → Where are they used, and why purposes?

Examples from model systems (why best / initially revealed in that system)

Useful methods (How were they used, what can they tell you)

Axes

soma - germ line

germ layers

Emerging, Pre-existing

Evolutionary considerations

ancestral process → Neural tube formation

available (ancestral) systems → e.g. Wnt, Shh, BMP, Notch

In class question

- **Q**: How would you describe the differences between quorum sensing and the response to a morphogen gradient.
- Q: What factors influence the response to a morphogen gradient?
- **Q**: What makes a developmental "decision" difficult to reverse?
- **Q**: What cellular factors influence the response to a signal (e.g Wnt or BMP or Shh)
- **Q**: Why doesn't a particular signal produce the same effect in different systems (e.g. Shh in the neural tube and the Limb bud)
- **Q:** In the limb a null mutation in Gli3 could reverse many (but not all) of the phenotypic effects of a null mutation in Shh. More
- **Q:** In a gastruloid - ES cells can spontaneously produce a gradient of HOX gene expression. What steps lead up to that emerging Hox axis?
- **Q**: A gene is expressed in different tissues at different times and with different effects - what factors could lead to these differences?
- Q: Explain the roles and limitations of a forward and reverse genetic screens; why are both needed to define the gene network involve in a particular process.
- Q: Under what conditions is "conditional" mutagenesis critical for understanding a particular process. Why can't you learn everything from a null mutation?
- Q: How is a maternal mutation can have no paternal phenotype? Can you imagine a non-de novo dominant maternal mutation, and if so, how might it work?

- **Q**: What specific developmental features make *C. elegans* and *D. melanogaster* such useful model organisms? How did those features figure in revealing specific developmental processes. (name of a process and the reasons that the model system was useful).
- **Q**: How are the axes established in Drosophila (too specific)