Emergence And Maintenance Of Stable Coexistence in Snowflake Yeast Long Term Evolution Experiment

Rozenn Pineau, David Demory, Eric Libby,
William Ratcliff & Ozan Bozdag

INTRO

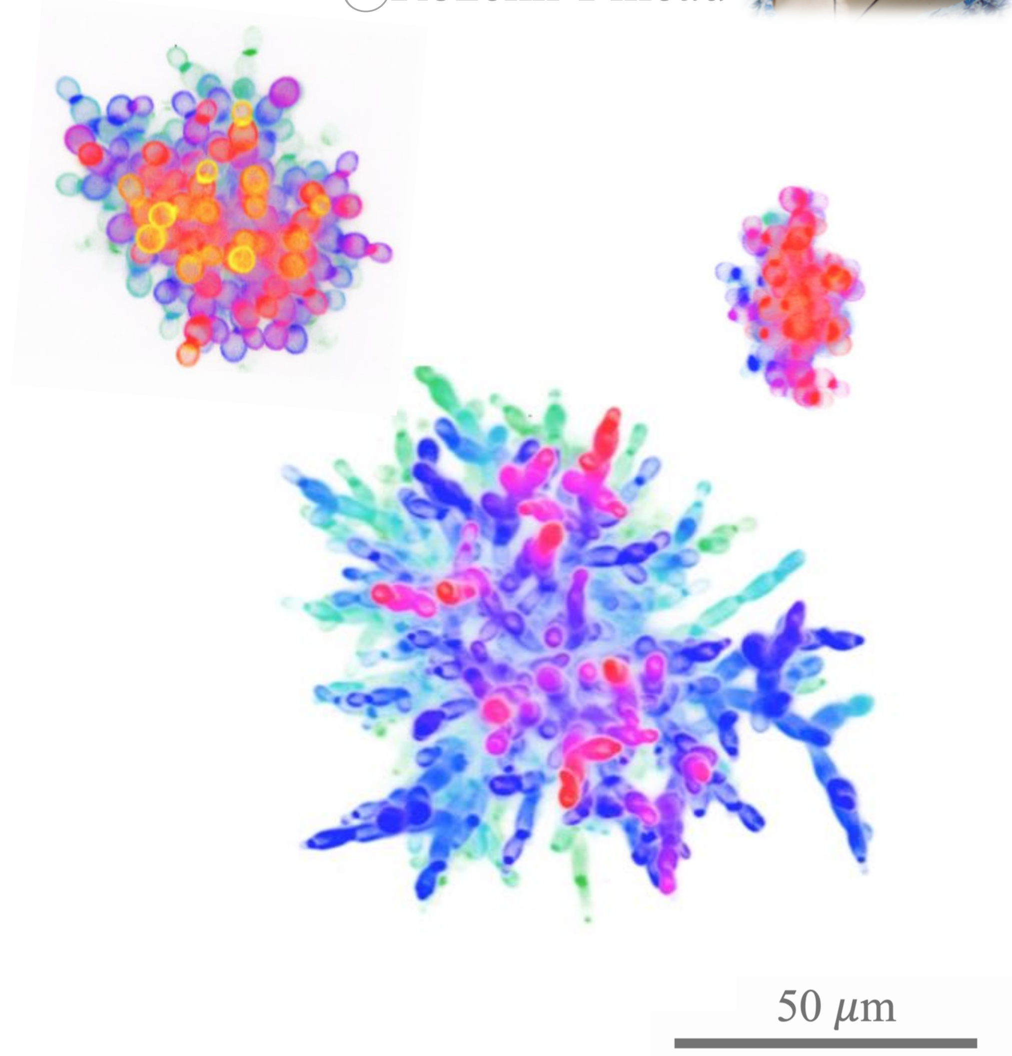
- The transition to multicellularity allowed for increases in organismal and ecological complexity
  - cell-cell communication, division of labor
  - potential for novel types interactions
- No study has explored the direct link between the acquisition of multicellular features and the consequences for colonization of ecological space

