Science Advances
AAAS

Supplementary Materials for

A programmable high-expression yeast platform responsive to user-defined signals

Qi Liu, Lili Song, Qiangqiang Peng, Qiaoyun Zhu, Xiaona Shi, Mingqiang Xu, Qiyao Wang, Yuanxing Zhang, Menghao Cai*

*Corresponding author. Email: cmh022199@ecust.edu.cn

Published 11 February 2022, *Sci. Adv.* **8**, eabl5166 (2022)
DOI: 10.1126/sciadv.abl5166

This PDF file includes:

Supplementary Text

Construction of strains for optimization and characterization of iTSAD

Two fragments were amplified from a plasmid of pP-P_{AOX1}G with primer pairs of cA F/pP R and pP F/cA R, respectively, and then fused to produce a plasmid of pPcAG by gibson assembly. Similarly, the plasmids of pPlacO1cAG, pParaO1cAG, pParaO2cAG and pParaIcAG were constructed. The core promoter, cP_{DAS1} and cP_{GAP}, were amplified from *P. pastoris* GS115 genome by primer pairs of lacO-DAS1 F/GFP-DAS1 R and lacO-GAP F/GFP-GAP R, respectively. The core promoter cP_{ScGAP} was amplified from *S. cerevisiae* BY4741 genome by primer pairs of lacO-ScGAP F/GFP-ScGAP R. Then a fragment was cloned from the plasmid pPlacO1cAG with primer pair of GFPUP F/lacO R and fused with the obtained core promoter fragments to generate plasmids of pPlacO1cDG, pPlacO1cGG and pPlacO1cScGG by gibson assembly, respectively. The sequences of core promoters referred to previous reports (*20, 53*).

LacI coding sequence was synthesized with codon optimization by Genewiz and amplified by primer pair of GAP-LacI F/LacI R. Three fragments were amplified from *P. pastoris* genome with primer pairs of LacI-P1AD F/pG-P1AD R, LacI-X1AD F/pG-X1AD R and LacI-M1AD F/pG-M1AD R, which were fused with the *lacI* fragment and the vector cloned from pGAPZ B by primer pair of pG F/LacI-GAP R, respectively. By this, plasmids of pGP_{GAP}LacIP1AD, pGP_{GAP}LacIX1AD and pGP_{GAP}LacIM1AD were obtained respectively. A fragment was amplified from the plasmid pGP_{GAP}LacIM1AD with primer pair of M1AD F/SV-GAP R, and fused with *araC* fragment amplified from *E. coli* genome with primer pair of M1AD F/SV-GAP R, resulting a plasmid of pGP_{GAP}AraCM1AD.

Linearized plasmids, i.e., pPlacO1cAG (by *Sal*I), pGP_{GAP}LacIM1AD (by *Bln*I) pGP_{GAP}AraCM1AD (by *Bln*I), were transformed into competent *P. pastoris* GS115 by electroporation. The obtained single copy expression strains were designated as GS-*O1cA*-G, GS_P_{GAP}-LM, GS-P_{GAP}-CM, respectively. The plasmids of pGP_{GAP}LacIP1AD, pGP_{GAP}LacIX1AD, and pGP_{GAP}LacIM1AD were linearized by *Bln*I and separately transformed into competent cells of GS-*O1cA*-G. Single copy expression strains were then identified and named as GS-P_{GAP}-LP_*O1cA*-G, GS-P_{GAP}-LX_*O1cA*-G, and GS-P_{GAP}-LM_*O1cA*-G, respectively. The plasmids of pPlacOcDG, pPlacOcGG, and pPlacOcScGG were linearized by *Sal*I and separately transformed into competent cells of GS_P_{GAP}-LM. Single copy expression strains were then identified and named as GS_P_{GAP}-LM_*O1cD*-G, GS_P_{GAP}-LM_*O1cG*-G and GS_P_{GAP}-LM_*O1cScG*-G, respectively. The plasmids of pParaO1cAG, pParaO2cAG and pParaIcAG were linearized by *Sal*I and separately transformed into competent cells of GS_P_{GAP}-CM. Single copy expression strains were then identified and named as GS-P_{GAP}-CM_*aO1cA*-G, GS_P_{GAP}-CM_*aO2cA*-G and GS_P_{GAP}-CM_*aIcA*-G, respectively.

Two primers lacO1 F and lacO1 R were annealed to obtain *lacO1* fragment. It was then inserted into a vector generated by digesting the plasmid pPlacO1cAG with *Sac*I/*Xho*I, resulting a plasmid of pPlacO2cAG containing two *lacO* motifs. In the same way, a series of plasmids containing 3~9 *lacO* were obtained in succession. The above plasmids were linearized by *Sal*I and separately transformed into competent cells of GS_P_{GAP}-LM. The strains carrying single *egfp* expression cassette were then identified and designated as GS_P_{GAP}-LM_*OncA*-G (n=2~9).

Various input promoters, i.e., P_{AOX2}, P_{ICL1}, P_{GPM1}, P_{ENO1}, were amplified from *P. pastoris* genome using primer pairs of pG-AOX2 F/GFP-AOX2 R, pG-ICL1 F/GFP-ICL1 R, pG-GPM1 F/GFP-GPM1 R and pG-ENO1 F/GFP-ENO1 R, respectively. The sequences of P_{GPM1} referred to previous reports (*33*). For other promoters, ~1000 bp DNA fragment upstream of each gene were selected and cloned. Then the obtained fragments were fused with a fragment cloned from pGZB_cP*AOX1*-GFP by primer pair of pGGFP F/pG R to generate plasmids of pGP$_{AOX2}$G, pGP$_{ICL1}$G, pGP$_{GPM1}$G and pGP$_{ENO1}$G, respectively. Two fragments were amplified from plasmids of pGAPZ B and pP-P$_{GAP}$G, respectively, with primer pairs of 3AOX1 F/pGAP R and pGAP F/3AOX1. Then they were fused to produce a plasmid of pGP$_{GAP}$G by gibson assembly. Afterwards, the above plasmids were linearized by *Bln*I and separately transformed into competent cells of *P. pastoris* GS115, and strains carrying single *egfp* expression cassette were then identified and named as GS_*cA*-G, GS_P$_{AOX2}$-G, GS_P$_{ICL1}$-G, GS_P$_{GPM1}$-G, GS_P$_{ENO1}$-G, and GS_P$_{GAP}$-G, respectively.

The plasmid pPlacO5cAG was linearized by *Sal*I and transformed into competent cells of *P. pastoris* GS115. Single copy expression strains were then identified and named as GS_*O5cA*-G. The *lacI-MIT1AD* fragment was amplified from pGP$_{GAP}$LacIM1AD with primer pair of LacI F/3AOX1. The plasmids of pGZB_cP*AOX1*-GFP, pGP$_{ICL1}$G, pGP$_{GPM1}$G and pGP$_{ENO1}$G were used as templates to clone the corresponding fragments, respectively, with primer pairs of 3AOX1 F/LacI-cAOX1 R, 3AOX1 F/LacI-ICL1 R, 3AOX1 F/LacI-GPM1 R and 3AOX1 F/LacI-ENO1 R. Then they were fused with the *lacI-MIT1AD* fragment to generate plasmids of pGcALacIM1AD, pGP$_{ICL1}$LacIM1AD, pGP$_{GPM1}$LacIM1AD and pGP$_{ENO1}$LacIM1AD separately by gibson assembly. These plasmids were linearized by *Bln*I and separately transformed into competent cells of GS_*O5cA*-G. The obtained strains with single copy of each expression cassette were designated as GS_*cA*-LM_*O5cA*-G, GS-P$_{ICL1}$-LM_*O5cA*-G, GS-P$_{GPM1}$-LM_*O5cA*-G and GS-P$_{ENO1}$-LM_*O5cA*-G, respectively. All the constructed strains were listed in Table S2.

Construction of strains for functional verification of CRISPRi system in *P. pastoris*

Two fragments were amplified from a plasmid of p414-TEF1p-Cas9-CYC1t with primer pairs of dCas9 F1/dCas9 R1 and dCas9 F2/dCas9 R2, respectively, and then fused with a fragment cloned from pGP$_{GAP}$AraCM1AD with primer pair of dCas9-pG F/dCas9-SV R to generate a plasmid of pGP$_{GAP}$dCas9 by gibson assembly. Afterwards, pGP$_{GAP}$dCas9 was linearized by *Bln*I and transformed into competent cells of GS_P$_{AOX1}$-G. The strains with single *dCAS9* expression cassette were then identified and designated as GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9.

The P$_{AOX1}$ fragment was amplified from the plasmid pP-P$_{AOX1}$G by primer pair of pA-AOX1 F/pA-AOX1 R and insert into a vector generated by digesting the plasmid pAG32 with *Sac*I/*Spe*I, resulting a plasmid of pAA. HH-giF1-HDV fragment was synthesized by Genewiz and amplified by primer pair of giF1HH F/TT-HDV R. Two fragments were amplified from a plasmid of pGAPZ B with primer pairs of pAA-GAP F/HHgiF1-GAP R and 3AOX1F/pAA-TT R, respectively. The above fragments were fused with a vector of *BamH*I/*Sal*I digested pAA to produce a plasmid of pAA-P$_{GAP}$giF1 by gibson assembly. Afterwards, two fragments were amplified from pAA-P$_{GAP}$giF1 with primer pairs of inOri R/giF2HH-GAP R and HHgiF2-handle F/inOri F, respectively, and fused to generate a plasmid of pAA-P$_{GAP}$giF2. By similar methods, the plasmids of pAA-P$_{GAP}$giF3, pAA-P$_{GAP}$giR1, pAA-P$_{GAP}$giR2 and pAA-P$_{GAP}$giR3 were obtained. The above plasmids containing different giRNAs were linearized by *Sac*I and separately transformed into competent cells of GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9. Single copy expression strains were then identified and named as GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9_P$_{GAP}$-giF1, GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9_P$_{GAP}$-giF2, GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9_P$_{GAP}$-giF3, GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9_P$_{GAP}$-giR1, GS_P$_{AOX1}$-G_ P$_{GAP}$-dCas9_P$_{GAP}$-giR2 and GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9_P$_{GAP}$-giR3, respectively. All the constructed strains were listed in Table S2.

Construction of strains for optimization and characterization of CRISPRiD

The plasmid pGP$_{GAP}$dCas9 was linearized by *Bln*I and transformed into competent cells of *P. pastoris* GS115. The strains with single *dCAS9* expression cassette were then identified and designated as GS_P$_{GAP}$-dCas9. A fragment was amplified from a plasmid of pGcALacIM1AD with primer pair of pP-cA F/lacO-TT R and cloned into a vector of *Sac*I/*Xho*I digested pPlacO5cAG by gibson assembly, resulting a plasmid of pPcALMO5. It was then linearized by *BspE*I and transformed into competent cells of GS_P$_{GAP}$-dCas9. Single copy expression strains were then identified and named as GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G. Afterwards, competent cells of this strain were prepared for construction of subsequent strains.

