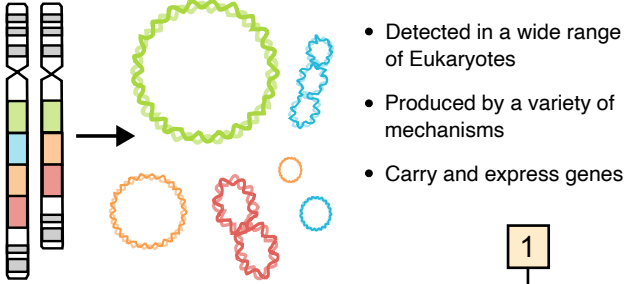


# Can yeast harness the adaptive potential of extrachromosomal circular DNA?

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## 1. Introduction

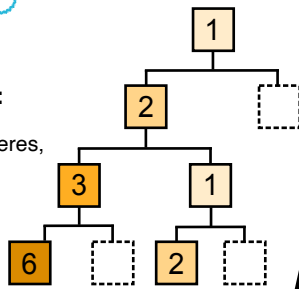
**eccDNAs are a source of genetic heterogeneity:**



- Detected in a wide range of Eukaryotes
- Produced by a variety of mechanisms
- Carry and express genes

**Non-Mendelian inheritance:**

- eccDNAs do not have centromeres, and do not segregate 1:1
- eccDNA accumulation has been linked to adaptive phenotypes<sup>1</sup>



## 2. Aims

**Our Question:**

If eccDNA is asymmetrically inherited, how mechanistically can circles support long-term adaptive phenotypes within a cell population?

**Our Model:**

As shown centrally, *S. cerevisiae* retain circles in the Mother cell<sup>2</sup>. By using the gene *CUP1* and the stressor copper, we aim to dissect the emergence of resistance via eccDNA accumulation and track whether inheritance changes under stress, linking a single circle to a specific adaptive phenotype.

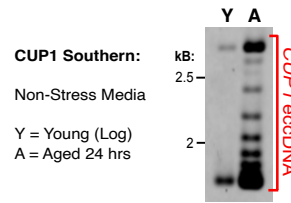
## 3. Methods

Redacted

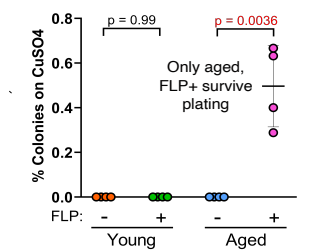
## 4. Results: Circles and Adaptation

**CUP1 eccDNA allows robust adaptation to copper stress:**

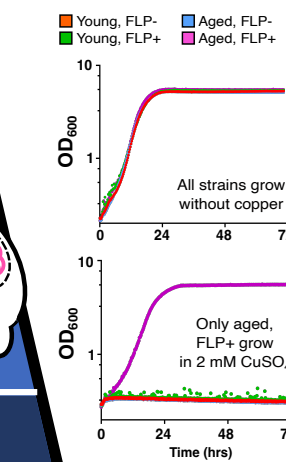
**A Asymmetric inheritance prior to stress**



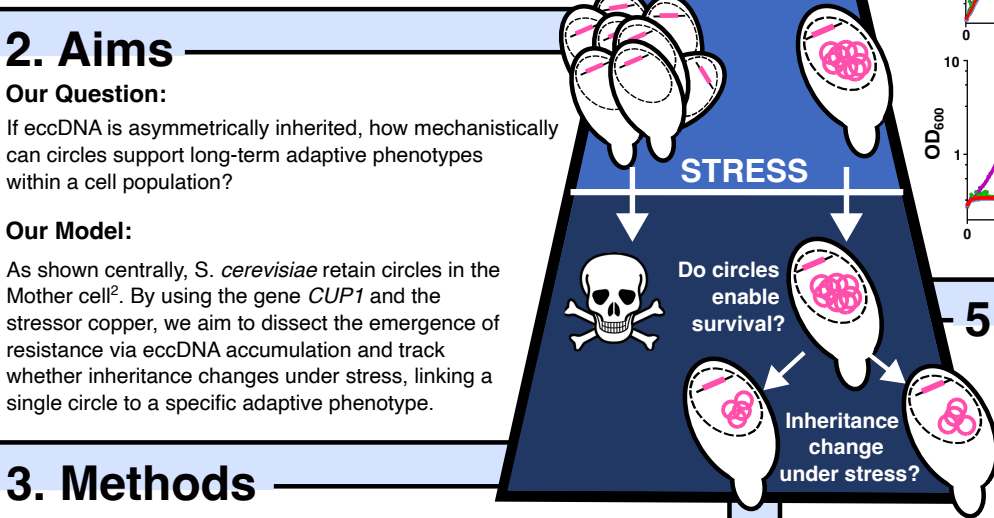
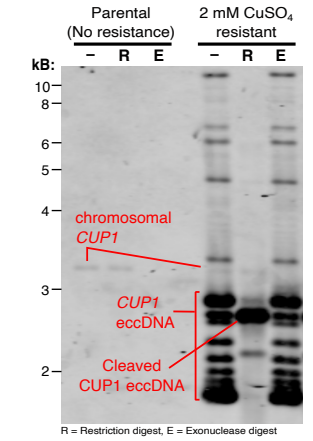
**B Survival on 2 mM CuSO<sub>4</sub>**



**C Growth in liquid culture**



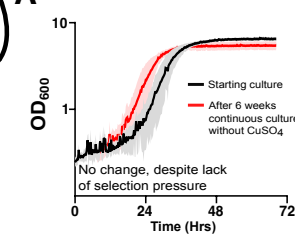
**D Detection of CUP1 circles by Southern Blot**



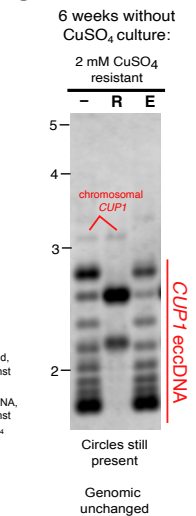
## 5. Results: Circle Stability

**CUP1 eccDNA is stable once acquired:**

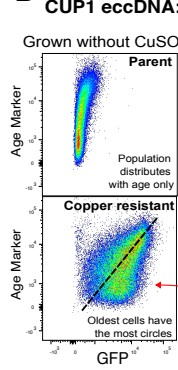
**A Growth rate in 2 mM CuSO<sub>4</sub>**



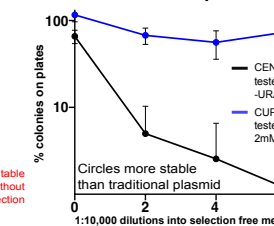
**C Southern Blot**



**D GFP-Tagged CUP1 eccDNA:**



**B CUP1 eccDNA vs. Centromeric plasmid**



## 6. Future Directions

Our data shows that circles can indeed support long-term adaptation to stress at the population level. Future work will investigate why CUP1 circles become so unusually stable in our experimental system.