METHODS

- Snowflake Yeast : a model system for exploring the consequences of the transition to simple multicellularity
- Long Term Evolution Experiment : following evolution in real time
- Genetic Information : learn about heritable changes
- Theory : describe the ecological processes at play

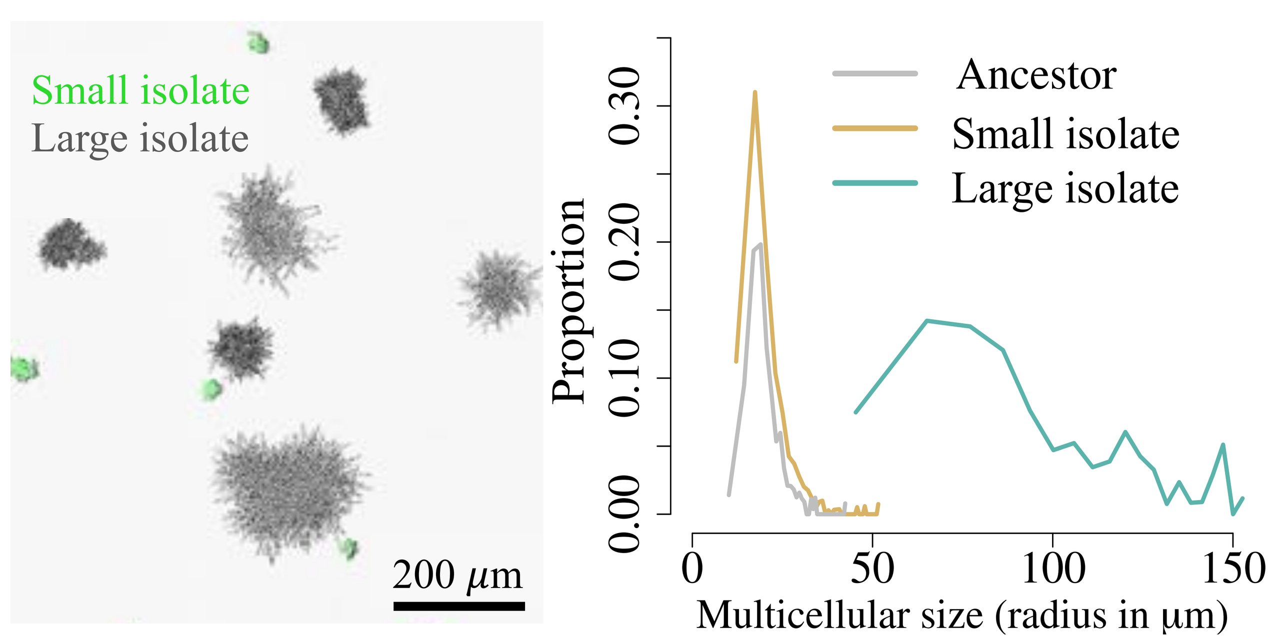
The **transition to multicellularity** immediately drives **adaptive diversification** and **expansion in multicellular ecological space**.