The plasmid pAA-P$_{GAP}$giR1 was digested with *Sac*I/*Spe*I, and the small fragment (~2600 bp) was recovered from agarose gel. The plasmid pAA-P$_{GAP}$giR2 was digested with *Sac*I/*Xba*I, and the large fragment (~3600 bp) was recovered from agarose gel too. Two fragments were fused to generate a plasmid of pAA-P$_{GAP}$giR1R2. In the same way, the plasmids of pAA-P$_{GAP}$giR1F1 and pAA-P$_{GAP}$giR2F1 were obtained. The promoter fragments, i.e., P$_{AOX2}$, P$_{ICL1}$, P$_{GPM1}$, P$_{ENO1}$, were amplified from *P. pastoris* genome using primer pairs of pAA-AOX2 F/HH-AOX2 R, pAA-ICL1 F/HH-ICL1 R, pAA-GPM1 F/HH-GPM1 R and pAA-ENO1 F/HH-ENO1 R, respectively. Then the obtained fragments were fused with a large fragment digested from the plasmid pAA-P$_{GAP}$giF1 with *Xho*I/*Kpn*I, producing plasmids of pAA-P$_{AOX2}$giF1, pAA-P$_{ICL1}$giF1, pAA-P$_{GPM1}$giF1 and pAA-P$_{ENO1}$giF1 by gibson assembly, respectively. The above plasmids were linearized by *Sac*I and separately transformed into competent cells of GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G. The derived single copy expression strains were then identified and all listed in Table S2.

Construction of strains for functional verification of trigger RNA

The fragments of HH-anti-HDV, HH-ribo-HDV, HH-ncRNA-HDV and HH-giF1c-HDV were synthesized by Genewiz and digested with *Xba*I/*Spe*I, respectively. The obtained small fragments (~200 bp) were separately inserted into a vector (~5800 bp) of *Xba*I/*Spe*I digested pAA-P$_{GAP}$giF1, resulting plasmids of pAA-P$_{GAP}$antiRNA, pAA-P$_{GAP}$riboRNA, pAA-P$_{GAP}$ncRNA and pAA-P$_{GAP}$giF1c, respectively. The plasmids of pAA-P$_{AOX2}$giF1 and pAA-P$_{GAP}$giF1c were digested with *Xba*I/*Kpn*I. Then the small fragment (~1000 bp) and large fragment (~5600 bp) were recovered, respectively, and fused to generate a plasmid of pAA-P$_{AOX2}$giF1c. It was linearized by *Sac*I and transformed into competent cells of GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G. The strain with single expression cassette was then identified and designated as GS_P$_{GAP}$-dCas9_*cA*-LM-O5*cA*-G_P$_{AOX2}$-giF1c.

Two short fragments (~1500 bp) were recovered from *EcoR*I/*Sal*I digested pAA-P$_{GAP}$antiRNA and pAA-P$_{GAP}$ncRNA, respectively. Then they were separately cloned into a vector (~5900 bp) of *Xho*I/*EcoR*I digested pAA-P$_{AOX2}$giF1, generating plasmids of pAA-P$_{GAP}$anti-P$_{AOX2}$giF1 and pAA-P$_{GAP}$ncRNA-P$_{AOX2}$giF1, respectively. Similarly, plasmids of pAA-P$_{GAP}$ribo-P$_{AOX2}$giF1c and pAA-P$_{GAP}$ncRNA-P$_{AOX2}$giF1c were constructed. All above plasmids were linearized by *Sac*I and transformed into competent cells of GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G. The derived single copy expression strains were then identified and all listed in Table S2.

Construction of strains for functional verification of CRISPRa on P$_{AOX1}$

The VP16 coding sequence was amplified from the plasmid pZ_P$_{ICL1}$-LacI-VP16 by primer pair of inCas9DO F/pGTTout R. The *MIT1* and *MXR1* fragments were separately amplified from the plasmid pGP$_{GAP}$LacIM1AD and pGP$_{GAP}$LacIX1AD with primer pairs of Cas9-Mit1AD F/pGTTout R and Cas9-Mxr1AD F/pGTTout R, respectively. They were fused with a fragment cloned from pGP$_{GAP}$dCas9 with primer pair of pGTTout F/inCas9DO R by gibson assembly, respectively, generating plasmids of pGP$_{GAP}$dCas9VP16, pGP$_{GAP}$dCas9M1AD and pGP$_{GAP}$dCas9X1AD. They were linearized by *Bln*I and transformed into competent GS115, and the obtained single expression cassette strains were named as GS_P$_{GAP}$-dCas9VP16, GS_P$_{GAP}$-dCas9M1AD and GS_P$_{GAP}$-dCas9X1AD, respectively. Two primers of Xho-fapO-Apa F and Apa-fapO-Xho R were annealed and the product was insert into a vector of *Xho*I/*Apa*I digested pPlacO1cAG, resulting a plasmid of pPfapO1cAG. Then the annealed product of fapO1 F and fapO1 R was inserted into a vector of *Apa*I/*Xho*I digested pPfapO1cAG, generating a plasmid of pPfapO2cAG. The process was repeated eight times to obtain a plasmid of pPfapO10cAG. The plasmids pPfapO1cAG and pPfapO10cAG were linearized by *Sal*I and separately transformed into competent cells of GS_P$_{GAP}$-dCas9VP16, GS_P$_{GAP}$-dCas9M1AD and GS_P$_{GAP}$-dCas9X1AD. The strains with single *egfp* cassette were identified and designated as GS_P$_{GAP}$-dCas9VP16_*fO1cA*-G, GS_P$_{GAP}$-dCas9VP16_*fO10cA*-G, GS_P$_{GAP}$-dCas9M1AD_*fO1cA*-G, GS_P$_{GAP}$-dCas9M1AD_*fO10cA*-G, GS_P$_{GAP}$-dCas9X1AD_*fO1cA*-G and GS_P$_{GAP}$-dCas9X1AD_*fO10cA*-G. All the constructed strains were listed in Table S2.

Two fragments were amplified from pAA-P$_{GAP}$giF1 with primer pairs of inOri R/gA1HH-GAP R and HHgA1-handle F/inOri F, respectively, and fused to generate a plasmid of pAA-P$_{GAP}$gA1. With similar methods, the plasmids of pAA-P$_{GAP}$gA2, pAA-P$_{GAP}$gA3, pAA-P$_{GAP}$gA4, pAA-P$_{GAP}$gA5, pAA-P$_{GAP}$gA6, pAA-P$_{GAP}$gA7 and pAA-P$_{GAP}$gA8 were obtained respectively. The above plasmids were linearized by *Sac*I and separately transformed into competent cells of GS_P$_{GAP}$-dCas9VP16_*fO1cA*-G, GS_P$_{GAP}$-dCas9VP16_*fO10cA*-G, GS_P$_{GAP}$-dCas9M1AD_*fO1cA*-G, GS_P$_{GAP}$-dCas9M1AD_*fO10cA*-G, GS_P$_{GAP}$-dCas9X1AD_*fO1cA*-G and GS_P$_{GAP}$-dCas9X1AD_*fO10cA*-G, respectively. The derived single copy expression strains were then identified and all listed in Table S2.

Construction of strains for functional verification of dCpf1 in *P. pastoris*

The plasmid pPcALMO5 was linearized by *BspE*I and transformed into competent GS115. The strains carrying single *egfp* expression cassette were then identified and designated as GS_*cA*-LM-O5*cA*-G. Two fragments were amplified from the plasmid pET28TEV-LbCpf1 with primer pairs of SV-LbCpf1 F/dCpf1 R and dCpf1 F/TTout-LbCpf1 R, respectively. They were then fused with a vector obtained from pGP$_{GAP}$dCas9 by primer pair of pGTTout F/inSV R, generating a plasmid of pGP$_{GAP}$dCpf1 by gibson assembly. It was linearized by *Bln*I and transformed into competent cells of GS_*cA*-LM-O5*cA*-G. Single copy expression strains were then identified and named as GS_*cA*-LM-O5*cA*-G_P$_{GAP}$-dCpf1.

Two fragments were amplified from the plasmid pAA-P$_{GAP}$giF1 with primer pairs of inOri R/2Bbs-GAP R and 2Bbs-HDV F/inOri F respectively, and then fused to produce a plasmid of pAA-P$_{GAP}$2BbsHDV by gibson assembly. A fragment generated by annealing primers of HH-DR-2Bbs F and HH-DR-2Bbs R was inserted the *Bbs*I digested pAA-P$_{GAP}$2BbsHDV, resulting a plasmid of pAA-P$_{GAP}$crRNADR2Bbs. Then two primers of crRNA-NT1 F and crRNA-NT1 R were annealed and the product was insert into the *Bbs*I digested P$_{GAP}$crRNADR2Bbs, generating a plasmid of pAA-P$_{GAP}$crNT1. In the same way, plasmids of pAA-P$_{GAP}$crNT2, pAA-P$_{GAP}$crNT3, pAA-P$_{GAP}$crT1, pAA-P$_{GAP}$crT2 and pAA-P$_{GAP}$crT3 were obtained. The six plasmids mentioned above were linearized by *Sac*I and transformed into competent cells of GS_*cA*-LM-O5*cA*-G_P$_{GAP}$-dCpf1. The derived single copy expression strains were then identified and all listed in Table S2. The plasmid pET28TEV-LbCpf1 was kindly provided by Dr. Gaoyi Tan in our university.

Construction of strains for functional verification of CRISPRaD

Two fragments were amplified from pAA-P_{GAP}giF1 with primer pairs of inOri R/ga1HH-GAP R and ga1-handle F/inOri F respectively, and fused to generate a plasmid of pAA-P_{GAP}ga1 by gibson assembly. Two primers of HH-ga2-2Bbs F and HH-ga2-2Bbs R were annealed and the obtained product was inserted into the *Bbs*I digested pAA-P_{GAP}2BbsHDV, generating a plasmid of pAA-P_{GAP}ga2-2Bbs. It was digested by *Bbs*I for ligation with the primer pair of ga2 F/ga2 R annealed product. The obtained plasmid was designated as pAA-P_{GAP}ga2. Two fragments were amplified from pAA-P_{GAP}giF1 with primer pairs of inOri R/2Bbs-GAP R and 2Bbs-handle F/inOri F, respectively, and fused to produce a plasmid of pAA-P_{GAP}2BbsCashHDV. Two fragments obtained separately by annealed primer pairs ga3HH-2Bbs F/ga3HH-2Bbs R and HH-giF1m-2Bbs F/HH-giF1m-2Bbs R respectively. Then they were inserted into the *Bbs*I digested pAA-P_{GAP}2BbsCashHDV, respectively, generating plasmids of pAA-P_{GAP}ga3CashHDV and pAA-P_{GAP}giF1m-2Bbs. Subsequently, the primer pair of ga3 F/ga3 R annealed product was inserted into the *Bbs*I digested pAA-P_{GAP}ga3CashHDV, resulting a plasmid of pAA-P_{GAP}ga3. Also, the primer pair of F1m F/F1m R annealed product was inserted into the *Bbs*I digested pAA-P_{GAP}giF1m-2Bbs, resulting a plasmid of pAA-P_{GAP}giF1m. The plasmids pAA-P_{AOX2}giF1 and P_{GAP}giF1m were digested with *Xho*I/*Kpn*I, then the small fragment (~1000 bp) and large fragment (~5600 bp) were recovered, respectively, and fused to generate a plasmid of pAA-P_{AOX2}giF1m. It was linearized by *Sac*I and transformed into competent cells of GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G. The strain with single expression cassette was then identified and designated as GS_P_{GAP}-dCas9_*cA*-LM- O5*cA*-G_P_{AOX2}-giF1m. The annealing products of primer pairs of cra1 F/cra1 R, cra2 F/cra2 R and cra3 F/cra3 R were separately inserted the *Bbs*I digested pAA-P_{GAP}crRNADR2Bbs, generating plasmids of pAA-P_{GAP}cra1, pAA-P_{GAP}cra2 and pAA-P_{GAP}cra3, respectively.

