

Inventory of Supplemental Information:

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Figures S1-S8

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LEGENDS FOR SUPPLEMENTAL FIGURES

Fig. S1. Fitness values of *S. cerevisiae* and *S. pombe* strains lacking one-to-one orthologs are highly correlated (Pearson's correlation $r = 0.79$, $P < 10^{-300}$). Each dot represents a one-to-one orthologous pair. The diagonal is indicated by a dashed line.

Fig. S2. The relationships among the mean fitness values of various groups of gene deletion strains do not change qualitatively when different Δw cutoffs (see METHODS) are used in *S. pombe*. The Δw cutoffs are (A) 0.05, (B) 0.2, and (C) 1, respectively.

Fig. S3. Expression levels are similar between duplicates with fitness gains (DWFG) and duplicates without fitness gains (DWOFG). (A) The expression levels of the orthologs in *S. pombe* (*Sp*). The difference between DWFG and DWOFG is not significant ($P = 0.20$, two-tail Kolmogorov-Smirnov test; $P = 0.10$, two-tail Mann-Whitney U test). (B) The average expression levels of the duplicates in *S. cerevisiae* (*Sc*). The difference between DWFG and DWOFG is not significant ($P = 0.18$, two-tail Kolmogorov-Smirnov test; $P = 0.11$, two-tail Mann-Whitney U test).

Fig. S4. DWFG are not regulated by more unshared transcriptional factors than are DWOFG ($P = 0.44$, two-tail Mann-Whitney U test).

Fig. S5. DWFG do not participate in more unshared protein complexes than do DWOFG ($P = 0.47$, two-tail Mann-Whitney U test).

Fig. S6. Quantile-quantile plots between DWFG and DWOFG for d_N and d_N/d_S between duplicates.

Fig. S7. DWFG do not obtain more phosphorylation sites in *S. cerevisiae* than do DWOFG ($P = 0.17$, two-tail Mann-Whitney U test).

Fig. S8. DWFG do not obtain more glycosylation sites in *S. cerevisiae* than do DWOFG ($P = 0.24$, two-tail Mann-Whitney U test).

