

BioSentinel: Improving desiccation tolerance of yeast biosensors for deep-space missions

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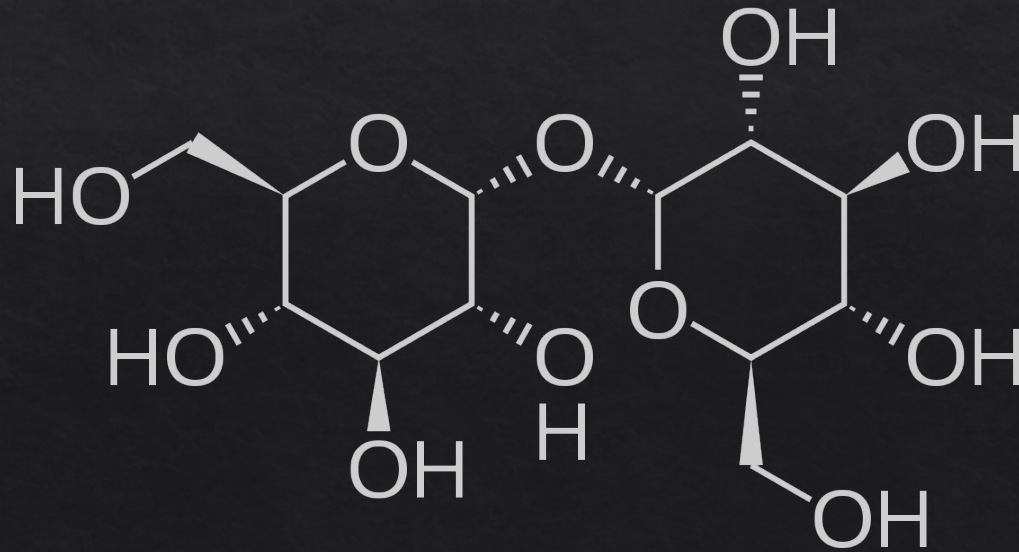
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Trehalose and Desiccation Tolerance

- ◇ Trehalose: nonreducing disaccharide composed of two glucose molecules
- ◇ Found in many desiccation tolerant strains of *S. cerevisiae*
- ◇ Serves as a protective agent against the aggregation of cytoplasmic and membrane proteins during desiccation (Tapia and Koshland, 2014)



