wtf: killing gametes for more than 110 million years

Other

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**wtf:** Killing gametes for more than 110 million years

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**Phylogenetic analysis suggests wtf genes are 110 million years old**

<table>
<thead>
<tr>
<th>Species</th>
<th>PSI-BLAST BLASTn hits</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. octosporus</td>
<td>83</td>
</tr>
<tr>
<td>S. osmophilus</td>
<td>42</td>
</tr>
<tr>
<td>S. cryophilus</td>
<td>5</td>
</tr>
<tr>
<td>S. pombe</td>
<td>25</td>
</tr>
<tr>
<td>S. japonicus</td>
<td>None</td>
</tr>
</tbody>
</table>

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**Conclusions**

- **wtf genes** are present in *S. octosporus*, *S. osmophilus*, *S. cryophilus* and *S. pombe*
- **wtf genes** are associated with dispersed repetitive sequences which may allow them to duplicate in the genome by gene conversion
- **wtf genes** of the four species encode poison and antidote proteins
- **S. octosporus** *wtf* gene cause meiotic drive in *S. octosporus* (Li-Lin Du lab)
- **wtf genes** have been meiotic drivers for at least **110 million years**

**References:** Nuckolls and Bravo Núñez et al. (2017); Hu et al. (2017), Rhind et al. (2011)

**Funding:** NIH R00, NIH DP2, Searle Scholars Award, Stowers Institute

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**Meiotic drivers break Mendel's law of segregation**

- Increase their own transmission into the next generation (up to 100%)
- Can decrease fertility
- Are found throughout eukaryotes:
  - *SD* in *Drosophila melanogaster*
  - *t* haplotype in *Mus musculus*
  - *Spok* in *Podospora anserina*
  - *Sa* in *Oryza sativa*

**S. octosporus, S. osmophilus and S. cryophilus wtf genes share features with S. pombe meiotic drivers**

**Model for meiotic drive evolution**

- Birth of new active driver
- Fixation of driver
- Decay of driver
- Suppression of driver
- Extinction of driver

**wtf genes are meiotic drivers in S. pombe**

- *wtf* (with transposon fission yeast)
- 1 gene encodes two proteins
- Poison spreads to all gametes
- Antidote is gamete-specific
- Drive facilitates spread of *wtf* allele in a population

**wtf genes encode poison and antidote proteins**

Testing ability of *S. octosporus*, *S. osmophilus* and *S. cryophilus* *wtf* genes to encode poison and antidote proteins by expressing them in budding yeast.

**References:** Nuckolls and Bravo Núñez et al. (2017); Hu et al. (2017), Rhind et al. (2011)

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