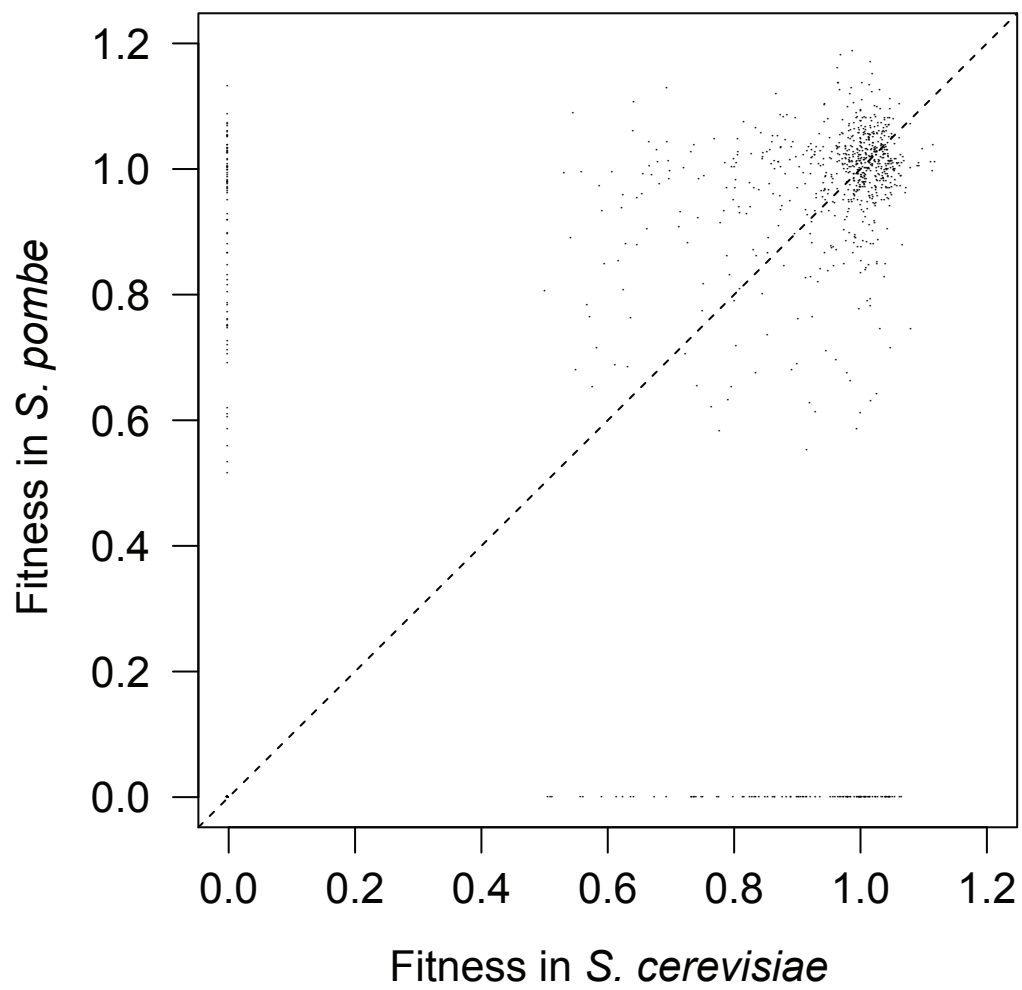


Figure S1

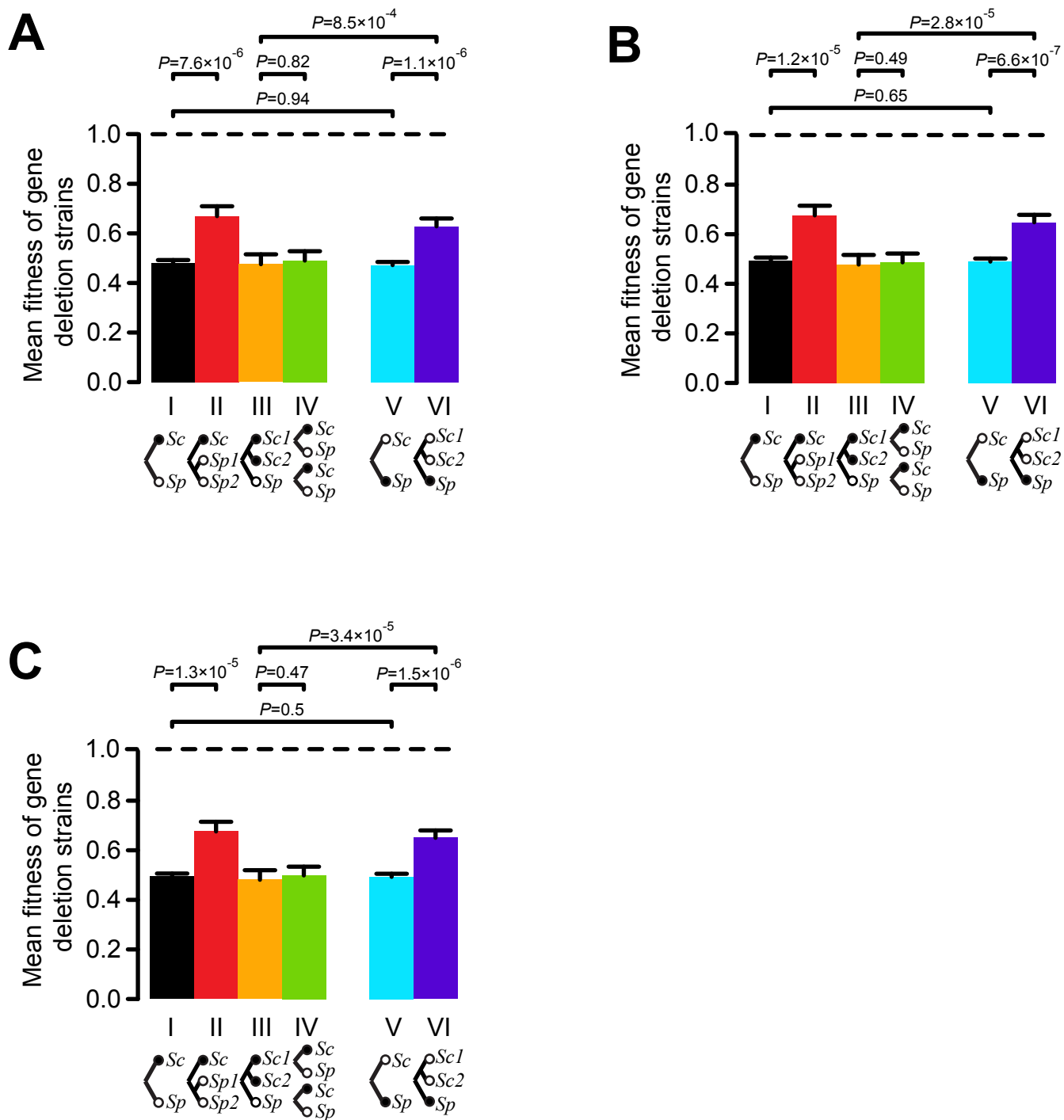


