

Table S1. Plasmids and Yeast Strains used in this study.

Strain	Genotype	Source	Background	Figure(s)
CCY747	<i>MATα</i> , <i>leu2,3-112</i> , <i>lys2Δ</i> , <i>ura3-1</i> , <i>his3-11::pCUP1-GFP12-lacI12:HIS3</i> , <i>trp1-1::256lacO:TRP1</i>	a	W303	1B
CCY149	<i>MATα/MATα</i> , <i>ura3-1/ura3-1</i> , <i>LEU2/leu2,3-112</i> , <i>LYS2/lys2Δ</i> , <i>ADE2/ade2-1</i> , <i>can1-100</i> , <i>bar1Δ</i> , <i>his3-11::pCUP1-GFP12-lacI12:HIS3/his3-11::pCUP1-GFP12-lacI12:HIS3</i> <i>trp1-1::256lacO:TRP1/trp1-1::256lacO:TRP1</i> , <i>BIR1/bir1Δ::hphNT1</i>	a	W303	1
<i>bir1Δ-ad</i> haploids	All 102 strains were derived from tetrad dissection of CCY149	c	W303	1B, 1C, 1D, 1E, 3A, 3B, 3C, 3F, S1
<i>bir1Δ-ad2</i> haploids	All haploid strains were derived from <i>bir1Δ-ad</i> haploids	c	W303	7B, 7C
BY4741	<i>MATα</i> , <i>his3Δ1</i> , <i>leu2Δ0</i> , <i>ura3Δ0</i> , <i>met15Δ0</i>	b	S288c	-
BY4742	<i>MATα</i> , <i>his3Δ1</i> , <i>leu2Δ0</i> , <i>ura3Δ0</i>	b	S288c	-
CCY1865	<i>MATα</i> , <i>his3Δ1</i> , <i>leu2Δ0</i> , <i>ura3Δ0</i>	c	S288c	-
CCY1905	<i>MATα</i> , <i>leu2,3-112</i> , <i>lys2Δ</i> , <i>ura3-1</i> , <i>his3-11::pCUP1-GFP12-lacI12:HIS3</i> , <i>trp1-1::256lacO:TRP1</i> , <i>bir1Δ::hphNT1</i> , <i>pCC598:URA3</i>	c	W303	-
CCY1976	CCY1905 + <i>cen2::p^{-GAL1}-CEN3:LYS2/cen2::p^{-GAL1}-CEN3:lys2::pCC644:LEU2</i>	c	W303	2B
CCY1947	CCY1905 + <i>cen10::p^{-GAL1}-CEN3:LYS2/cen10::p^{-GAL1}-CEN3:lys2::pCC644:LEU2</i>	c	W303	2B
CCY2161	CCY1905 + <i>cen3::p^{-GAL1}-CEN3:LYS2/cen3::p^{-GAL1}-CEN3:lys2::pCC644:LEU2</i>	c	W303	2B
CCY1943	CCY1905 + <i>cen8::p^{-GAL1}-CEN3:LYS2/cen8::p^{-GAL1}-CEN3:lys2::pCC644:LEU2</i>	c	W303	2B
CCY2284	CCY1905 + <i>cen9::p^{-GAL1}-CEN3:LYS2/cen9::p^{-GAL1}-CEN3:lys2::pCC644:LEU2</i>	c	W303	2B
CCY1924	CCY1865 + <i>cen8::p^{-GAL1}-CEN3:URA3/cen8::p^{-GAL1}-CEN3:ura3::pCC644:HIS3</i>	c	S288c	S3A
CCY1927	CCY1865 + <i>cen10::p^{-GAL1}-CEN3:URA3/cen10::p^{-GAL1}-CEN3:ura3::pCC644:HIS3</i>	c	S288c	S3A
CCY2122	CCY1865 + <i>cen10::p^{-GAL1}-CEN3:LYS2/cen10::p^{-GAL1}-CEN3:lys2::pCC644:LEU2</i>	c	S288c	S3A
CCY2125	BY4742 + <i>cen8::p^{-GAL1}-CEN3:LYS2/cen8::p^{-GAL1}-CEN3:lys2::pCC644:LEU2</i>	c	S288c	S3A
CCY2073	BY4742 + <i>cen3::p^{-GAL1}-CEN3:URA3/cen3::p^{-GAL1}-CEN3:ura3::pCC644:HIS3</i> , <i>cen8::p^{-GAL1}-CEN3:LYS2/cen8::p^{-GAL1}-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2074	BY4742 + <i>cen2::p^{-GAL1}-CEN3:URA3/cen2::p^{-GAL1}-CEN3:ura3::pCC644:HIS3</i> , <i>cen8::p^{-GAL1}-CEN3:LYS2/cen8::p^{-GAL1}-CEN3:lys2::pCC644:LEU2</i>	c	S288c	S2H
CCY2075	BY4742 + <i>cen3::p^{-GAL1}-CEN3:URA3/cen3::p^{-GAL1}-CEN3:ura3::pCC644:HIS3</i> , <i>cen10::p^{-GAL1}-CEN3:LYS2/cen10::p^{-GAL1}-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F