Four large fragments (~5400 bp) were recovered from *Xho*I/*EcoR*I digested pAA-P_{GAP}ga1, pAA-P_{GAP}ga2, pAA-P_{GAP}cra1 and pAA-P_{GAP}cra3, respectively. Then they were separately ligated with the small fragment (~2100 bp) of *EcoR*I/*Sal*I digested pAA-P_{AOX2}giF1to produce plasmids of pAA-P_{AOX2}giF1-P_{GAP}ga1, pAA-P_{AOX2}giF1-P_{GAP}ga2, pAA-P_{AOX2}giF1-P_{GAP}cra1 and pAA-P_{AOX2}giF1-P_{GAP}cra3. By similar methods, plasmids of pAA-P_{AOX2}giF1c-P_{GAP}ga3, pAA-P_{AOX2}giF1m-P_{GAP}cra2 and pAA- P_{AOX2}giF1m-P_{GAP}ncRNA were obtained. All above plasmids were linearized by *Sac*I and transformed into competent cells of GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G. The derived single copy expression strains were then identified and all listed in Table S2.

Three fragments were amplified from the plasmid pGP$_{GAP}$dCas9VP16 with primer pairs of inCas9DO F/dCas9V R, dCas9V F/dCas9R R and dCas9R F/dCas9ER R respectively, and then fused to generate a plasmid of pGP$_{GAP}$VRERVP16 by gibson assembly. Two fragments were amplified from the plasmids pGP$_{GAP}$VRERVP16 and pGP$_{GAP}$dCpf1, respectively, with primer pairs of LbCpf1-linker F/inOri R and inOri F/inLbCpf1DO R. Then they were fused to generate a plasmid of pGP$_{GAP}$dCpf1VP16 by gibson assembly. The two plasmids were linearized by *Bln*I and transformed into competent cells of *P. pastoris* GS115, then the single copy expression strains were separately identified and named as GS_P_{GAP}-VRERVP16 and GS_P_{GAP}-dCpf1VP16. The *Sac*I linearized plasmids of pAA-P_{GAP}ga1, pAA-P_{GAP}ga2 and pAA-P_{GAP}ga3 were transformed into competent cells of GS_P_{GAP}-VRERVP16, respectively, and then the single copy expression strains were then identified and designated as GS_P_{GAP}-VRERVP16_P_{GAP}-ga1, GS_P_{GAP}-VRERVP16_P_{GAP}-ga2 and GS_P_{GAP}-VRERVP16_P_{GAP}-ga3. Also, plasmids of pAA-P_{GAP}cra1, pAA-P_{GAP}cra2 and pAA-P_{GAP}cra3 were linearized by *Sac*I and separately transformed into competent cells of GS_P_{GAP}-dCpf1VP16. The strains with single expression cassette were then identified and designated as GS_P_{GAP}-dCpf1VP16_P_{GAP}-cra1, GS_P_{GAP}-dCpf1VP16_P_{GAP}-cra2 and GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra3, respectively.

Two fragments were amplified from the plasmid pPcAG with primer pairs of g1-cA F/inOri R and inOri F/g1-pP R, respectively, and then fused to produce a plasmid of pPg1cAG by gibson assembly. Similarly, plasmids of pPg1rcAG, pPg2cAG, pPg2rcAG, pPg3cAG, pPg3rcAG, pPcr1cAG, pPcr1rcAG, pPcr2cAG, pPcr2rcAG, pPcr3cAG and pPcr3rcAG were obtained. All above plasmids were linearized by *Sac*I and separately transformed into corresponding competent cells mentioned above. The derived single copy expression strains were then identified and all listed in Table S2.

Two fragments were amplified from the plasmids pPg1cAG and pGcALacIM1AD, respectively, with primer pairs of 3AOX1 F/5AOX1 R and 5AOX1/3AOX1. They were then fused to produce a plasmid of pPg1cALM by gibson assembly. Afterwards, two fragments were amplified from the plasmids pPg1cALM and pPcALMO5, respectively, with primer pairs of inOri F/CN-LacI R and CN-LacI F/inOri R. Then they were fused to generate a plasmid of pPg1cALMO5 by gibson assembly. Similarly, plasmids of pPg1rcALMO5, pPg2cALMO5, pPg2rcALMO5, pPg3cALMO5, pPg3rcALMO5, pPcr1cALMO5, pPcr1rcALMO5, pPcr2cALMO5, pPcr2rcALMO5, pPcr3cALMO5 and pPcr3rcALMO5 were obtained. All above plasmids were linearized by *BspE*I and separately transformed into corresponding competent cells harboring various CRISPRaD. The derived single copy expression strains were then identified and all listed in Table S2.

Construction of strains loaded with iTSAD, CRISPRiD and CRISPRaD

Considering many cassettes of the three devices were needed to integrate into genome but with limited screening markers, our previously developed CRISPR-mediated marker-free integration method (*32*) was introduced for the subsequent constructions. Two fragments were amplified from the plasmids pDTg1-npgA and pGP$_{GAP}$dCas9, respectively, with primer pairs of 3AOX1 F/pGAP R and pGAP F/3AOX1. They were then fused to generate a plasmid of pDTg1P$_{GAP}$dCas9 by gibson assembly. It was used as template to amplify donor DNA fragment by primer pair of HAPTg1UP F/HAPTg1DO R. To improve the CRISPR-mediated integration efficiency, the non-homologous-end-joining defective strain Δ*ku70* was used as the parent strain (*32*). Then 1 μg donor DNA fragment and 100 ng plasmid 3.5k-TEF1-gRNA1 were simultaneously transformed into competent cells of *P. pastoris* Δ*ku70*. The positive transformant was screened by *HIS4* and streaked on YPD agar plate to lose plasmid 3.5k-TEF1-gRNA1. Two days later, the transformant without 3.5k-TEF1-gRNA1 was identified and designated as Δ*ku*_P$_{GAP}$-dCas9. The plasmids of pGP$_{GAP}$VRERVP16 and pGP$_{GAP}$dCpf1VP16 were linearized by *Bln*I and transformed into competent cells of Δ*ku*_P$_{GAP}$-dCas9, then the single copy expression strains were separately identified and designated as Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16 and Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16 respectively. The pAA-P$_{GAP}$ga2 and pAA-P$_{GAP}$cra3 plasmids were digested with *Xho*I/*Kpn*I, respectively. Then the two large fragments (~5500 bp) were recovered and separately ligated with the small fragment of *Xho*I/*Kpn*I digested pAA-P$_{AOX2}$giF1, generating plasmids of pAA-P$_{AOX2}$ga2 and pAA-P$_{AOX2}$cra3 respectively. In the same way, plasmids of pAA-P$_{ICL1}$ga2, pAA-P$_{GPM1}$ga2, pAA-P$_{ENO1}$ga2, pAA-P$_{ICL1}$cra3, pAA-P$_{GPM1}$cra3 and pAA-P$_{ENO1}$cra3 were obtained.

The plasmid of pPg2rcALMO5 were linearized by *BspE*I and transformed into competent cells of Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16. The obtained single expression cassette strain was named as Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G. The plasmids of pAA-P$_{ICL1}$giF1, pAA-P$_{GPM1}$giF1, pAA-P$_{ENO1}$giF1 and pAA-P$_{GAP}$giF1 were digested with *EcoR*I/*Sal*I, respectively. Then the four small fragments were recovered and separately inserted into the vector of *Xho*I/*EcoR*I digested pAA-P$_{AOX2}$ga2, generating plasmids of pAA-P$_{ICL1}$giF1-P$_{AOX2}$ga2, pAA-P$_{GPM1}$giF1-

P_{AOX2}ga2, pAA-P_{ENO1}giF1-P_{AOX2}ga2 and pAA-P_{GAP}giF1-P_{AOX2}ga2 respectively. Similarly, plasmids of pAA-P_{AOX2}giF1-P_{ICL1}ga2, pAA-P_{GPM1}giF1-P_{ICL1}ga2, pAA-P_{ENO1}giF1-P_{ICL1}ga2, pAA-P_{GAP}giF1-P_{ICL1}ga2, pAA-P_{AOX2}giF1-P_{GPM1}ga2, pAA-P_{ICL1}giF1-P_{GPM1}ga2, pAA-P_{ENO1}giF1-P_{GPM1}ga2, pAA-P_{GAP}giF1-P_{GPM1}ga2, pAA-P_{AOX2}giF1-P_{ENO1}ga2, pAA-P_{ICL1}giF1-P_{ENO1}ga2, pAA-P_{GPM1}giF1-P_{ENO1}ga2, pAA-P_{GAP}giF1-P_{ENO1}ga2, pAA-P_{AOX2}giF1-P_{GAP}ga2, pAA-P_{ICL1}giF1-P_{GAP}ga2, pAA-P_{GPM1}giF1-P_{GAP}ga2 and pAA-P_{ENO1}giF1-P_{GAP}ga2 were obtained successively. The above-mentioned 20 plasmids were linearized by *Sac*I and separately transformed into competent Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G. The derived single copy expression strains were then identified and all listed in Table S2.

The plasmid of pPcr3cALMO5 were linearized by *BspE*I and transformed into competent cells of Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16. The obtained single expression cassette strain was named as Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3rcA*-LM-*O5cA*-G. The plasmids of pAA-P_{ICL1}giF1, pAA-P_{GPM1}giF1, pAA-P_{ENO1}giF1 and pAA-P_{GAP}giF1 were digested with *EcoR*I/*Sal*I, respectively. Then the four small fragments were recovered and separately inserted into the vector of *Xho*I/*EcoR*I digested pAA-P_{AOX2}cra3, generating plasmids of pAA-P_{ICL1}giF1-P_{AOX2}cra3, pAA-P_{GPM1}giF1-P_{AOX2}cra3, pAA-P_{ENO1}giF1-P_{AOX2}cra3 and pAA-P_{GAP}giF1-P_{AOX2}cra3, respectively. Similarly, plasmids of pAA-P_{AOX2}giF1-P_{ICL1}cra3, pAA-P_{GPM1}giF1-P_{ICL1}cra3, pAA-P_{ENO1}giF1-P_{ICL1}cra3, pAA-P_{GAP}giF1-P_{ICL1}cra3, pAA-P_{AOX2}giF1-P_{GPM1}cra3, pAA-P_{ICL1}giF1-P_{GPM1}cra3, pAA-P_{ENO1}giF1-P_{GPM1}cra3, pAA-P_{GAP}giF1-P_{GPM1}cra3, pAA-P_{AOX2}giF1-P_{ENO1}cra3, pAA-P_{ICL1}giF1-P_{ENO1}cra3, pAA-P_{GPM1}giF1-P_{ENO1}cra3, pAA-P_{GAP}giF1-P_{ENO1}cra3, pAA-P_{AOX2}giF1-P_{GAP}cra3, pAA-P_{ICL1}giF1-P_{GAP}cra3, pAA-P_{GPM1}giF1-P_{GAP}cra3 andpAA-P_{ENO1}giF1-P_{GAP}cra3 were obtained successively. The above-mentioned 20 plasmids were linearized by *Sac*I and separately transformed into competent cells of Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3rcA*-LM-*O5cA*-G. The derived single copy expression strains were then identified and all listed in Table S2.