Figure S2

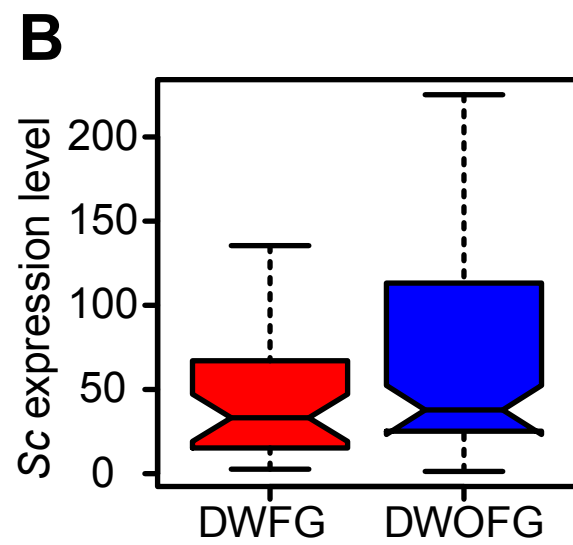
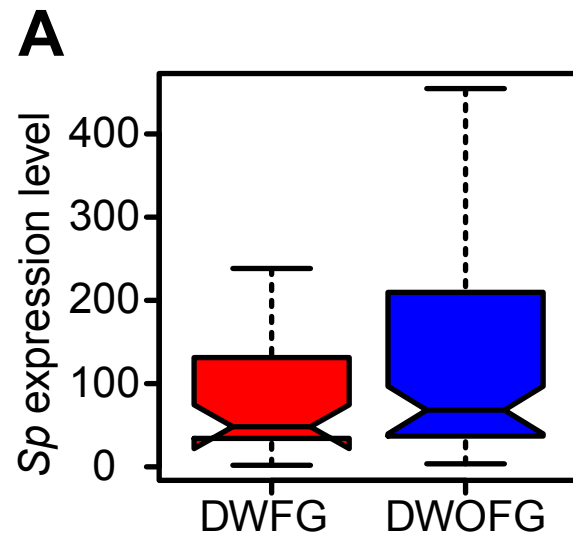


