

|                                                                                                                                                                                                                  |                      |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------|
|                                                                                                                                                                                                                  | Gephebase Gene       | GepheID      |
| GAL4 ( <a href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=~GAL4~#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=~GAL4~#gephebase-summary-title</a> ) | GP00001427           | Main curator |
| Published                                                                                                                                                                                                        | Entry Status Prigent |              |

| Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category=~Physiology~#gephebase-summary-title)                  |  | Trait Category         | Taxon A                                                                                                                                                                                                                                                                                        |  | Taxon B                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                   |  |
|----------------------------------------------------------------------------------------------------------------------------------|--|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Carbohydrate metabolism (https://www.gephebase.org/search-criteria?/and+Trait=~Carbohydrate metabolism~#gephebase-summary-title) |  | Trait                  | Saccharomyces bayanus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=~Saccharomyces bayanus~#gephebase-summary-title)                                                                                                                                                      |  | Saccharomyces cerevisiae (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=~Saccharomyces cerevisiae~#gephebase-summary-title)                                  |                                                                                                                                                                                                                                                                                                                   |  |
| Yeast without growth lag because GAL genes not repressed on glucose-galactose medium                                             |  | Trait State in Taxon A | baker's yeast                                                                                                                                                                                                                                                                                  |  | baker's yeast                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                   |  |
| Yeast with growth lag because GAL genes repressed on glucose-galactose medium                                                    |  | Trait State in Taxon B | -                                                                                                                                                                                                                                                                                              |  | baker's yeast                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                   |  |
| Taxon A                                                                                                                          |  | Ancestral State        | Saccharomyces bayanus var. bayanus; BCRC:21960; CBS 380; CBS:380; CCRC 21960; CCRC:21960; CLIB 181; CLIB:181; DBVPG 6171; DBVPG:6171; DSM 70412; DSM:70412; IFO 11022; IFO 1127; IFO:11022; IFO:1127; IGC 4456; IGC:4456; JCM 7258; JCM:7258; NCYC 2578; NCYC:2578; NRRL Y-12624; NRRL:Y:12624 |  | Taxonomic Status                                                                                                                                                                 | Saccharomyces capensis; Saccharomyces italicus; Saccharomyces oviformis; Saccharomyces uvarum var. melibiosus; baker's yeast; S. cerevisiae; brewer's yeast; ATCC 18824; ATCC:18824; CBS 1171; CBS:1171; NRRL Y-12632; NRRL:Y:12632; Saccharomyces cerevisiae; Saccharomyces cerevisiae; Saccharomyces cerevisiae |  |
| Interspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=~Interspecific~#gephebase-summary-title)          |  |                        | species                                                                                                                                                                                                                                                                                        |  | species                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                   |  |
| Taxon A                                                                                                                          |  | Latin Name             | cellular organisms; Eukaryota; Opisthokonta; Fungi; Dikarya; Ascomycota; saccharomyceta; Saccharomycotina; Saccharomycetes; Saccharomycetales; Saccharomycetaceae; Saccharomyces                                                                                                               |  | cellular organisms; Eukaryota; Opisthokonta; Fungi; Dikarya; Ascomycota; saccharomyceta; Saccharomycotina; Saccharomycetes; Saccharomycetales; Saccharomycetaceae; Saccharomyces |                                                                                                                                                                                                                                                                                                                   |  |
|                                                                                                                                  |  | Common Name            | Saccharomyces                                                                                                                                                                                                                                                                                  |  | Saccharomyces                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                   |  |
|                                                                                                                                  |  | Synonyms               | Saccharomyces () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4930 )                                                                                                                                                                                          |  | Saccharomyces () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4930 )                                                                            |                                                                                                                                                                                                                                                                                                                   |  |
|                                                                                                                                  |  | Rank                   | 4931 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4931 )                                                                                                                                                                                                                      |  | 4932 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4932 )                                                                                                        |                                                                                                                                                                                                                                                                                                                   |  |
|                                                                                                                                  |  | Lineage                | is Taxon A an Intraspecies?                                                                                                                                                                                                                                                                    |  | is Taxon B an Intraspecies?                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                   |  |
|                                                                                                                                  |  | Parent                 | No                                                                                                                                                                                                                                                                                             |  | No                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                   |  |

| Generic Gene Name                                                                                                                                                                                       | UniProtKB Saccharomyces cerevisiae (strain ATCC 204508 / S288c)                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GAL4                                                                                                                                                                                                    | P04386 ( <a href="http://www.uniprot.org/uniprot/P04386">http://www.uniprot.org/uniprot/P04386</a> )                                                       |
| GAL81; YPL248C                                                                                                                                                                                          | GenebankID or UniProtKB NM_001184062 ( <a href="https://www.ncbi.nlm.nih.gov/nuccore/NM_001184062">https://www.ncbi.nlm.nih.gov/nuccore/NM_001184062</a> ) |
| 4932.YPL248C<br>( <a href="http://string-db.org/newstring.cgi/show_network_section.pl?identifier=4932.YPL248C">http://string-db.org/newstring.cgi/show_network_section.pl?identifier=4932.YPL248C</a> ) |                                                                                                                                                            |
| -                                                                                                                                                                                                       |                                                                                                                                                            |
| GO - Molecular Function                                                                                                                                                                                 |                                                                                                                                                            |
| GO:0042802 : identical protein binding<br>( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0042802">https://www.ebi.ac.uk/QuickGO/term/GO:0042802</a> )                                                 |                                                                                                                                                            |
| GO:0008270 : zinc ion binding ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0008270">https://www.ebi.ac.uk/QuickGO/term/GO:0008270</a> )                                                             |                                                                                                                                                            |
| GO:0000981 : DNA-binding transcription factor activity, RNA polymerase II-specific<br>( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0000981">https://www.ebi.ac.uk/QuickGO/term/GO:0000981</a> )     |                                                                                                                                                            |
| GO:0001077 : proximal promoter DNA-binding transcription activator activity, RNA                                                                                                                        |                                                                                                                                                            |