Three promoters, i.e., P_{LRA3}, P_{DAS1}, P_{THI11}, were amplified from *P. pastoris* genome using primer pairs of pAA-LRA3 F/HHgiF1-LRA3 R, pAA-DAS1 F/HHgiF1-DAS1 R and pAA-THI11 F/HHgiF1-THI11 R, respectively. Then they were separately fused with a vector of *Xho*I/*Kpn*I digested pAA-P_{GAP}giF1, resulting plasmids of pAA-P_{LRA3}giF1, pAA-P_{DAS1}giF1 and pAA-P_{THI11}giF1. The three plasmids were digested with *EcoR*I/*Sal*I, respectively. Then three small fragments were recovered and separately inserted into the vector of *Xho*I/*EcoR*I digested pAA-P_{GAP}cra3, generating plasmids of pAA-P_{LRA3}giF1-P_{GAP}cra3, pAA-P_{DAS1}giF1-P_{GAP}cra3 and pAA-P_{THI11}giF1-P_{GAP}cra3. Afterwards, they were linearized by *Sac*I and separately transformed into competent cells of Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3rcA*-LM-*O5cA*-G. The derived single copy expression strains were then identified and all listed in Table S2.

The fragment containing α-amylase cassette was amplified from the plasmid pPIC9K-Amy by primer pair of 5AOX1/3AOX1, and fused with a fragment cloned from pPlacO5cAG with primer pair of 3AOX1 F/5AOX1 R by gibson assembly, generating a plasmid of pPlacO5cAAmy. Afterwards, two fragments were amplified from the plasmids pPlacO5cAAmy and BB3eN_14, respectively, with primer pairs of inOri F/BB3-TT R and CN- TT-BB3 F/inOri R. Then they were fused to generate a plasmid of BB3eN-lacO5cAAmy by gibson assembly. It was linearized by *Pme*I and transformed into competent cells of Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{THI11}-giF1-P_{GAP}-cra3. The strain with single expression cassette was then identified and listed in Table S2.

Design and validation of regulatory RNA

The regulatory RNA and their duplex were drawn in Fig. 3C according to the prediction of RNA secondary structure. The DNA targeting region of each giRNA was annotated in yellow, while for each gaRNA and craRNA, the DNA targeting region was annotated in pink. For gaRNA_1, the DNA targeting sequence was designed to be fully complementary to the DNA targeting sequence of giRNA_F1, and the Cas handle region remained the same as that of giRNA_F1. For gaRNA_2, base-pair mutations (CU to UC and AG to GA) were performed in the hairpin of Cas handle region, resulting a ~30-base pairs in giRNA_F1:gaRNA_2 duplex. As a result, the Cas handle regions of both giRNA_F1 and gaRNA_2 were destroyed, which prevented the binding of VRER or dCas9. The mutant region of gaRNA_2 was annotated in red. In addition, a combination of giRNA_F1c and gaRNA_3 was designed to form the duplex by a linear-loop interaction (*65*). There is a YUNR motif on the loop (purple) of gaRNA_3 that can be recognized by the 5' linear region (purple) of giRNA_F1c, then the dimerization occurs in the 5' hairpin of giRNA_F1c and gaRNA_3 (grey). It causes the formation of new stem-loop which will block the DNA targeting sequence in both giRNA_F1c and gaRNA_3. Also, three craRNAs containing a 5' Cpf1 handle region were designed. The DNA targeting sequences of craRNA_1 and craRNA_3 were separately complementary to the 3' stem-loop and the linker sequence of Cas handle region of giRNA_F1, destroying the recognition of VRER to giRNA_F1 and blocking the DNA targeting region of craRNA_1 and craRNA_3. Besides, the 3' stem-loop of giRNA_F1m was mutated for complementary to Cpf1 handle region of craRNA_2, producing a ~40-base pairs in giRNA_F1m:craRNA_2 duplex. All RNA sequences were listed in Table S1.

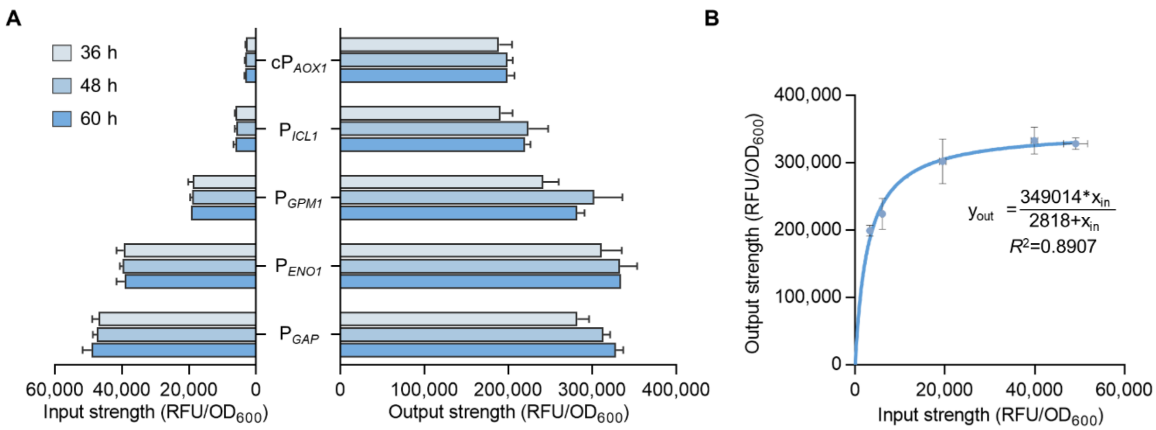


Fig. S1. The regulation model of iTSAD.

(A) The input and output strength of iTSAD driven by input promoters of different intensities at various time points. (B) The regression curve of the relationship between the input and output signals. Data of output strength (y_{out}) and input strength (x_{in}) were fitted according to the Michaelis-Menten equation. The regression coefficient R^2 was obtained as 0.8907, representing that the dependence of input and output signals of iTSAD followed Michaelis–Menten kinetics.

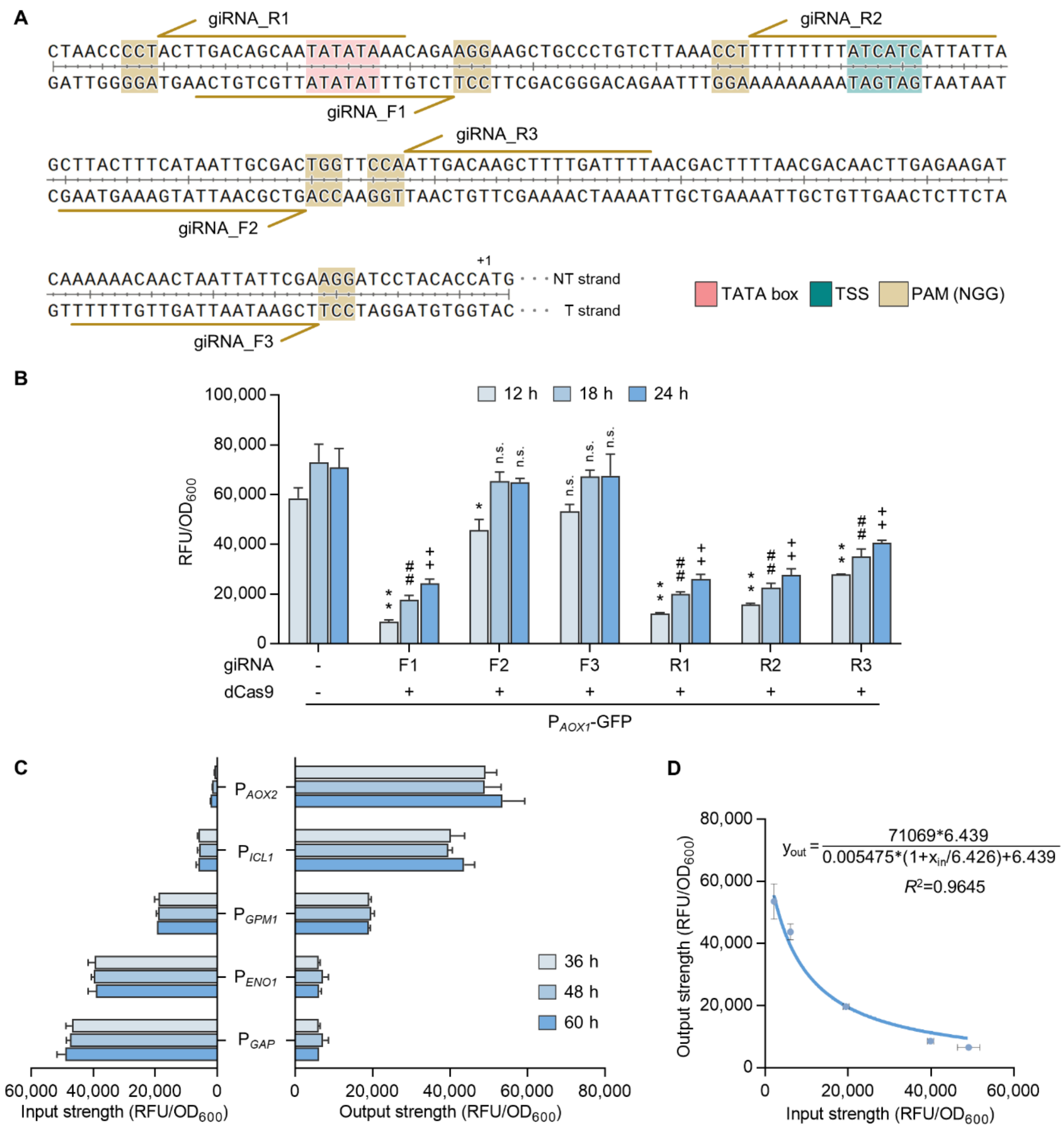


Fig. S2. The effect of CRISPRi system on the P_{AOX1} activity in *P. pastoris* and the regulation model of CRISPRiD.