Figure S3

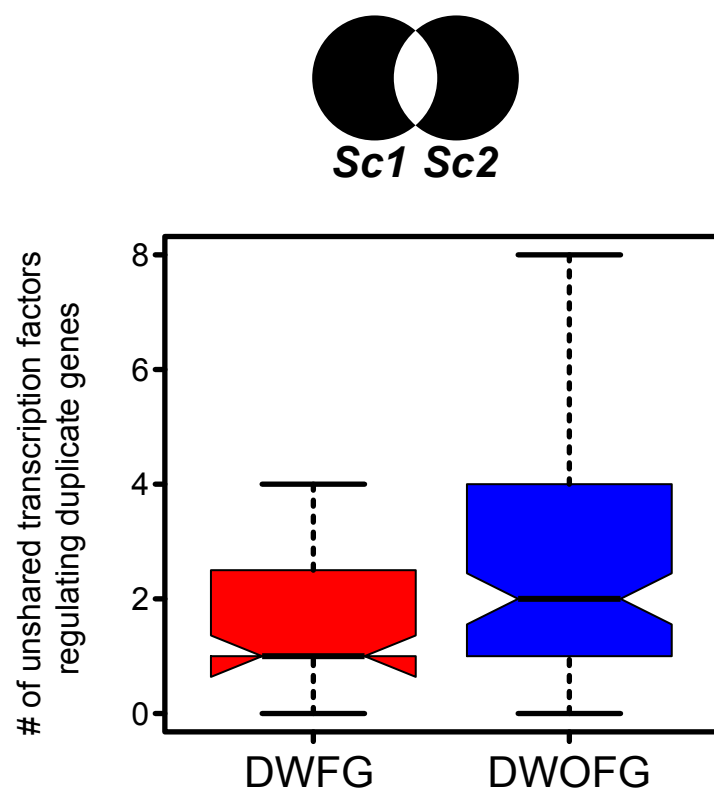


Figure S4

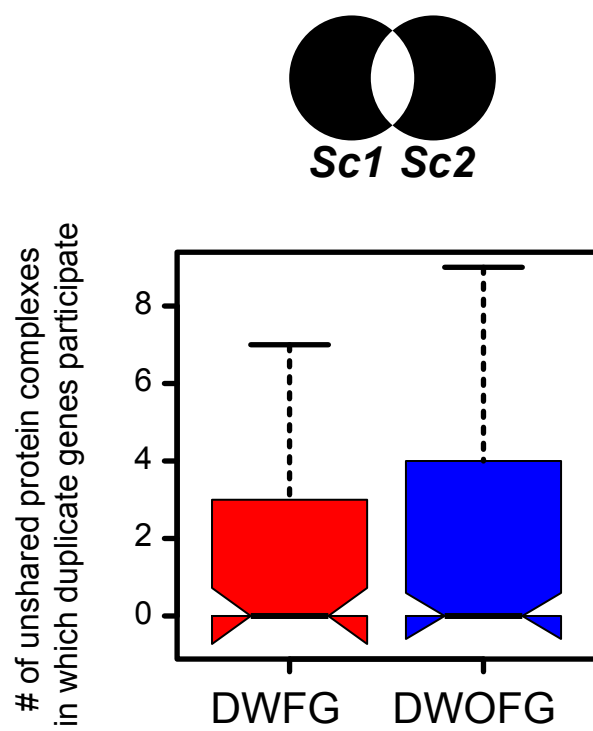


Figure S5

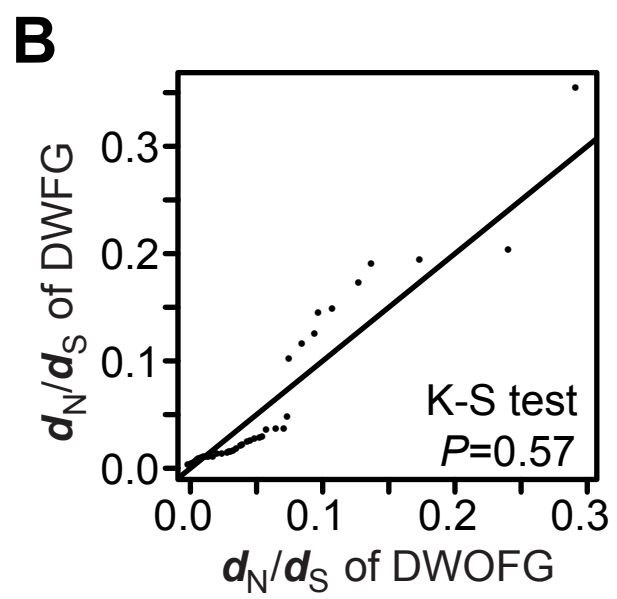
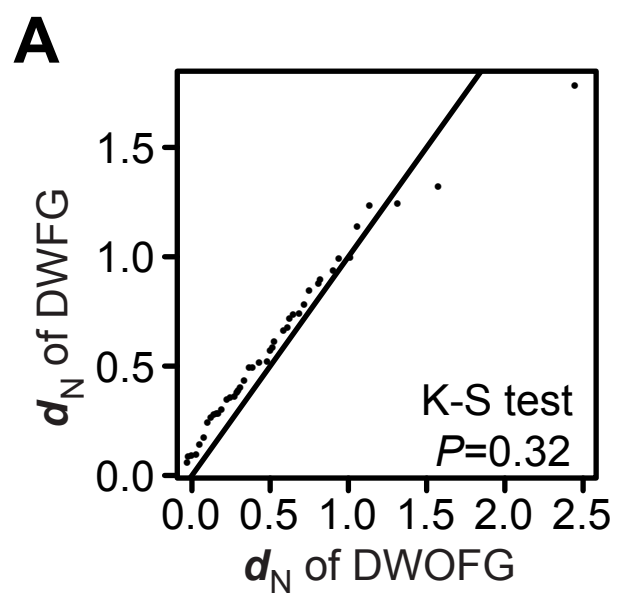