CCY2076	<i>BY4742 + cen10::p⁻GAL1-CEN3:URA3/cen10::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen8::p⁻GAL1-CEN3:LYS2/cen8::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2077	<i>BY4742 + cen2::p⁻GAL1-CEN3:URA3/cen2::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen10::p⁻GAL1-CEN3:LYS2/cen10::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	S2h
CCY2078	<i>BY4742 + cen8::p⁻GAL1-CEN3:URA3/cen8::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen10::p⁻GAL1-CEN3:LYS2/cen10::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2260	<i>BY4741 + cen1::p⁻GAL1-CEN3:URA3/cen1::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen8::p⁻GAL1-CEN3:LYS2/cen8::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2261	<i>BY4741 + cen1::p⁻GAL1-CEN3:URA3/cen1::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen10::p⁻GAL1-CEN3:LYS2/cen10::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2264	<i>BY4741 + cen3::p⁻GAL1-CEN3:URA3/cen3::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen8::p⁻GAL1-CEN3:LYS2/cen8::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2266	<i>BY4742 + cen13::p⁻GAL1-CEN3:URA3/cen13::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen10::p⁻GAL1-CEN3:LYS2/cen10::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2364	<i>BY4742 + cen13::p⁻GAL1-CEN3:URA3/cen13::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen3::p⁻GAL1-CEN3:LYS2/cen3::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2366	<i>BY4741 + cen2::p⁻GAL1-CEN3:URA3/cen2::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen3::p⁻GAL1-CEN3:LYS2/cen3::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	S2H
CCY2368	<i>BY4742 + cen8::p⁻GAL1-CEN3:URA3/cen8::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen3::p⁻GAL1-CEN3:LYS2/cen3::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2369	<i>BY4741 + cen10::p⁻GAL1-CEN3:URA3/cen10::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen3::p⁻GAL1-CEN3:LYS2/cen3::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2370	<i>BY4742 + cen13::p⁻GAL1-CEN3:URA3/cen13::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen3::p⁻GAL1-CEN3:LYS2/cen3::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2372	<i>BY4741 + cen2::p⁻GAL1-CEN3:URA3/cen2::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen1::p⁻GAL1-CEN3:LYS2/cen1::p⁻GAL1-CEN3:lys2::pCC644:LEU2</i>	c	S288c	S2H
CCY2374	<i>BY4741 + cen3::p⁻GAL1-CEN3:URA3/cen3::p⁻GAL1-CEN3:ura3::pCC644:HIS3, cen1::p⁻GAL1-</i>	c	S288c	3E, 3F