(A) Design of giRNAs directed to the cP_{AOX1}. Yellow arrows indicate target sites of each giRNA. The sequences of TATA box, transcription start site (TSS) and 5'-NGG-3' protospacer-adjacent motif (PAM) are highlighted; (B) Effects of different giRNAs on P_{AOX1} activity. Statistical significance of eGFP intensity of each strain with various giRNAs relative to the parent strain without giRNA and dCas9 is shown for each time point ($^{**}P < 0.01$, $^{*}P < 0.05$ at 12 h; $^{\#\#}P < 0.01$, $^{\#}P < 0.05$ at 18 h; $^{++}P < 0.01$, $^{+}P < 0.05$ at 24 h; n.s., not significance). (C) The input and output strength of CRISPRiD-iTSAD tandem system at different time points. (D) The regression curve of the relationship between the input signals and output signals. Data of output strength (y_{out}) and input strength (x_{in}) were fitted according to the equation of a competitive enzyme-inhibition model.

The regression coefficient R^2 was obtained as 0.9645, representing that the dependence of input and output signals of CRISPRi-iTSAD tandem system followed the competitive inhibition model.

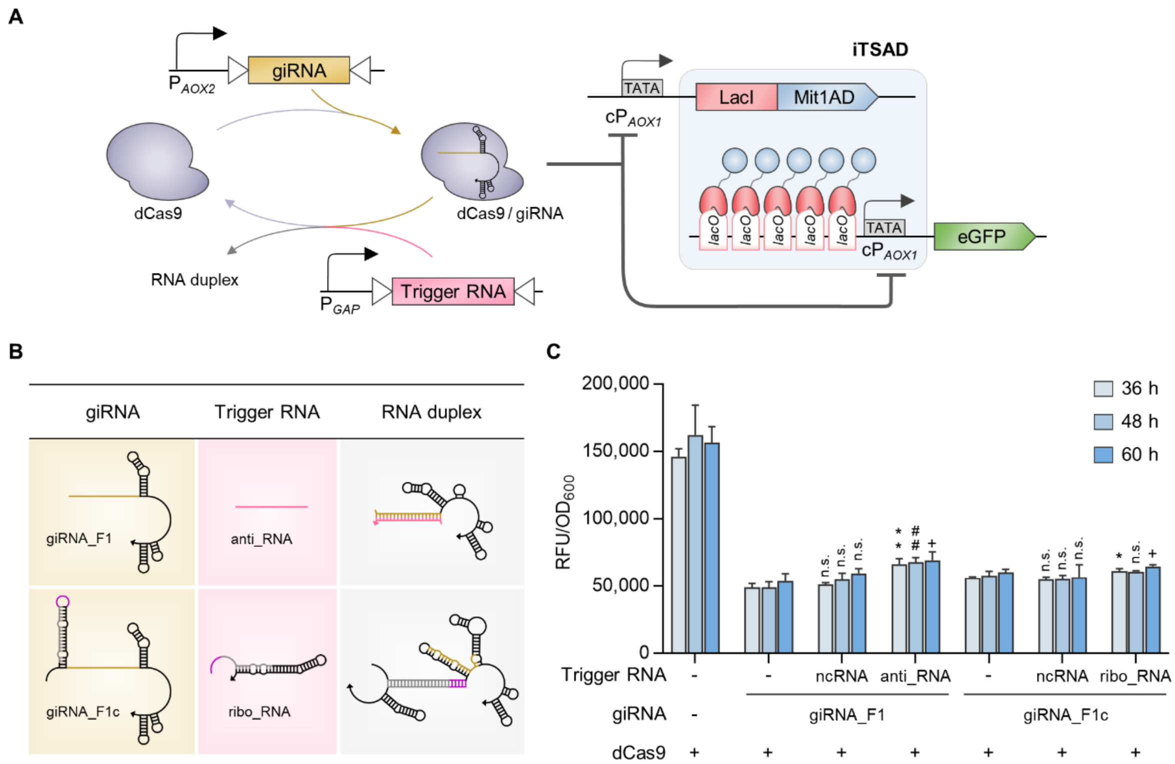
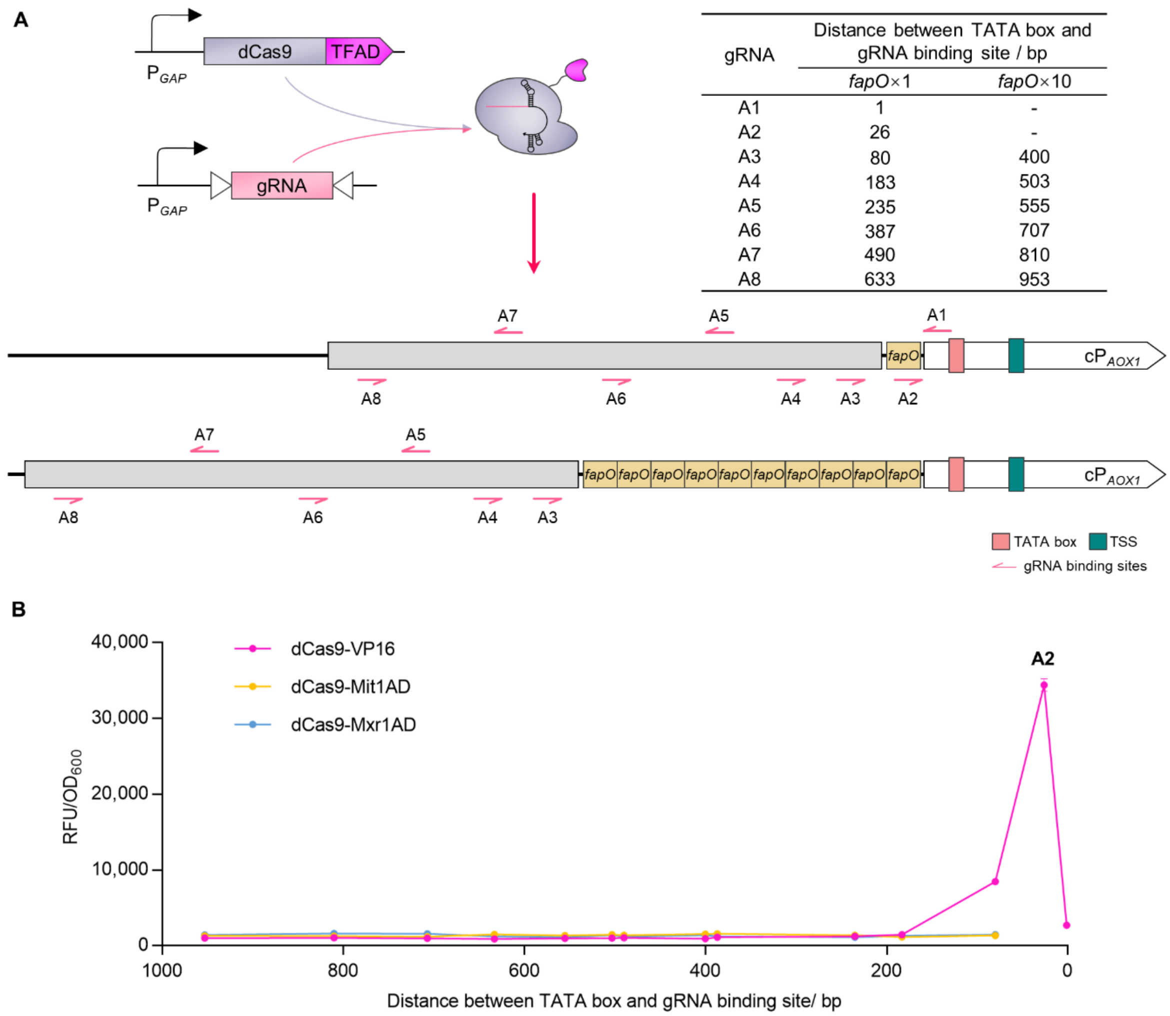


Fig. S3. Design of trigger RNAs and their derepression effects on CRISPRiD.

(A) Schematic diagram of trigger RNA mediated interference of CRISPRiD repression. Trigger RNA can form a duplex with giRNA, which will interfere with the repression effect of dCas9/giRNA on the iTSAD. The trigger RNA and giRNA were driven by P_{GAP} and P_{AOX2}, respectively. (B) Design of trigger RNAs and secondary structure predictions for the duplex of trigger RNA and giRNA. The anti_RNA was designed to fully complement DNA-targeting region of giRNA_F1. The ribo_RNA was designed to bind with giRNA_F1c which added a *cis*-hairpin structure at 5'end of giRNA_F1. (C) Derepression effect on CRISPRiD by interaction of trigger RNA with giRNA. The ncRNA refers to a short RNA without any interaction region with giRNA_F1 and giRNA_F1c. Statistical significance of eGFP intensity of each strain with anti_RNA and ribo_RNA relative to the parent strain without trigger RNA is shown for each time point (**$P < 0.01$, $^{*}P < 0.05$ at 36 h; ##P < 0.01 at 48 h; +P < 0.05 at 60 h; n.s., not significance).



gRNA	Distance between TATA box and gRNA binding site / bp	
	fapO×1	*fapO*×10
A1	1	-
A2	26	-
A3	80	400
A4	183	503
A5	235	555
A6	387	707
A7	490	810
A8	633	953

Fig. S4. The activation effect of CRISPRa system on the cP$_{AOX1}$ activity in *P. pastoris*.

(A) Schematic diagram showing the position of designed gRNAs targeting upstream sequences of cP$_{AOX1}$. The chimeric activator dCas9-TFAD was combined with various gRNAs to activate cP$_{AOX1}$. A series of gRNA binding sites with PAM sequence (5'-NGG-3') were selected upstream of the TATA box of cP$_{AOX1}$. Bacterial *fapO* motifs (one or ten) were inserted before cP$_{AOX1}$ to adjust the gap length between TATA box and gRNA binding site. (B) Effect of distance between gRNA binding site and TATA box on the activation of cP$_{AOX1}$ by different chimeric activators. The viral activator VP16, *P. pastoris* endogenous Mit1AD and Mxr1AD were used as TFAD for fusion with dCas9, respectively. Then the eGFP intensity of the strains was measured after cultured for 48 h in YPD medium.