Figure S6

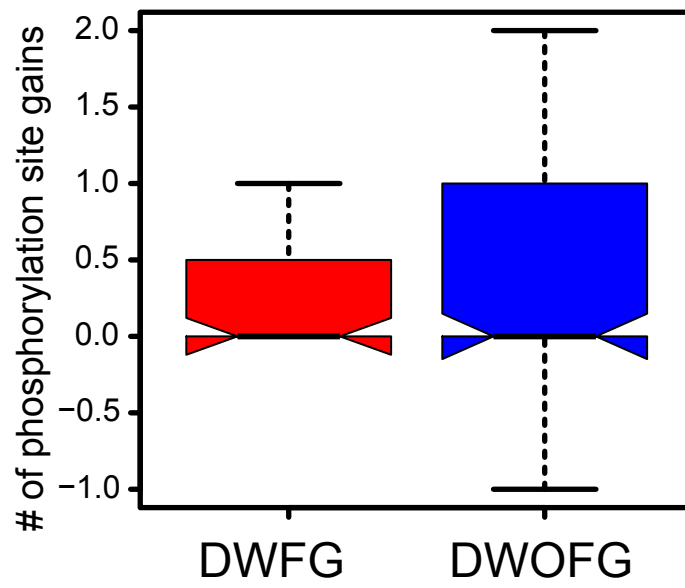


Figure S7

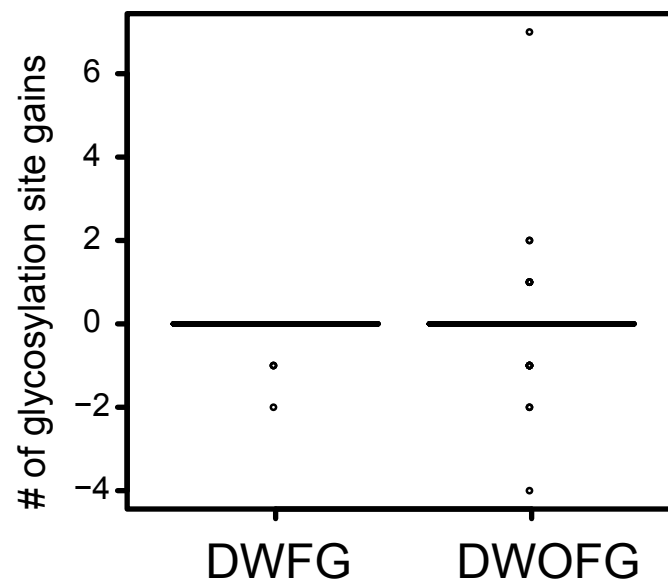


Figure S8

Table S1. *S. cerevisiae* duplicates with fitness gains (DWFG) in rich media.