Not at the poster? Find me!
rpineau3@gatech.edu
@Rozenn-Pineau

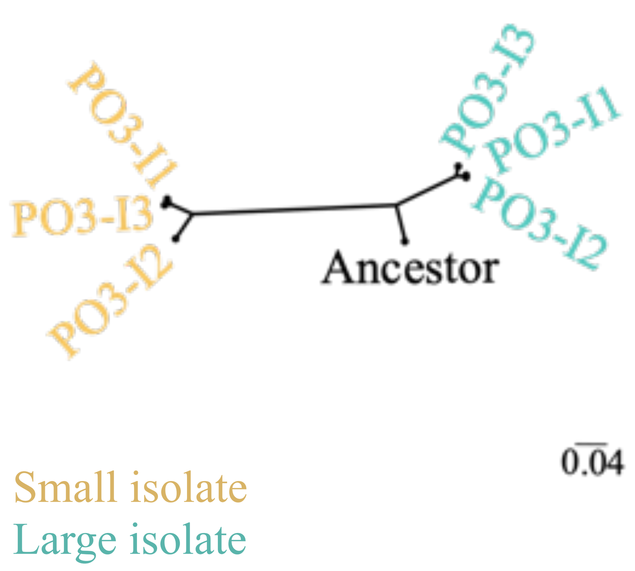


RESULTS

1 - We observe the emergence of two distinct phenotypes in an initially monomorphic population : a Small and a Large phenotype.

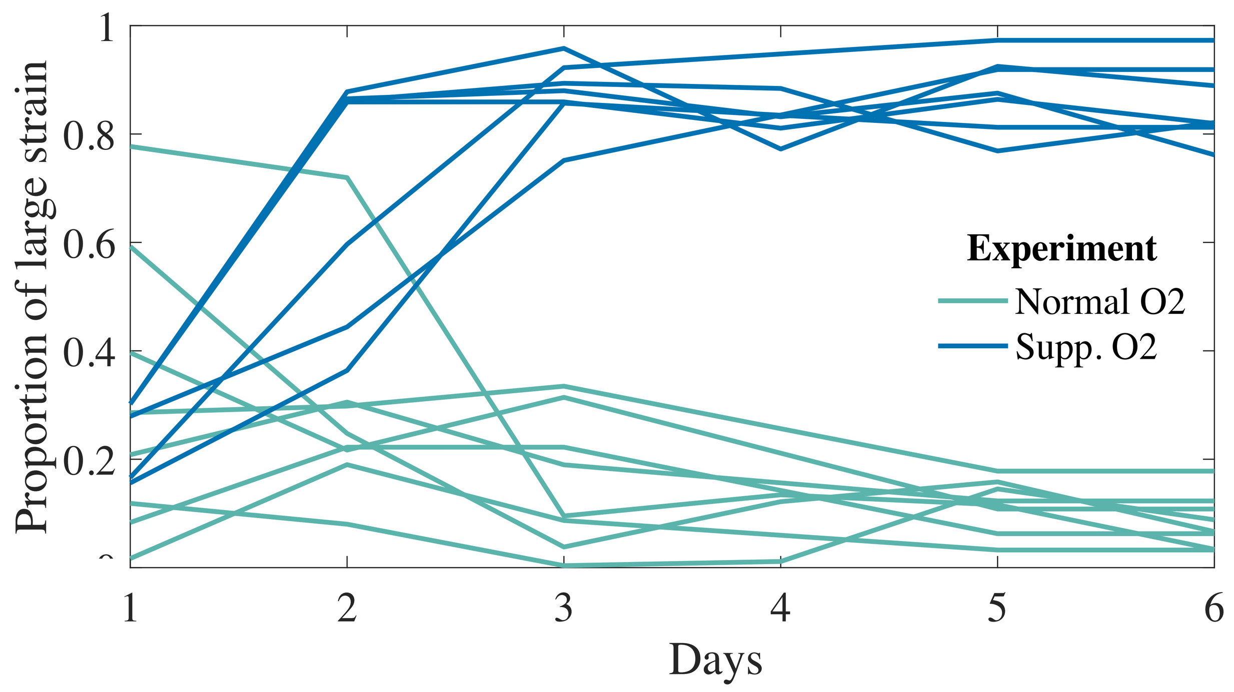


2 - The Small and Large phenotype diverged early from the ancestor and have been coexisting for ~3000+ generations.

