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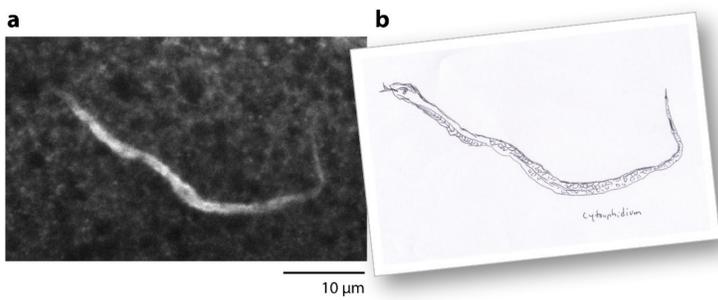
What are cytoophidia?

➤ **2010**: Independent discovery by three groups of the ability of CTP synthase, to form filamentous, membraneless structures (collectively named **cytoophidia**) in *Drosophila* (Liu, 2010), bacteria (Ingerson-Mahar et al., 2010) and budding yeast (Noree et al., 2010)

➤ **CTP synthase (CTPS)**, is an essential metabolic enzyme which catalyzes the rate limiting step in the *de novo* production of CTP:



Morphology and naming



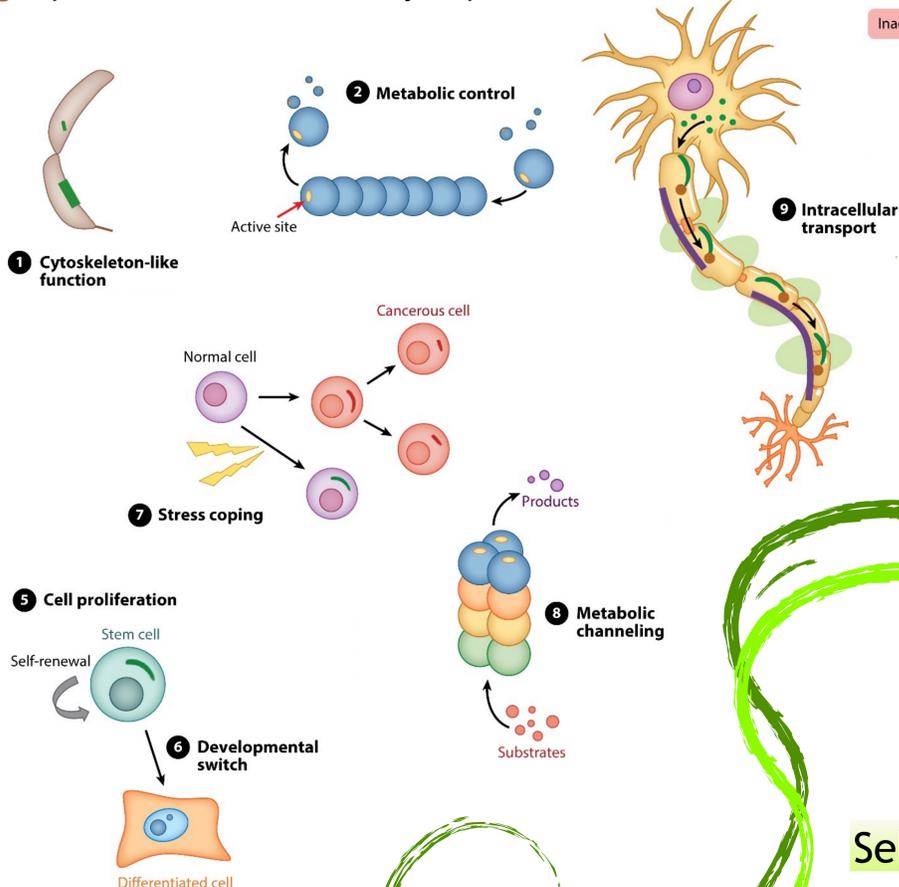
Liu J-L. 2016. Annu. Rev. Cell Dev. Biol. 32:349-72

➤ The **cytoophidium**: a **snake in the cell**. Liu (2010) referred to these subcellular snake-like structures as cytoophidia (Greek: cyto-, meaning cell, and ophidia, meaning serpents).

➤ Depicted in the figure is a snake-like structure observed in a *Drosophila* oocyte. This was one of the first images of cytoophidia obtained by antibody cross-reaction.