	<i>CEN3:LYS2/cen1::p^{-GAL1} CEN3:lys2::pCC644:LEU2</i>			
CCY2376	<i>BY4741 + cen8::p^{-GAL1}-CEN3:URA3/cen8::p^{-GAL1} CEN3:ura3::pCC644:HIS3, cen1::p^{-GAL1} CEN3:LYS2/cen1::p^{-GAL1} CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2378	<i>BY4742 + cen10::p^{-GAL1}-CEN3:URA3/cen10::p^{-GAL1} CEN3:ura3::pCC644:HIS3, cen1::p^{-GAL1} CEN3:LYS2/cen1::p^{-GAL1} CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY2379	<i>BY4742 + cen13::p^{-GAL1}-CEN3:URA3/cen13::p^{-GAL1} CEN3:ura3::pCC644:HIS3, cen1::p^{-GAL1} CEN3:LYS2/cen1::p^{-GAL1} CEN3:lys2::pCC644:LEU2</i>	c	S288c	3E, 3F
CCY1480	<i>MATa/MATa, ura3-1/ura3-1, LEU2/leu2,3-112, LYS2/lys2Δ, ADE2/ade2-1, can1-100, bar1Δ, his3- 11:pCUP1-GFP12-lacI12:HIS3/his3-11:pCUP1- GFP12-lacI12:HIS3 trp1-1:256lacO:TRP1/ trp1- 1:256lacO:TRP1, NBL1/nbl1Δ::hphNT1</i>	c	W303	-
<i>nbl1Δ-ad haploids</i>	<i>All nbl1Δ-ad strains were derived from tetrad dissection of CCY1480</i>	c	W303	4B, 4C, 4D, 4E
CCY1482	<i>MATa/MATa, ura3-1/ura3-1, LEU2/leu2,3-112, LYS2/lys2Δ, ADE2/ade2-1, can1-100, bar1Δ, his3- 11:pCUP1-GFP12-lacI12:HIS3/his3-11:pCUP1- GFP12-lacI12:HIS3 trp1-1:256lacO:TRP1/ trp1- 1:256lacO:TRP1, SGO1/sgo1Δ::hphNT1</i>	c	W303	-
<i>sgo1Δ-ad haploids</i>	<i>All sgo1Δ-ad strains were derived from tetrad dissection of CCY1482</i>	c	W303	4B, 4C, 4D, 4E
CCY1484	<i>MATa/MATa, ura3-1/ura3-1, LEU2/leu2,3-112, LYS2/lys2Δ, ADE2/ade2-1, can1-100, bar1Δ, his3- 11:pCUP1-GFP12-lacI12:HIS3/his3-11:pCUP1- GFP12-lacI12:HIS3 trp1-1:256lacO:TRP1/ trp1- 1:256lacO:TRP1, BUB1/bub1Δ::hphNT1</i>	c	W303	-
<i>bub1Δ-ad haploids</i>	<i>All bub1Δ-ad strains were derived from tetrad dissection of CCY1484</i>	c	W303	4B, 4C, 4D, 4E
CCY1739	<i>tetradploid, MATa/MATaΔ::natNT2/Mata/MataΔ::kanMX4, ura3-1, lys2Δ, LEU2/leu2,3-112, his3-11:pCUP1- GFP12-lacI12:HIS3 trp1-1:256lacO:TRP1 ADE2/ade2-1, can1-100, bar1Δ, BIR1/BIR1/bir1Δ::hphNT1/bir1Δ::hphNT1</i>	c	W303	-
CCY1743	<i>MATa/MATa, ura3-1/ura3-1, lys2Δ/lys2Δ, LEU2/leu2,3-112, his3-11:pCUP1-GFP12- lacI12:HIS3, trp1-1:256lacO:TRP1, ADE2/ade2-1, can1-100, bar1Δ, bir1Δ::hphNT1/bir1Δ::natNT2, pCC599::URA3</i>	c	W303	-
CCY1744	<i>MATa/MATa, ura3-1/ura3-1, lys2Δ/lys2Δ, LEU2/leu2,3-112, his3-11:pCUP1-GFP12- lacI12:HIS3, trp1-1:256lacO:TRP1, ADE2/ade2-1, can1-100, bar1Δ, bir1Δ::hphNT1/bir1Δ::kanMX4, pCC599::URA3</i>	c	W303	-
<i>bir1Δ-ad diploids</i>	<i>All 25 strains were derived from tetrad dissection of strains with the genotype of CCY1739, or from counter-selection of URA3 plasmid of CCY1743,</i>	c	W303	5, S3B

	CCY1744			
<i>bir1Δ-ad2</i> diploids	All <i>bir1Δ-ad2</i> diploid strains were derived from <i>bir1Δ-ad</i> diploids	c	W303	7D, 7E
CCY1295	CCY149 + <i>SLI15/sli15 Δ:natNT2</i>	c	W303	-
CCY1320	CCY1295 + <i>ura3-1:pCC411:URA3</i>	c	W303	-
<i>bir1Δ-ad</i> <i>SLI15</i> Duplication	All <i>bir1Δ-ad</i> <i>SLI15</i> Duplication strains were derived from spores of CCY1320	c	W303	S2C, S2D, S2E
CCY2761	CCY1295 + <i>cup1-1:pCC607:URA3</i>	c	W303	-
<i>bir1Δ-ad</i> <i>SLI15</i> Relocation	All <i>bir1Δ-ad</i> <i>SLI15</i> Relocation strains were derived from spores of CCY2761	c	W303	S2G
CCY2115	CCY1905 + <i>trp1-1:pCC272:TRP1</i>	c	W303	S2B

Plasmid	Description	Source		
pRS306	<i>pBluescript URA3</i>	d		
pCC272	<i>SLI15 + 1kb upstream in pRS304</i>	c		
pCC283	<i>BIR1 + 1kb upstream in pRS306</i>	a		
pKA52	<i>HIS3</i> integration plasmid with part of <i>URA3</i> inserted at the MCS. Can insert <i>HIS3</i> into a <i>URA3</i> locus. Used for making disomic strains.	e		
pGALCEN-JC3-13	For replacing centromeres with <i>CEN3</i> under the <i>GAL-10</i> promoter (<i>URA3</i>)	e		
pCC658	For replacing centromeres with <i>CEN3</i> under the <i>GAL-10</i> promoter (<i>LYS2</i>)	c		
pCC644	<i>LEU2</i> integration vector with bases 3043-3538 of <i>LYS2</i> for Disruption of the <i>LYS2</i> gene. Used for making disomic strains.	c		
pCC598	<i>BIR1 + 1kb upstream in pRS306</i>	c		
pCC411	<i>SLI15 + 1kb upstream in pRS306</i>	c		
pCC607	<i>pCC411 + sequence from Cup1-1 gene for integrating Sli15 plus promoter into that location of chromosome 8</i>	c		

Key

Source

- a Campbell and Desai, Nature 497: 118–121 (2013)
- b Brachmann CB et al., Yeast. (1998)
- c This study
- d Sinorski and Hieter Genetics 122: 19-27 (1989)
- e Anders et. al., BMC Genetics (2009)