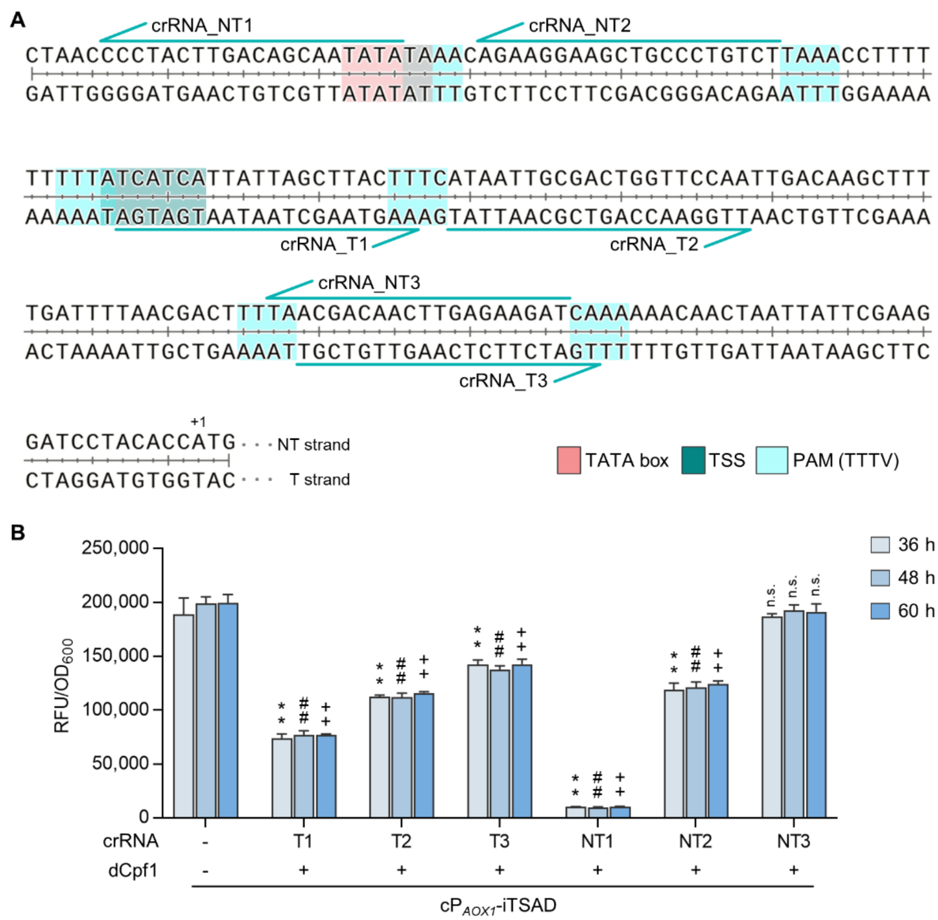


Fig. S5. Function verification of dCpf1 in *P. pastoris*.

(A) Design of crRNAs directed to the cP$_{AOX1}$ region. Cyan arrows indicate target sites of each crRNA. The sequence of TATA box, transcription start site (TSS) and 5'-TTTV-3' PAM are highlighted. (B) Repression effects of dCpf1 with different crRNAs on iTSAD driven by cP$_{AOX1}$. Statistical significance of eGFP intensity of each strain with various crRNAs relative to the parent strain without crRNA and dCpf1 is shown for each time point (**$P < 0.01$ at 36 h; ##$P < 0.01$ at 48 h; ++$P < 0.01$ at 60 h; n.s., not significance).

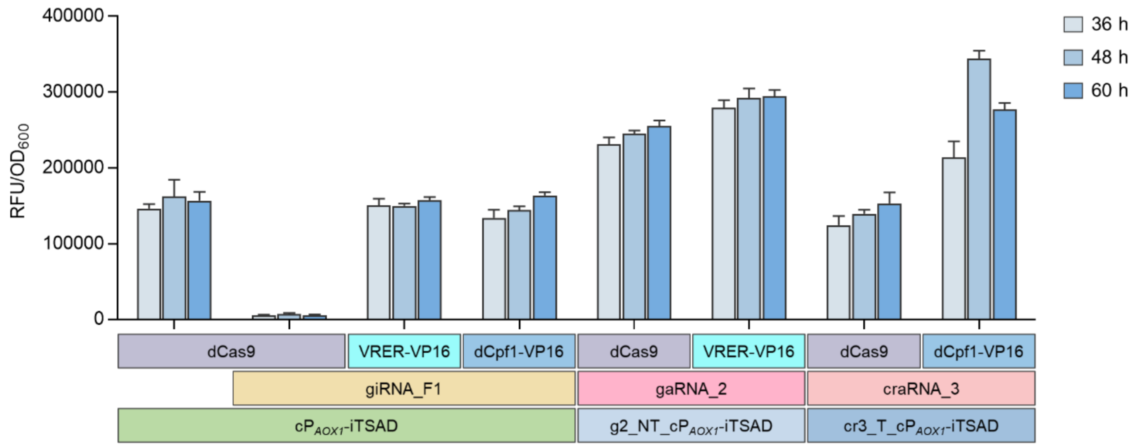


Fig. S6. Orthogonality of CRISPRiD and CRISPRaD.

Orthogonality of CRISPRiD and CRISPRaD. VRER-VP16 and dCpf1-VP16 were separately assembled into CRISPRiD instead of dCas9. The strain harboring iTSAD and dCas9 driven by cP_{AOX1} was used as control. The combination of giRNA_F1+VRER-VP16 or giRNA_F1+dCpf1-VP16 showed no effect on iTSAD driven by cP_{AOX1}. The dCas9 was assembled into CRISPRaD instead of VRER-VP16 or dCpf1-VP16, respectively. The corresponding CRISPRaD-iTSAD tandem systems (Fig. 4) were used as control. The combination of gaRNA_2+dCas9 had certain activation effect on iTSAD. In contrast, the dCas9 showed no effect on iTSAD with craRNA_3.

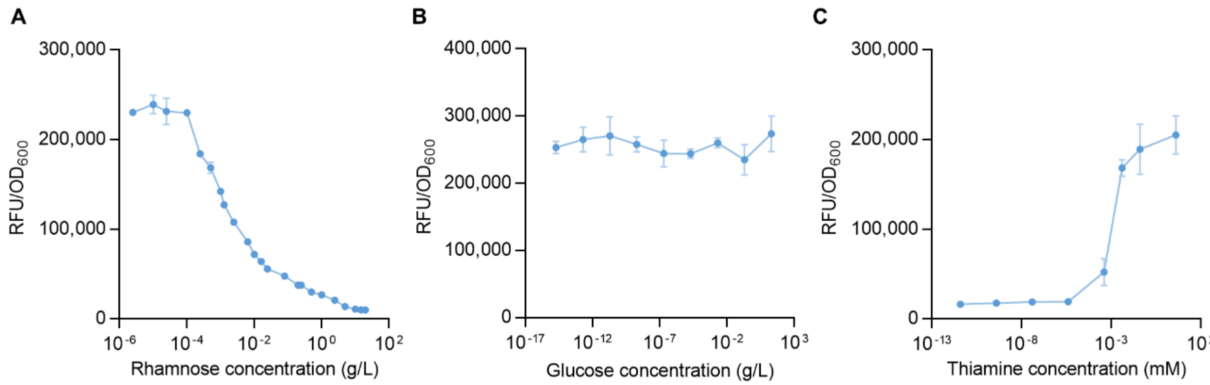


Fig. S7. Dose-response relationship of SynPic-X based regulatory switches.

(A) Dose-response curve describing the relationship between rhamnose concentration and output strength of SynPic-R. (B) Dose-response curve describing the relationship between glucose concentration and output strength of SynPic-M. (C) Dose-response curve describing the relationship between thiamine concentration and output strength of SynPic-T.

Table S1. The coding sequence of regulatory RNAs used in this study*

Name	Sequence
giRNA_F1	TGACAGCAATATATAAACAGAGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
giRNA_F2	CTTACTTTCATAATTGCGACGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
giRNA_F3	AAAAACAACTAATTATTCGAGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
giRNA_R1	TTTATATATTGCTGTCAAGTGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
giRNA_R2	AATAATGATGATAAAAAAAAGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
giRNA_R3	AAAATCAAAAGCTTGTCAATGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
giRNA_F1c	GATACTTTTCAGAGAGCAATATATATTGGGTTATATCTTGCTCTCAGAAATGACAGCAATATATAAACAGAGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
giRNA_F1m	TGACAGCAATATATAAACAGAGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGTCTGCTAGTAGCAGATATT
nc_RNA	GACCTGATACATCTCAGTCA
anti_RNA	TCTGTTTATATATTGCTGTCA
ribo_RNA	ACCCAATATATATTGCTCTCTGAAAATGGTGGTTAATGAAAATTAACTTACTATTTTCTGACAGCAAAGA
gRNA_A1	TGCTGTCAAGTAGGGGTTAGGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
gRNA_A2	ATTAGTACCTAGTCTTAATTGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
gRNA_A3	ATTGTGAAATAGACGCAGATGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
gRNA_A4	TGACATTAACCTATAAAAATGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
gRNA_A5	ACTTTTCGGGGAAATGTGCGGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
gRNA_A6	ATGCCGCAAAAAAGGGAATAGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
gRNA_A7	ATCGAACTGGATCTCAACAGGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
gRNA_A8	CATTCTGAGAATAGTGTATGGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
crRNA_NT1	AATTTCTACTAAGTGTAGATTATATTGCTGTCAAGTAGGG
crRNA_NT2	AATTTCTACTAAGTGTAGATAGACAGGGCAGCTTCCTTCT
crRNA_NT3	AATTTCTACTAAGTGTAGATATCTTCTCAAGTTGTCGTTA
crRNA_T1	AATTTCTACTAAGTGTAGATTCATCATTATTAGCTTACTT
crRNA_T2	AATTTCTACTAAGTGTAGATATAATTGCGACTGGTTCCAA
crRNA_T3	AATTTCTACTAAGTGTAGATACGACAACTTGAGAAGATCA
gaRNA_1	TCTGTTTATATATTGCTGTCAGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
gaRNA_2	TAGCTCTTAAAGTCTGTTTATGTTTTAGAGTCAGAAATGACAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
gaRNA_3	CGTCACCCAATATATATTGCTCTCTGAAAATGGTGGTTAATGAAAATTAACTTACTATTTTCTGACAGCAAAGAAATTGTGCTATCAGATCGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCAACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT

craRNA_1	AATTTCTACTAAGTGTAGAT	GCACAAACTCGGACCCACTT
craRNA_2	AATTTCTACTAAGTGTAGAT	ACTTTTTCACATTGATAACGGA
craRNA_3	AATTTCTACTAAGTGTAGAT	TTGATAACGGACTAGCCTTA

* Cas9 handle sequences are highlighted in green background and the different mutant bases are labeled in red. Cpf1 handle sequences are highlighted in yellow background. DNA targeting sequences are underlined.

Table S2. Plasmids and strains used in this study.