Why is it important to study cytoophidia?

➤ *Speculated functions of cytoophidia*



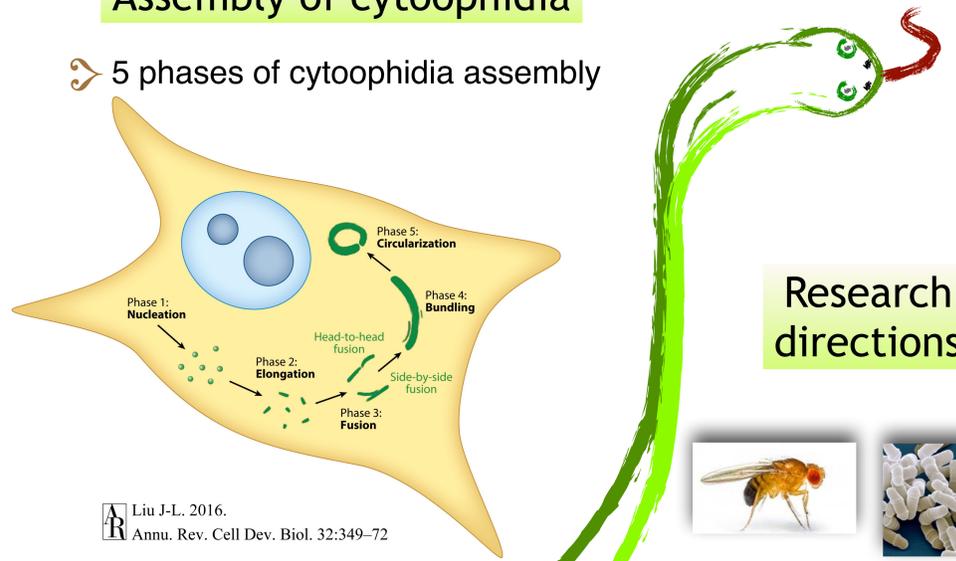
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➤ **Compartmentation by filamentation** is an important general mechanism for the regulation of metabolism

➤ Cytoophidia are **dynamic** structures that respond to metabolic state and external cues such as stresses (novel therapies?)

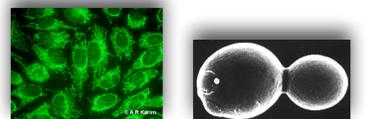
Assembly of cytoophidia

➤ 5 phases of cytoophidia assembly



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Research directions



➤ Study cytoophidia in multiple organisms (**fruit fly, fission yeast, budding yeast, mammalian cells**)

- **Multidisciplinary** research (metabolic, developmental, structural)
- How is cytoophidia formation **regulated**?
- Confirm potential **roles** in the cells
- Elucidate relation with **functional partners**
- Study a **range of cytoophidia-forming proteins**

The Cytoophidia Team

- Principal Investigator: Prof Jilong Liu
- **ShanghaiTech** Group (13 members)
- **Oxford** Group (6 members)

More information

- Website: cytoophidia.org
- Contact: Professor Jilong Liu
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Selected Publications

1. Liu JL. (2016). The cytoophidium and its kind: Filamentation and compartmentation of metabolic enzymes. *Annual Review of Cell and Developmental Biology* 32:349-72.
2. Aughey GN, Grice SJ and Liu JL. (2016). The interplay between MYC and CTP synthase in *Drosophila*. *PLOS Genetics* 12(2):e1005867.
3. Ghosh S, Tibbit C and Liu JL. (2016). Effective knockdown of *Drosophila* long non-coding RNAs by CRISPR interference. *Nucleic Acids Research* 44 (9): e84.
4. Bassett AR, Tibbit C, Ponting CP and Liu JL. (2013). Highly efficient targeted mutagenesis of *Drosophila* with the CRISPR/Cas9 system. *Cell Reports* 4(1):220-8. [**Cell Reports Best of 2013**]
5. Liu JL. (2010). Intracellular compartmentation of CTP synthase in *Drosophila*. *Journal of Genetics and Genomics* 37(5):281-96. [**NATURE I News Feature**]
6. Liu JL, Murphy C, Buszczak M, Clatterbuck S, Goodman R and Gall JG. (2006). The *Drosophila* melanogaster Cajal body. *Journal of Cell Biology* 172(6):875-84.