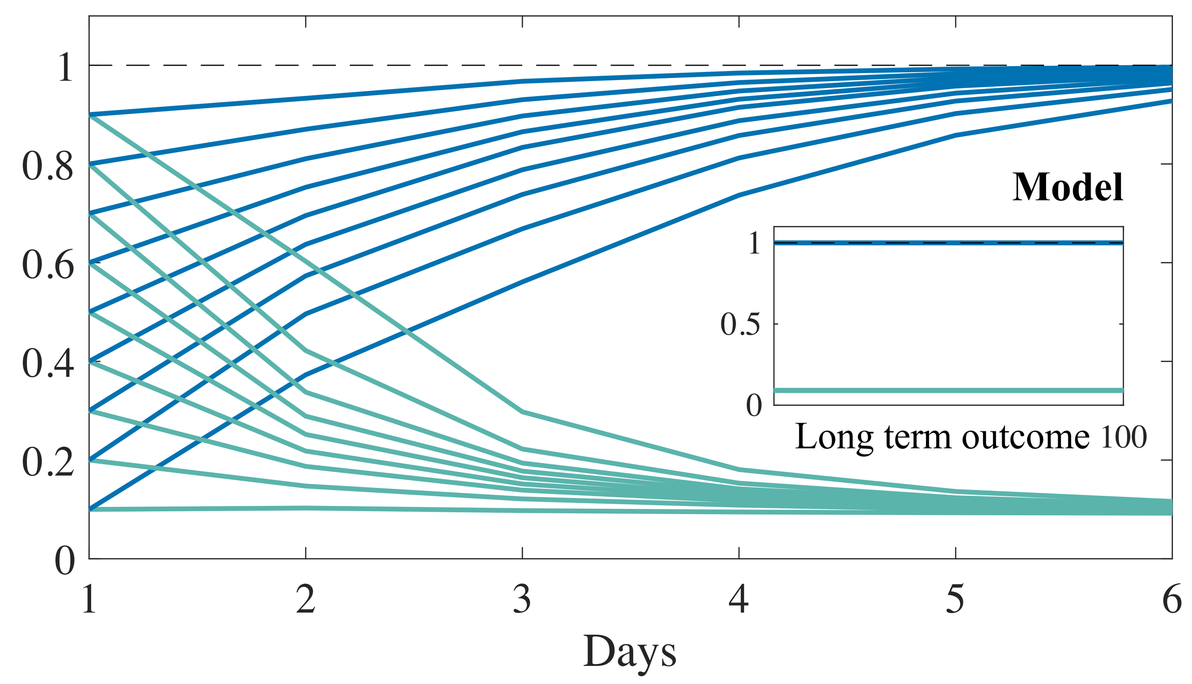


"The top of the scale is always an open ecological niche."
John T. Bonner

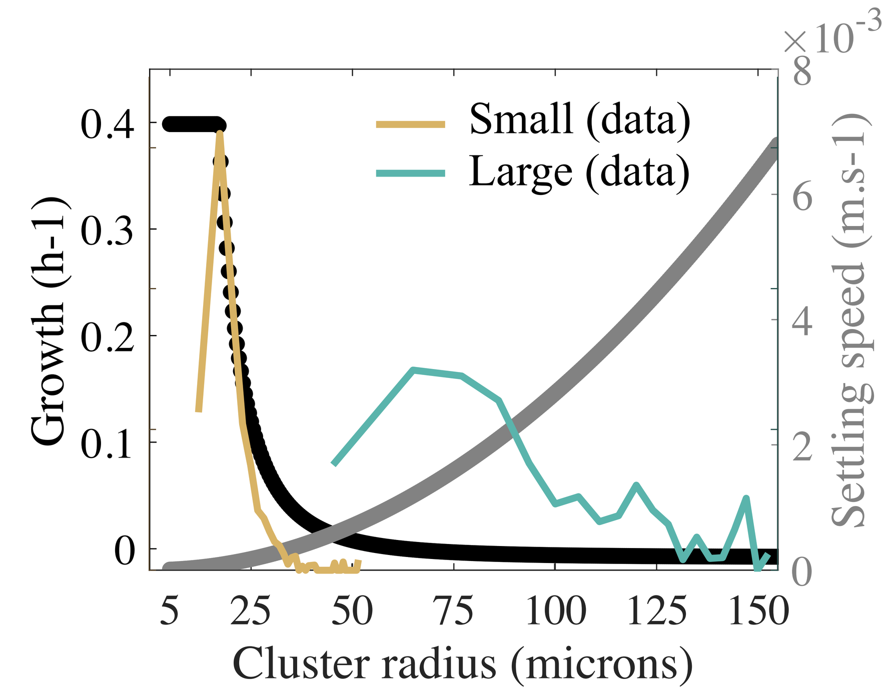
3 - . The experiment shows competition for oxygen creates a niche for coexistence.