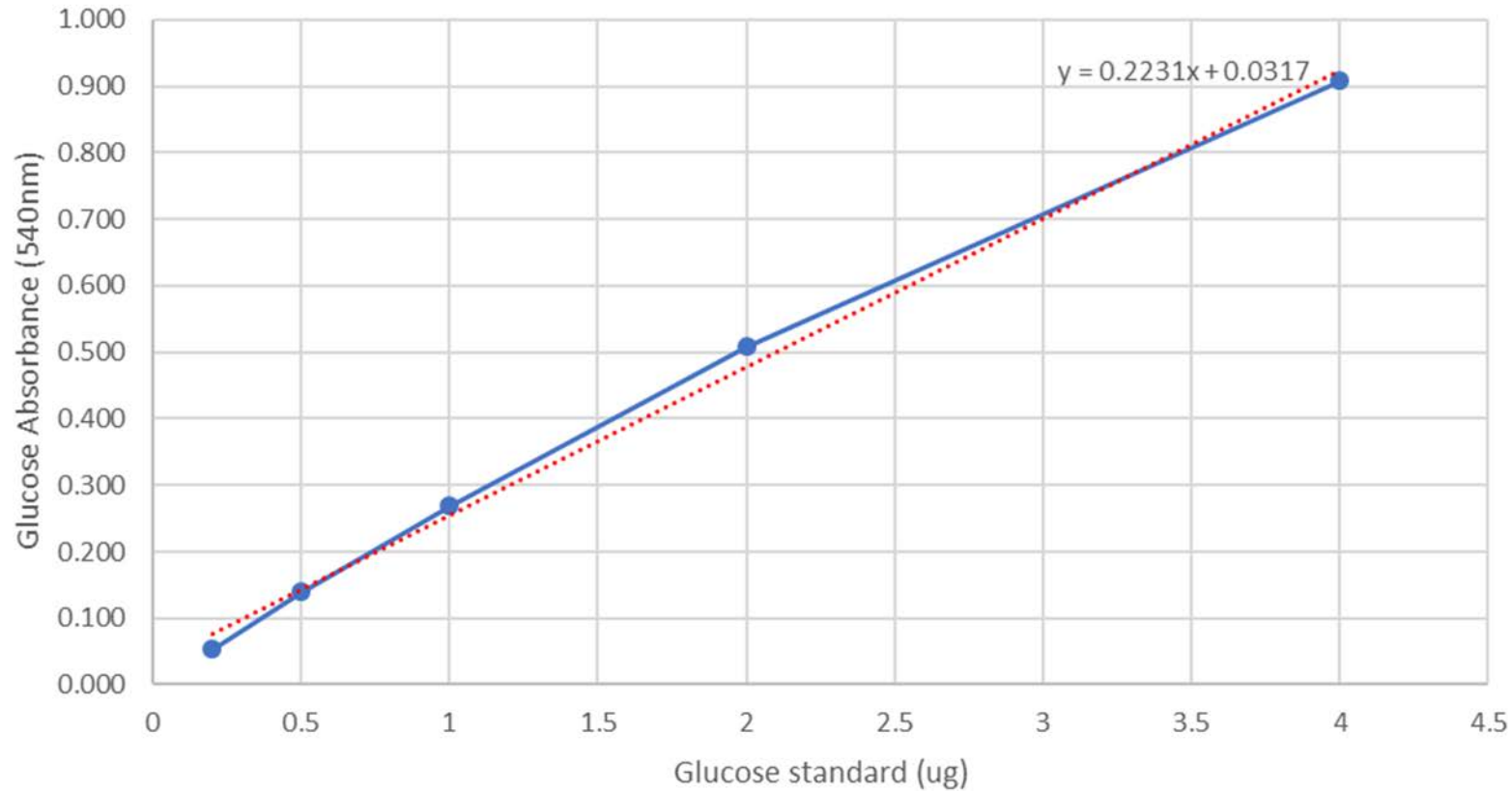
Intracellular Trehalose Screen

- ◇ Trehalose assay (Parrou and Francois, 1997; Tapia et al., 2015)
- ◇ Previous work: *rad51* screen found DRY1 and DRY2 strains with increased desiccation tolerance
- ◇ Sequence analysis: DRY1 (mutation in *ALG3*), DRY2 (mutations in *LEO1* and *ENV9*)
- ◇ New screen: quantifying intracellular trehalose in wild-type, original *rad51*, DRY1, and DRY2 strains each week after desiccation
- ◇ Comparative genome sequencing and transcriptome analysis

Troubleshooting Intracellular Trehalose Protocol

- ◇ Protocol: requires 1×10^7 cells per mL → didn't yield measurable amounts of glucose
- ◇ Glucose standards → didn't yield measurable amounts of glucose
- ◇ Tested cell concentrations: 1×10^7 , 5×10^7 , 1×10^8 , 2×10^8
- ◇ Tested glucose standard quantities: 1, 2.5, 5, 10, and 20 ug

Glucose Standard Test



Strain	Trehalose concentration (ug/mL)
wt-1 - 1x10 ⁷	0.247
wt-1 - 5x10 ⁷	1.158
wt-1 - 1x10 ⁸	2.413
wt-1 - 2x10 ⁸	4.161
wt-2 - 1x10 ⁷	0.202
wt-2 - 5x10 ⁷	1.218
wt-2 - 1x10 ⁸	2.293
wt-2 - 2x10 ⁸	4.183
wt-3 - 1x10 ⁷	0.209
wt-3 - 5x10 ⁷	1.315
wt-3 - 1x10 ⁸	2.518
wt-3 - 2x10 ⁸	4.437

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