Age*	<i>Sp</i> genes	<i>Sc1</i> genes	<i>Sc2</i> genes	<i>Sp</i> [†]	<i>Sc</i> [†]	<i>Sp - Sc</i> [†]
4	SPAC110.01	YOR233W	YPL141C	1.040112	0.6818	0.358312
4	SPAC1687.05	YDR409W	YOR156C	0.942332	0	0.942332
4	SPAC1687.09	YKR019C	YJL083W	1.119235	0.9765	0.142735
4	SPAC17G8.10c	YNL116W	YHR115C	1.137605	0.983071	0.154534
4	SPAC17H9.13c	YDR300C	YHR033W	1.097865	0	1.097865
1	SPAC1B3.03c	YJR032W	YLR216C	0.880627	0.68735	0.193277
2	SPAC1B3.05	YPR072W	YIL038C	0.837313	0	0.837313
5	SPAC1F3.03	YPR032W	YBL106C	1.035788	0	1.035788
4	SPAC23C11.14	YOR316C	YMR243C	0.95902	0.5101	0.44892
4	SPAC25G10.02	YKL011C	YIR021W	1.017309	0.58101	0.436299
4	SPAC26H5.05	YIR033W	YKL020C	0.833835	0	0.833835
4	SPAC2F7.10	YDR264C	YOR034C	1.081963	0	1.081963
4	SPAC31F12.01	YML109W	YMR273C	0.795663	0	0.795663
2	SPAC3H5.09c	YPR117W	YLR454W	1.034913	0.8212	0.213713
2	SPAC4H3.05	YJL092W	YOL095C	1.036395	0.6446	0.391795
5	SPAC57A10.09c	YBR089C-A	YPR052C	1.033202	0.90717	0.126032
4	SPAC637.13c	YNL047C	YIL105C	1.013143	0	1.013143
4	SPAC6B12.12	YNL121C	YHR117W	0.899368	0.6698	0.229568
1	SPAC823.05c	YOL018C	YAL014C	0.987553	0.8702	0.117353
1	SPAC824.09c	YIL044C	YDR524C	0.99699	0.8498	0.14719
4	SPAP27G11.02	YMR115W	YKL133C	1.010768	0.8704	0.140368
3	SPBC1105.02c	YDL182W	YDL131W	1.018911	0	1.018911
4	SPBC119.08	YHR030C	YKL161C	1.078252	0	1.078252
4	SPBC16D10.07c	YOL068C	YDL042C	1.050495	0.895971	0.154523
4	SPBC16E9.02c	YOR042W	YDR273W	1.125908	1.009122	0.116786
4	SPBC1703.12	YER098W	YBL067C	1.256533	0.855116	0.401417
4	SPBC2G2.03c	YER019C-A	YER087C-B	0.688387	0	0.688387
2	SPBC30B4.04c	YPL016W	YFR016C	0.994594	0	0.994594
4	SPBC36.10	YLR168C	YDR185C	1.074061	0.9613	0.112761
4	SPBC3H7.13	YDR200C	YLR238W	1.020357	0.912	0.108357
4	SPBC543.07	YOR231W	YPL140C	0.997957	0	0.997957
4	SPBC582.08	YLR089C	YDR111C	1.063016	0.86795	0.195066
4	SPBC660.07	YDR001C	YBR001C	1.073402	0.9509	0.122502
4	SPBC725.07	YDR244W	YMR018W	1.045575	0.887	0.158575
4	SPBC725.15	YML106W	YMR271C	1.075702	0	1.075702
4	SPBC800.02	YOR083W	YKR091W	1.147286	1.0333	0.113986
2	SPBC9B6.09c	YLR188W	YPL270W	1.041452	0.80445	0.237002
2	SPCC18B5.11c	YPL153C	YDL101C	1.01887	0	1.01887
4	SPCC330.12c	YKL141W	YMR118C	1.026216	0	1.026216
4	SPCC338.08	YGL075C	YPL200W	0.690133	0	0.690133

4	SPCC622.12c	YOR375C	YAL062W	1.083775	0	1.083775
4	SPCC70.02c	YDL181W	YDL130W-A	1.034362	0	1.034362
4	SPCPB16A4.03c	YLR028C	YMR120C	1.04115	0	1.04115

* See **Fig. 3A** for the definition of age groups.

† Fitness value upon single gene deletion (in *S. pombe*) or double gene deletion (in *S. cerevisiae*).

Table S2. *S. cerevisiae* duplicates without fitness gains (DWOFG) in rich media.

Age*	<i>Sp</i> gene	<i>Sc1</i> gene	<i>Sc2</i> gene	<i>Sp</i> [†]	<i>Sc</i> [†]	<i>Sp</i> - <i>Sc</i> [†]
4	SPAC10F6.03c	YJR103W	YBL039C	0	0	0
4	SPAC12G12.11c	YGL082W	YPL191C	1.081675	0.998929	0.082746
4	SPAC13G7.12c	YLR133W	YDR147W	0.601096	1.0329	-0.4318
4	SPAC144.18	YGL225W	YER039C	0	0	0
4	SPAC14C4.11	YFL004W	YPL019C	1.022959	0.964804	0.058154
5	PAC1556.02c	YKL148C	YJL045W	1.068157	0.99105	0.077107
2	SPAC16E8.07c	YMR054W	YOR270C	0	0	0
3	SPAC1783.07c	YDR423C	YML007W	1.053495	1.0515	0.001995
1	SPAC17A2.02c	YPR114W	YJR116W	1.074455	1.009122	0.065333
4	SPAC17A2.05	YEL047C	YJR051W	1.014623	1.0326	-0.01798
4	SPAC17G6.16c	YLR277C	YOR179C	0	0	0
4	SPAC17G8.03c	YBR278W	YJL065C	0	0.9801	-0.9801
4	SPAC1805.01c	YOL045W	YAL017W	1.022844	1.0832	-0.06036
4	SPAC18G6.14c	YOR096W	YNL096C	0	0	0
4	SPAC19A8.02	YHR155W	YNL257C	0.992517	1.0492	-0.05668
4	SPAC1B9.03c	YDR312W	YHR066W	0	0	0
4	SPAC1F5.02	YCL043C	YDR518W	0	0	0
4	SPAC1F7.05	YER070W	YIL066C	0	0	0
2	SPAC20H4.01	YHR196W	YDR398W	0	0	0
1	SPAC222.03c	YBR091C	YHR005C-A	0	0	0
5	SPAC227.09	YMR113W	YKL132C	0	0	0
4	SPAC22E12.11c	YKR029C	YJL105W	1.011761	1.0012	0.010561
4	SPAC22F8.08	YNL049C	YIL109C	0	0	0
4	SPAC23A1.03	YML022W	YDR441C	1.034276	0.93777	0.096506
1	SPAC23C11.11	YOR061W	YIL035C	0	0	0
1	SPAC23D3.06c	YDR192C	YIL115C	0	0	0
5	SPAC24H6.01c	YGL084C	YPL189W	0	0.96553	-0.96553
4	SPAC27F1.02c	YIL138C	YNL079C	0	0	0
4	SPAC30D11.07	YOL043C	YAL015C	1.017149	0.988736	0.028413
4	SPAC328.05	YCL011C	YNL004W	1.04534	1.0557	-0.01036
4	SPAC328.09	YPL134C	YOR222W	1.040416	1.011827	0.028589
4	SPAC3F10.15c	YGR230W	YHR152W	1.068564	1.090667	-0.0221
4	SPAC3H1.14	YBR105C	YGR066C	1.045948	1.0291	0.016848
1	SPAC4D7.04c	YMR101C	YBR002C	0	0	0
4	SPAC4F10.14c	YDR252W	YPL037C	0.866688	0.9123	-0.04561
4	SPAC4F8.07c	YDR516C	YCL040W	0	1.0444	-1.0444
4	SPAC4H3.10c	YAL038W	YOR347C	0	0	0
4	SPAC56E4.04c	YMR207C	YNR016C	0	0	0
2	SPAC56F8.05c	YIL041W	YPR148C	0.938729	1.0687	-0.12997
4	SPAC644.04	YPL228W	YMR180C	0	0	0