polymerase II-specific (<https://www.ebi.ac.uk/QuickGO/term/GO:0001077>)  
GO:0000978 : RNA polymerase II proximal promoter sequence-specific DNA binding  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0000978>)  
GO:0001085 : RNA polymerase II transcription factor binding  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0001085>)

GO - Biological Process

GO:0006351 : transcription, DNA-templated  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0006351>)  
GO:0006012 : galactose metabolic process  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0006012>)  
GO:0000435 : positive regulation of transcription from RNA polymerase II promoter by galactose (<https://www.ebi.ac.uk/QuickGO/term/GO:0000435>)

GO - Cellular Component

GO:0005634 : nucleus (<https://www.ebi.ac.uk/QuickGO/term/GO:0005634>)

|                                                                                                                                                                                                                                                              |                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
|                                                                                                                                                                                                                                                              | Presumptive Null                  |
| Unknown ( <a href="https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Unknown^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Unknown^#gephebase-summary-title</a> )                                |                                   |
|                                                                                                                                                                                                                                                              | Molecular Type                    |
| Cis-regulatory ( <a href="https://www.gephebase.org/search-criteria?/and+Molecular Type=^Cis-regulatory^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Molecular Type=^Cis-regulatory^#gephebase-summary-title</a> )               |                                   |
|                                                                                                                                                                                                                                                              | Aberration Type                   |
| Unknown ( <a href="https://www.gephebase.org/search-criteria?/and+Aberration Type=^Unknown^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Aberration Type=^Unknown^#gephebase-summary-title</a> )                                  |                                   |
|                                                                                                                                                                                                                                                              | Molecular Details of the Mutation |
| unknown                                                                                                                                                                                                                                                      |                                   |
|                                                                                                                                                                                                                                                              | Experimental Evidence             |
| Candidate Gene ( <a href="https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title</a> ) |                                   |
|                                                                                                                                                                                                                                                              | Main Reference                    |
| Polygenic evolution of a sugar specialization trade-off in yeast. (2016) ( <a href="https://pubmed.ncbi.nlm.nih.gov/26863195">https://pubmed.ncbi.nlm.nih.gov/26863195</a> )                                                                                 |                                   |
|                                                                                                                                                                                                                                                              | Authors                           |
| Roop JI; Chang KC; Brem RB                                                                                                                                                                                                                                   |                                   |

Abstract

The evolution of novel traits can involve many mutations scattered throughout the genome. Detecting and validating such a suite of alleles, particularly if they arose long ago, remains a key challenge in evolutionary genetics. Here we dissect an evolutionary trade-off of unprecedented genetic complexity between long-diverged species. When cultured in 1% glucose medium supplemented with galactose, *Saccharomyces cerevisiae*, but not *S. bayanus* or other *Saccharomyces* species, delayed commitment to galactose metabolism until glucose was exhausted. Promoters of seven galactose (GAL) metabolic genes from *S. cerevisiae*, when introduced together into *S. bayanus*, largely recapitulated the delay phenotype in 1% glucose-galactose medium, and most had partial effects when tested in isolation. Variation in GAL coding regions also contributed to the delay when tested individually in 1% glucose-galactose medium. When combined, *S. cerevisiae* GAL coding regions gave rise to profound growth defects in the *S. bayanus* background. In medium containing 2.5% glucose supplemented with galactose, wild-type *S. cerevisiae* repressed GAL gene expression and had a robust growth advantage relative to *S. bayanus*; transgenesis of *S. cerevisiae* GAL promoter alleles or GAL coding regions was sufficient for partial reconstruction of these phenotypes. *S. cerevisiae* GAL genes thus encode a regulatory program of slow induction and avid repression, and a fitness detriment during the glucose-galactose transition but a benefit when glucose is in excess. Together, these results make clear that genetic mapping of complex phenotypes is within reach, even in deeply diverged species.

Additional References

RELATED GEPHE

|                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Related Genes      |
| 3 (GAL1, GAL10, GAL3) ( <a href="https://www.gephebase.org/search-criteria?/or+Taxon ID=^4931^/and+Trait=Carbohydrate metabolism/or+Taxon ID=^4932^/and+Trait=Carbohydrate metabolism/and+groupHaplotypes=true#gephebase-summary-title">https://www.gephebase.org/search-criteria?/or+Taxon ID=^4931^/and+Trait=Carbohydrate metabolism/or+Taxon ID=^4932^/and+Trait=Carbohydrate metabolism/and+groupHaplotypes=true#gephebase-summary-title</a> ) |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Related Haplotypes |
| No matches found.                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |

EXTERNAL LINKS

COMMENTS

it is unclear if the change is only cis-regulatory