Plasmids	Characteristics	Source
pPIC3.5K	Ampicillin^R, G418^R; P_{AOX1}-based expression vector	Invitrogen
pGAPZ B	Zeocin^R; P_{GAP}-based expression vector	Invitrogen
pP-P_{AOX1}G	pPIC3.5k derivative containing P_{AOX1}-GFP cassette	(*21*)
pGZB_cP_{AOX1}-GFP	pGAPZ B derivative containing cP_{AOX1}-GFP cassette	(*62*)
pP-P_{GAP}G	pPIC3.5k derivative containing P_{GAP}-GFP cassette	(*30*)
pPcAG	pPIC3.5k derivative containing cP_{AOX1}-GFP cassette	This study
pPlacO1cAG	pPIC3.5k derivative containing *lacO1*-cP_{AOX1}-GFP cassette	This study
pParaO1cAG	pPIC3.5k derivative containing *araO1*-cP_{AOX1}-GFP cassette	This study
pParaO2cAG	pPIC3.5k derivative containing *araO2*-cP_{AOX1}-GFP cassette	This study
pParaIcAG	pPIC3.5k derivative containing *araI*-cP_{AOX1}-GFP cassette	This study
pPlacO1cDG	pPIC3.5k derivative containing *lacO1*-cP_{DAS1}-GFP cassette	This study
pPlacO1cGG	pPIC3.5k derivative containing *lacO1*-cP_{GAP}-GFP cassette	This study
pPlacO1cScGG	pPIC3.5k derivative containing *lacO1*-cP_{ScGAP}-GFP cassette	This study
pPlacO2cAG	pPIC3.5k derivative containing *lacO2*-cP_{AOX1}-GFP cassette	This study
pPlacO3cAG	pPIC3.5k derivative containing *lacO3*-cP_{AOX1}-GFP cassette	This study
pPlacO4cAG	pPIC3.5k derivative containing *lacO4*-cP_{AOX1}-GFP cassette	This study
pPlacO5cAG	pPIC3.5k derivative containing *lacO5*-cP_{AOX1}-GFP cassette	This study
pPlacO6cAG	pPIC3.5k derivative containing *lacO6*-cP_{AOX1}-GFP cassette	This study
pPlacO7cAG	pPIC3.5k derivative containing *lacO7*-cP_{AOX1}-GFP cassette	This study
pPlacO8cAG	pPIC3.5k derivative containing *lacO8*-cP_{AOX1}-GFP cassette	This study
pPlacO9cAG	pPIC3.5k derivative containing *lacO9*-cP_{AOX1}-GFP cassette	This study
pGP_{GAP}LacIP1AD	pGAPZ B derivative containing P_{GAP}-LacI-Prm1AD cassette	This study
pGP_{GAP}LacIX1AD	pGAPZ B derivative containing P_{GAP}-LacI-Mxr1AD cassette	This study
pGP_{GAP}LacIM1AD	pGAPZ B derivative containing P_{GAP}-LacI-Mit1AD cassette	This study
pGP_{GAP}AraCM1AD	pGAPZ B derivative containing P_{GAP}-AraC-Mit1AD cassette	This study
pGP_{AOX2}G	pGAPZ B derivative containing P_{AOX2}-GFP cassette	This study
pGP_{ICL1}G	pGAPZ B derivative containing P_{ICL1}-GFP cassette	This study
pGP_{GPM1}G	pGAPZ B derivative containing P_{GPM1}-GFP cassette	This study
pGP_{ENO1}G	pGAPZ B derivative containing P_{ENO1}-GFP cassette	This study
pGP_{GAP}G	pGAPZ B derivative containing P_{GAP}-GFP cassette	This study
pGcALacIM1AD	pGAPZ B derivative containing cP_{AOX1}-LacI-Mit1AD cassette	This study
pGP_{ICL1}LacIM1AD	pGAPZ B derivative containing P_{ICL1}-LacI-Mit1AD cassette	This study
pGP_{GPM1}LacIM1AD	pGAPZ B derivative containing P_{GPM1}-LacI-Mit1AD cassette	This study
pGP_{ENO1}LacIM1AD	pGAPZ B derivative containing P_{ENO1}-LacI-Mit1AD cassette	This study
pAG32	Ampicillin^R, hygromycin^R	(*66*)
p414-TEF1p-Cas9-CYC1t	Ampicillin^R, P_{TEF1}-Cas9 cassette	(*67*)

pGP$_{GAP}$dCas9	pGAPZ B derivative containing P$_{GAP}$-dCas9 cassette	This study
pAA	pAG32 derivative containing P$_{AOX1}$	This study
pAA-P$_{GAP}$giF1	pAA derivative containing P$_{GAP}$-HH-giF1-HDV cassette	This study
pAA-P$_{GAP}$giF2	pAA derivative containing P$_{GAP}$-HH-giF2-HDV cassette	This study
pAA-P$_{GAP}$giF3	pAA derivative containing P$_{GAP}$-HH-giF3-HDV cassette	This study
pAA-P$_{GAP}$giR1	pAA derivative containing P$_{GAP}$-HH-giR1-HDV cassette	This study
pAA-P$_{GAP}$giR2	pAA derivative containing P$_{GAP}$-HH-giR2-HDV cassette	This study
pAA-P$_{GAP}$giR3	pAA derivative containing P$_{GAP}$-HH-giR3-HDV cassette	This study
pPcALMO5	pPIC3.5k derivative containing cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pAA-P$_{GAP}$giR1R2	pAA derivative containing P$_{GAP}$-HH-giR1-HDV-HH-giR2-HDV cassette	This study
pAA-P$_{GAP}$giR1F1	pAA derivative containing P$_{GAP}$-HH-giR1-HDV-HH-giF1-HDV cassette	This study
pAA-P$_{GAP}$giR2 F1	pAA derivative containing P$_{GAP}$-HH-giR2-HDV-HH-giF1-HDV cassette	This study
pAA-P$_{AOX2}$giF1	pAA derivative containing P$_{AOX2}$-HH-giF1-HDV cassette	This study
pAA-P$_{ICL1}$giF1	pAA derivative containing P$_{ICL1}$-HH-giF1-HDV cassette	This study
pAA-P$_{GPM1}$giF1	pAA derivative containing P$_{GPM1}$-HH-giF1-HDV cassette	This study
pAA-P$_{ENO1}$giF1	pAA derivative containing P$_{ENO1}$-HH-giF1-HDV cassette	This study
pAA-P$_{GAP}$antiRNA	pAA derivative containing P$_{GAP}$-HH-antiRNA-HDV cassette	This study
pAA-P$_{GAP}$riboRNA	pAA derivative containing P$_{GAP}$-HH-riboRNA-HDV cassette	This study
pAA-P$_{GAP}$ncRNA	pAA derivative containing P$_{GAP}$-HH-ncRNA-HDV cassette	This study
pAA-P$_{GAP}$giF1c	pAA derivative containing P$_{GAP}$-HH-giF1c-HDV cassette	This study
pAA-P$_{AOX2}$giF1c	pAA derivative containing P$_{AOX2}$-HH-giF1c-HDV cassette	This study
pAA-P$_{GAP}$anti-P$_{AOX2}$giF1	pAA derivative containing P$_{GAP}$-HH-antiRNA-HDV and P$_{AOX2}$-HH-giF1-HDV cassette	This study
pAA-P$_{GAP}$ncRNA-P$_{AOX2}$giF1	pAA derivative containing P$_{GAP}$-HH-ncRNA-HDV and P$_{AOX2}$-HH-giF1-HDV cassette	This study
pAA-P$_{GAP}$ribo-P$_{AOX2}$giF1c	pAA derivative containing P$_{GAP}$-HH-riboRNA-HDV and P$_{AOX2}$-HH-giF1c-HDV cassette	This study
pAA-P$_{GAP}$ncRNA-P$_{AOX2}$giF1c	pAA derivative containing P$_{GAP}$-HH-ncRNA-HDV and P$_{AOX2}$-HH-giF1c-HDV cassette	This study
pGP$_{GAP}$dCas9VP16	pGAPZ B derivative containing P$_{GAP}$-dCas9VP16 cassette	This study
pGP$_{GAP}$dCas9M1AD	pGAPZ B derivative containing P$_{GAP}$-dCas9Mit1AD cassette	This study
pGP$_{GAP}$dCas9X1AD	pGAPZ B derivative containing P$_{GAP}$-dCas9Mxr1AD cassette	This study
pPfapO1cAG	pPIC3.5k derivative containing *fapO1*-cP$_{AOX1}$-GFP cassette	This study
pPfapO10cAG	pPIC3.5k derivative containing *fapO10*-cP$_{AOX1}$-GFP cassette	This study
pAA-P$_{GAP}$gA1	pAA derivative containing P$_{GAP}$-HH-gA1-HDV cassette	This study
pAA-P$_{GAP}$gA2	pAA derivative containing P$_{GAP}$-HH-gA2-HDV cassette	This study

pAA-P_{GAP}gA3	pAA derivative containing P_{GAP}-HH-gA3-HDV cassette	This study
pAA-P_{GAP}gA4	pAA derivative containing P_{GAP}-HH-gA4-HDV cassette	This study
pAA-P_{GAP}gA5	pAA derivative containing P_{GAP}-HH-gA5-HDV cassette	This study
pAA-P_{GAP}gA6	pAA derivative containing P_{GAP}-HH-gA6-HDV cassette	This study
pAA-P_{GAP}gA7	pAA derivative containing P_{GAP}-HH-gA7-HDV cassette	This study
pAA-P_{GAP}gA8	pAA derivative containing P_{GAP}-HH-gA8-HDV cassette	This study
pET28TEV-LbCpf1	Kanamycin^R; LbCas12a in pET28a	(*68*)
pGP$_{GAP}$dCpf1	pGAPZ B derivative containing P_{GAP}-dCpf1 cassette	This study
pAA-P_{GAP}2BbsHDV	pAA derivative containing P_{GAP}-2Bbs-HDV cassette	This study
pAA-P_{GAP}crRNADR2Bbs	pAA derivative containing P_{GAP}-HH-Cpf1DR-2Bbs-HDV cassette	This study
pAA-P_{GAP}crT1	pAA derivative containing P_{GAP}-HH-crT1-HDV cassette	This study
pAA-P_{GAP}crT2	pAA derivative containing P_{GAP}-HH-crT2-HDV cassette	This study
pAA-P_{GAP}crT3	pAA derivative containing P_{GAP}-HH-crT3-HDV cassette	This study
pAA-P_{GAP}crNT1	pAA derivative containing P_{GAP}-HH-crNT1-HDV cassette	This study
pAA-P_{GAP}crNT2	pAA derivative containing P_{GAP}-HH-crNT2-HDV cassette	This study
pAA-P_{GAP}crNT3	pAA derivative containing P_{GAP}-HH-crNT3-HDV cassette	This study
pAA-P_{GAP}ga1	pAA derivative containing P_{GAP}-HH-ga1-HDV cassette	This study
pAA-P_{GAP}ga2-2Bbs	pAA derivative containing P_{GAP}-ga2HH-2Bbs-HDV cassette	This study
pAA-P_{GAP}ga2	pAA derivative containing P_{GAP}-HH-ga2-HDV cassette	This study
pAA-P_{GAP}2BbsCashHDV	pAA derivative containing P_{GAP}-2Bbs-Cashandle-HDV cassette	This study
pAA-P_{GAP}ga3CashHDV	pAA derivative containing P_{GAP}-ga3HH-2Bbs-HDV cassette	This study
pAA-P_{GAP}ga3	pAA derivative containing P_{GAP}-HH-ga3-HDV cassette	This study
pAA-P_{AOX2}giF1-P_{GAP}ga1	pAA derivative containing P_{AOX2}-HH-giF1-HDV and P_{GAP}-HH-ga1-HDV cassette	This study
pAA-P_{AOX2}giF1-P_{GAP}ga2	pAA derivative containing P_{AOX2}-HH-giF1-HDV and P_{GAP}-HH-ga2-HDV cassette	This study
pAA-P_{AOX2}giF1c-P_{GAP}ga3	pAA derivative containing P_{AOX2}-HH-giF1c-HDV and P_{GAP}-HH-ga3-HDV cassette	This study
pAA-P_{GAP}cra1	pAA derivative containing P_{GAP}-HH-cra1-HDV cassette	This study
pAA-P_{GAP}cra2	pAA derivative containing P_{GAP}-HH-cra2-HDV cassette	This study
pAA-P_{GAP}cra3	pAA derivative containing P_{GAP}-HH-cra3-HDV cassette	This study
pAA-P_{GAP}giF1m-2Bbs	pAA derivative containing P_{GAP}-giF1mHH-2Bbs-HDV cassette	This study
pAA-P_{GAP}giF1m	pAA derivative containing P_{GAP}-HH-giF1m-HDV cassette	This study
pAA-P_{AOX2}giF1m	pAA derivative containing P_{AOX2}-HH-giF1m-HDV cassette	This study
pAA-P_{AOX2}giF1-P_{GAP}cra1	pAA derivative containing P_{AOX2}-HH-giF1-HDV and P_{GAP}-HH-cra1-HDV cassette	This study
pAA-P_{AOX2}giF1m-P_{GAP}cra2	pAA derivative containing P_{AOX2}-HH-giF1m-HDV and P_{GAP}-HH-cra2-HDV cassette	This study