4	SPAC664.15	YJL112W	YKR036C	1.008476	0.9284	0.080076
4	SPAC6C3.04	YNR001C	YCR005C	0.841639	0.984078	-0.14244
1	SPAC6F12.05c	YOR143C	YJR142W	0	0	0
4	SPAC6G9.11	YOR327C	YAL030W	0	0	0
1	SPAC806.02c	YIL003W	YDR267C	0	0	0
4	SPAC806.06c	YLR328W	YGR010W	0	0	0
4	SPAC823.11	YJL134W	YKR053C	0	1.0378	-1.0378
4	SPAC890.08	YDL075W	YLR406C	0	0	0
1	SPAC8F11.06	YHR036W	YGL247W	0	0	0
4	SPAC926.04c	YPL240C	YMR186W	0	0	0
4	SPAC977.17	YFL054C	YLL043W	0.956786	0.911	0.045786
4	SPAP14E8.02	YDR501W	YLR183C	1.077708	0.978543	0.099166
2	SPAPB17E12.11	YOR085W	YML019W	0	0	0
4	SPBC119.06	YBR037C	YBR024W	0.955415	0.907191	0.048225
4	SPBC119.09c	YLR350W	YGR038W	0	0	0
1	SPBC12C2.07c	YPR069C	YLR146C	1.0206	0.958156	0.062443
4	SPBC12C2.11	YKL104C	YMR084W	0	0	0
4	SPBC14F5.05c	YDR502C	YLR180W	0	0	0
1	SPBC16A3.11	YDR419W	YFR027W	0	0	0
2	SPBC1711.08	YDR214W	YNL281W	1.092679	1.0159	0.076779
2	SPBC1718.04	YBL011W	YKR067W	0	0	0
4	SPBC1718.07c	YDR151C	YLR136C	0.922109	0.9922	-0.07009
2	SPBC17D1.01	YDR464W	YGR044C	0	0	0
4	SPBC17F3.01c	YOR134W	YDR389W	1.001687	0.953883	0.047803
4	SPBC17G9.11c	YGL062W	YBR218C	0	0	0
4	SPBC18E5.06	YJL136C	YKR057W	0	0	0
4	SPBC1921.05	YKL157W	YHR047C	1.045136	0.96855	0.076586
4	SPBC19C2.05	YPL026C	YDR247W	0	0.9941	-0.9941
2	SPBC19C2.15c	YJL097W	YFR042W	0	0	0
2	SPBC19C7.05	YBR005W	YDR003W	1.025712	0.988736	0.036977
2	SPBC19G7.13	YPL128C	YOL116W	0	0	0
4	SPBC20F10.10	YER059W	YIL050W	0.831258	0.8933	-0.06204
4	SPBC211.03c	YEL022W	YJR031C	0	0	0
5	SPBC25B2.09c	YDR341C	YHR091C	0	0	0
4	SPBC25D12.04	YJL026W	YGR180C	0	0	0
1	SPBC25H2.08c	YOR334W	YPL060W	1.005835	0.968349	0.037485
4	SPBC26H8.02c	YGR009C	YMR017W	0	0	0
4	SPBC26H8.06	YDR098C	YER174C	0	0	0
4	SPBC29A10.05	YDR263C	YOR033C	0.999337	1.1274	-0.12806
4	SPBC29A10.15	YML065W	YLR442C	0	0	0
4	SPBC29A3.04	YHL033C	YLL045C	0	0	0
4	SPBC2G5.05	YBR117C	YPR074C	0	0	0
4	SPBC31A8.01c	YDR233C	YDL204W	1.050719	0.968349	0.082369