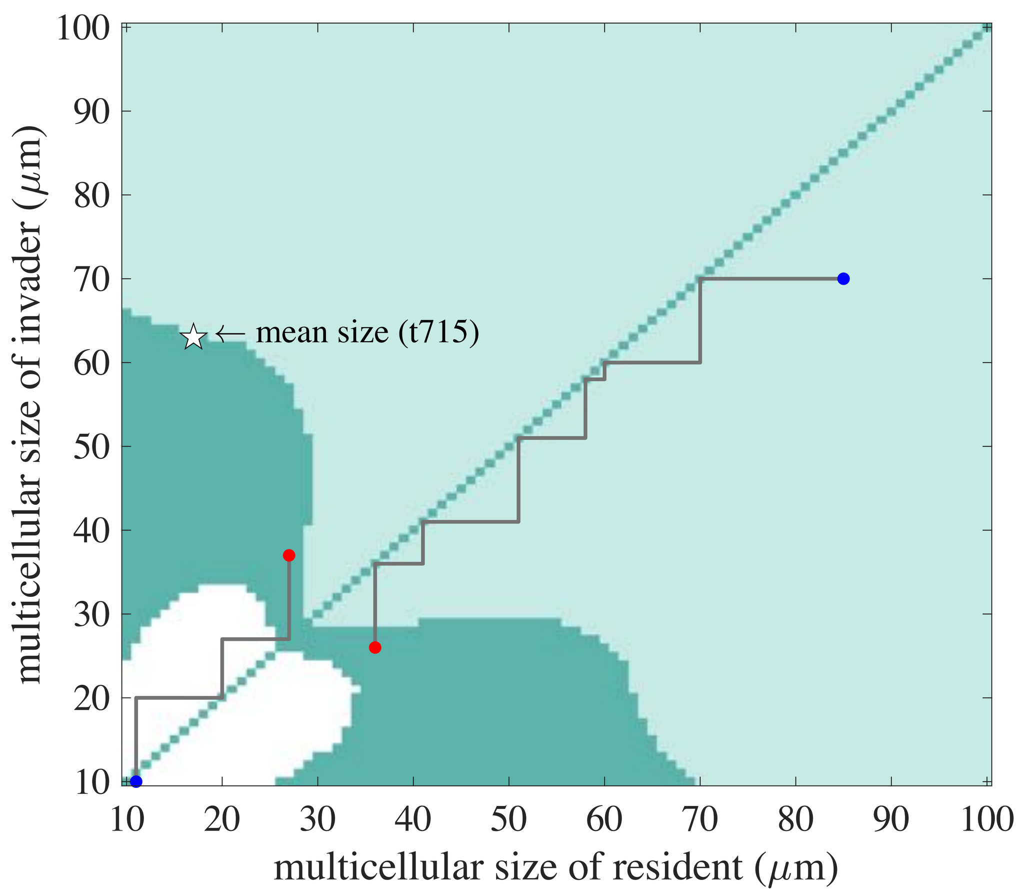
4- The model further explains removing oxygen releases the competition and coexistence is lost.