4	SPBC32F12.10	YKL127W	YMR105C	0	0	0
2	SPBC3E7.16c	YOR108W	YNL104C	1.045863	1.0369	0.008963
4	SPBC3H7.01	YNR026C	YCR067C	0	0	0
4	SPBC405.03c	YML018C	YDR438W	0.993857	1.0936	-0.09974
4	SPBC428.14	YDR018C	YBR042C	1.056621	1.0792	-0.02258
4	SPBC4F6.06	YDR122W	YLR096W	0.762092	1.0506	-0.28851
3	SPBC4F6.18c	YDL192W	YDL137W	0	0	0
4	SPBC646.13	YGL056C	YBR214W	0.929981	1.029508	-0.09953
4	SPBC660.11	YHL034C	YLL046C	0.819074	0.9241	-0.10503
4	SPBC660.16	YGR256W	YHR183W	0	0	0
2	SPBC725.05c	YCR026C	YEL016C	1.04295	1.0937	-0.05075
1	SPBC887.14c	YML061C	YHR031C	0	0.652362	-0.65236
4	SPBC8D2.16c	YMR310C	YGR283C	1.063907	0.968349	0.095558
4	SPBC9B6.11c	YMR285C	YML118W	0.948004	0.9831	-0.0351
4	SPBP23A10.13	YPR162C	YLR453C	0	0	0
1	SPBP23A10.15c	YLR163C	YBL045C	0	0	0
4	SPBPB2B2.13	YDR009W	YBR020W	1.102461	1.0222	0.080261
2	SPCC1020.05	YLR361C	YOR137C	0.958626	1.0209	-0.06227
4	SPCC1020.06c	YLR354C	YGR043C	0.978592	0.9968	-0.01821
4	SPCC1442.02	YGL060W	YBR216C	0.960298	1.019315	-0.05902
1	SPCC1450.15	YBR265W	YDR302W	0	0	0
4	SPCC162.09c	YML075C	YLR450W	0	0	0
2	SPCC1620.01c	YBL026W	YHR124W	0	0	0
4	SPCC1795.11	YPL119C	YOR204W	0	0	0
4	SPCC191.07	YEL039C	YJR048W	0	0.896997	-0.897
2	SPCC306.06c	YGR106C	YHR101C	0	0	0
4	SPCC576.03c	YML028W	YDR453C	0	0.9281	-0.9281
4	SPCC63.14	YMR031C	YKL050C	0.980863	0.988736	-0.00787
4	SPCC825.03c	YPL232W	YMR183C	0	0	0
2	SPCP1E11.10	YCR051W	YOR383C	0.751166	1.1173	-0.36613

* See **Fig. 3A** for the definition of age groups.

† Fitness value upon single gene deletion (in *S. pombe*) or double gene deletion (in *S. cerevisiae*).

Table S3. *S. cerevisiae* fitness datasets used in this study.

Study	Media in which fitness was measured	Genetic background	Ploidy	# of duplicate pairs for which the fitness data are analyzed in our study
Costanzo <i>et al.</i> 2010	Synthetic dextrose (SD) media	<i>S288C</i>	haploid	140
Dean <i>et al.</i> 2008	Yeast extract+ peptone+ dextrose (YPD) media	<i>S288C</i>	haploid	201
DeLuna <i>et al.</i> 2008	SD media	<i>S288C</i>	haploid	66
Musso <i>et al.</i> 2008	SD media	<i>S288C</i>	haploid	150