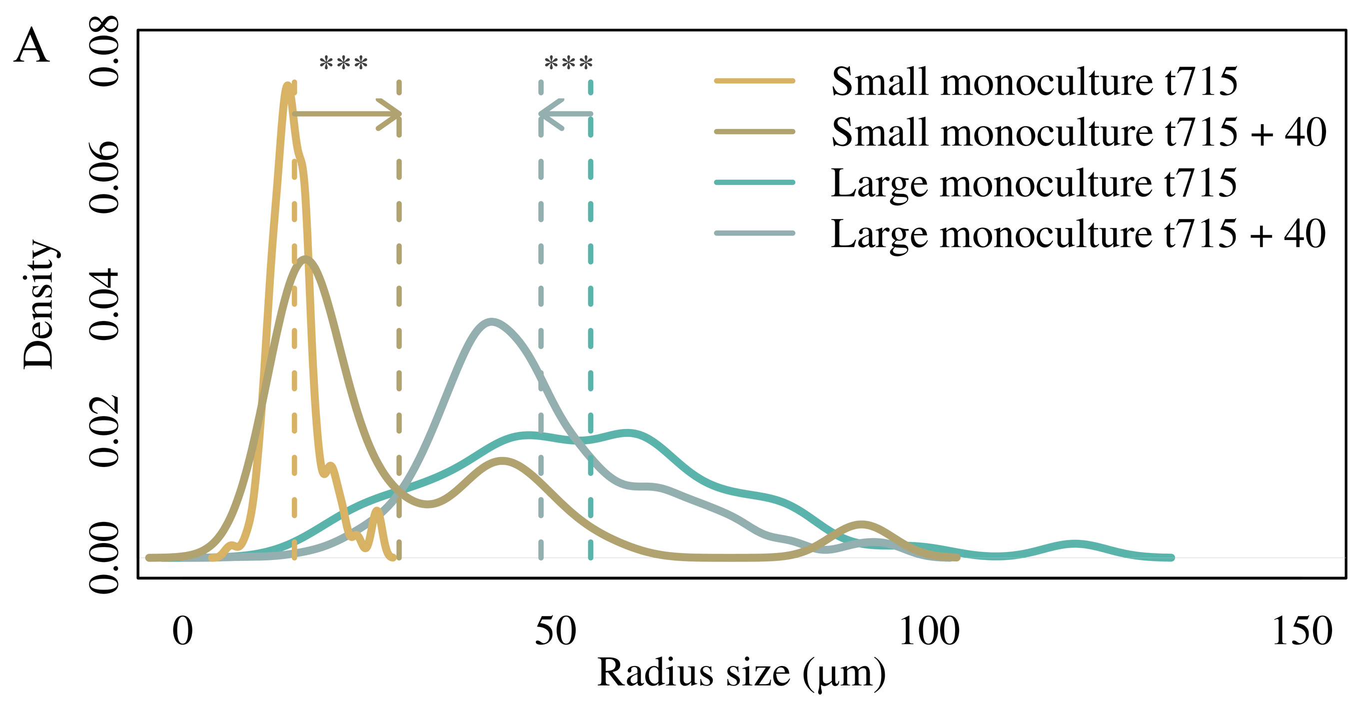
5 – We describe a functional specialization into growth and survival specialists mediated by competition for oxygen and selection for large size.



6 – The model shows that the trade off between growth and survival promotes the evolution of stable polymorphism.



7 –Removing one of the competitor prompts the evolution of the monoculture population towards the missing competitor.



CONCLUSIONS

- Theoretical modeling and experimentation show strong divergence from a simple initially monomorphic population.
- Selection for body size and competition over a key resource drives a fundamental trade-off between growth rate and survival.
- Taken together, this work exemplifies how the evolution of a new level of biological complexity can rapidly drive adaptive diversification and the expansion in multicellular ecological space.

Thank you to my team,
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