pAA-P$_{AOX2}$giF1-P$_{GAP}$cra3	pAA derivative containing P$_{AOX2}$-HH-giF1-HDV and P$_{GAP}$-HH-cra3-HDV cassette	This study
pAA-P$_{AOX2}$giF1m-P$_{GAP}$ncRNA	pAA derivative containing P$_{AOX2}$-HH-giF1m-HDV and P$_{GAP}$-HH-ncRNA-HDV cassette	This study
pGP$_{GAP}$VRERVP16	pGAPZ B derivative containing P$_{GAP}$-VRER-VP16 cassette	This study
pGP$_{GAP}$dCpf1VP16	pGAPZ B derivative containing P$_{GAP}$-dCpf1-VP16 cassette	This study
pPg1cAG	pPIC3.5k derivative containing g1-cP$_{AOX1}$-GFP cassette	This study
pPg1rcAG	pPIC3.5k derivative containing g1r-cP$_{AOX1}$-GFP cassette	This study
pPg2cAG	pPIC3.5k derivative containing g2-cP$_{AOX1}$-GFP cassette	This study
pPg2rcAG	pPIC3.5k derivative containing g2r-cP$_{AOX1}$-GFP cassette	This study
pPg3cAG	pPIC3.5k derivative containing g3-cP$_{AOX1}$-GFP cassette	This study
pPg3rcAG	pPIC3.5k derivative containing g3r-cP$_{AOX1}$-GFP cassette	This study
pPcr1cAG	pPIC3.5k derivative containing cr1-cP$_{AOX1}$-GFP cassette	This study
pPcr1rcAG	pPIC3.5k derivative containing cr1r-cP$_{AOX1}$-GFP cassette	This study
pPcr2cAG	pPIC3.5k derivative containing cr2-cP$_{AOX1}$-GFP cassette	This study
pPcr2rcAG	pPIC3.5k derivative containing cr2r-cP$_{AOX1}$-GFP cassette	This study
pPcr3cAG	pPIC3.5k derivative containing cr3-cP$_{AOX1}$-GFP cassette	This study
pPcr3rcAG	pPIC3.5k derivative containing cr3r-cP$_{AOX1}$-GFP cassette	This study
pPg1cALM	pPIC3.5k derivative containing g1-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPg1rcALM	pPIC3.5k derivative containing g1r-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPg2cALM	pPIC3.5k derivative containing g2-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPg2rcALM	pPIC3.5k derivative containing g2r-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPg3cALM	pPIC3.5k derivative containing g3-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPg3rcALM	pPIC3.5k derivative containing g3r-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPcr1cALM	pPIC3.5k derivative containing cr1-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPcr1rcALM	pPIC3.5k derivative containing cr1r-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPcr2cALM	pPIC3.5k derivative containing cr2-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPcr2rcALM	pPIC3.5k derivative containing cr2r-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPcr3cALM	pPIC3.5k derivative containing cr3-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPcr3rcALM	pPIC3.5k derivative containing cr3r-cP$_{AOX1}$-LacI-Mit1AD cassette	This study
pPg1cALMO5	pPIC3.5k derivative containing g1-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pPg1rcALMO5	pPIC3.5k derivative containing g1r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study

pPg2cALMO5	pPIC3.5k derivative containing g2-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pPg2rcALMO5	pPIC3.5k derivative containing g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pPg3cALMO5	pPIC3.5k derivative containing g3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pPg3rcALMO5	pPIC3.5k derivative containing g3r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pPcr1cALMO5	pPIC3.5k derivative containing cr1-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pPcr1rcALMO5	pPIC3.5k derivative containing cr1r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pPcr2cALMO5	pPIC3.5k derivative containing cr2-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pPcr2rcALMO5	pPIC3.5k derivative containing cr2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pPcr3cALMO5	pPIC3.5k derivative containing cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
pPcr3rcALMO5	pPIC3.5k derivative containing cr3r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP cassette	This study
3.5k-TEF1-gRNA1	pPIC3.5k derivative containing P$_{HTX1}$-Cas9 and P$_{HTX1}$-HH-TEF1gRNA1-HDV cassette	(*32*)
pDTg1-npgA	pUC18 derivative containing TEF1g1UP-P$_{GAP}$-npgA-TEF1g1DOWN cassette	(*32*)
pDTg1GdCas9	pUC18 derivative containing TEF1g1UP-P$_{GAP}$-dCas9-TEF1g1DOWN cassette	This study
pAA-P$_{AOX2}$ga2	pAA derivative containing P$_{AOX2}$-HH-ga2-HDV cassette	This study
pAA-P$_{ICL1}$ga2	pAA derivative containing P$_{ICL1}$-HH-ga2-HDV cassette	This study
pAA-P$_{GPM1}$ga2	pAA derivative containing P$_{GPM1}$-HH-ga2-HDV cassette	This study
pAA-P$_{ENO1}$ga2	pAA derivative containing P$_{ENO1}$-HH-ga2-HDV cassette	This study
pAA-P$_{AOX2}$giF1-P$_{ICL1}$ga2	pAA derivative containing P$_{AOX2}$-HH-giF1-HDV and P$_{ICL1}$-HH-ga2-HDV cassette	This study
pAA-P$_{AOX2}$giF1-P$_{GPM1}$ga2	pAA derivative containing P$_{AOX2}$-HH-giF1-HDV and P$_{GPM1}$-HH-ga2-HDV cassette	This study
pAA-P$_{AOX2}$giF1-P$_{ENO1}$ga2	pAA derivative containing P$_{AOX2}$-HH-giF1-HDV and P$_{ENO1}$-HH-ga2-HDV cassette	This study
pAA-P$_{ICL1}$giF1-P$_{AOX2}$ga2	pAA derivative containing P$_{ICL1}$-HH-giF1-HDV and P$_{AOX2}$-HH-ga2-HDV cassette	This study
pAA-P$_{ICL1}$giF1-P$_{GPM1}$ga2	pAA derivative containing P$_{ICL1}$-HH-giF1-HDV and P$_{GPM1}$-HH-ga2-HDV cassette	This study
pAA-P$_{ICL1}$giF1-P$_{ENO1}$ga2	pAA derivative containing P$_{ICL1}$-HH-giF1-HDV and P$_{ENO1}$-HH-ga2-HDV cassette	This study
pAA-P$_{ICL1}$giF1-P$_{GAP}$ga2	pAA derivative containing P$_{ICL1}$-HH-giF1-HDV and P$_{GAP}$-HH-ga2-HDV cassette	This study

pAA-P_{GPM1}giF1-P_{AOX2}ga2	pAA derivative containing P_{GPM1}-HH-giF1-HDV and P_{AOX2}-HH-ga2-HDV cassette	This study
pAA-P_{GPM1}giF1-P_{ICL1}ga2	pAA derivative containing P_{GPM1}-HH-giF1-HDV and P_{ICL1}-HH-ga2-HDV cassette	This study
pAA-P_{GPM1}giF1-P_{ENO1}ga2	pAA derivative containing P_{GPM1}-HH-giF1-HDV and P_{ENO1}-HH-ga2-HDV cassette	This study
pAA-P_{GPM1}giF1-P_{GAP}ga2	pAA derivative containing P_{GPM1}-HH-giF1-HDV and P_{GAP}-HH-ga2-HDV cassette	This study
pAA-P_{ENO1}giF1-P_{AOX2}ga2	pAA derivative containing P_{ENO1}-HH-giF1-HDV and P_{AOX2}-HH-ga2-HDV cassette	This study
pAA-P_{ENO1}giF1-P_{ICL1}ga2	pAA derivative containing P_{ENO1}-HH-giF1-HDV and P_{ICL1}-HH-ga2-HDV cassette	This study
pAA-P_{ENO1}giF1-P_{GPM1}ga2	pAA derivative containing P_{ENO1}-HH-giF1-HDV and P_{GPM1}-HH-ga2-HDV cassette	This study
pAA-P_{ENO1}giF1-P_{GAP}ga2	pAA derivative containing P_{ENO1}-HH-giF1-HDV and P_{GAP}-HH-ga2-HDV cassette	This study
pAA-P_{GAP}giF1-P_{AOX2}ga2	pAA derivative containing P_{GAP}-HH-giF1-HDV and P_{AOX2}-HH-ga2-HDV cassette	This study
pAA-P_{GAP}giF1-P_{ICL1}ga2	pAA derivative containing P_{GAP}-HH-giF1-HDV and P_{ICL1}-HH-ga2-HDV cassette	This study
pAA-P_{GAP}giF1-P_{GPM1}ga2	pAA derivative containing P_{GAP}-HH-giF1-HDV and P_{GPM1}-HH-ga2-HDV cassette	This study
pAA-P_{GAP}giF1-P_{ENO1}ga2	pAA derivative containing P_{GAP}-HH-giF1-HDV and P_{ENO1}-HH-ga2-HDV cassette	This study
pAA-P_{AOX2}cra3	pAA derivative containing P_{AOX2}-HH-cra3-HDV cassette	This study
pAA-P_{ICL1}cra3	pAA derivative containing P_{ICL1}-HH-cra3-HDV cassette	This study
pAA-P_{GPM1}cra3	pAA derivative containing P_{GPM1}-HH-cra3-HDV cassette	This study
pAA-P_{ENO1}cra3	pAA derivative containing P_{ENO1}-HH-cra3-HDV cassette	This study
pAA-P_{AOX2}giF1-P_{ICL1}cra3	pAA derivative containing P_{AOX2}-HH-giF1-HDV and P_{ICL1}-HH-cra3-HDV cassette	This study
pAA-P_{AOX2}giF1-P_{GPM1}cra3	pAA derivative containing P_{AOX2}-HH-giF1-HDV and P_{GPM1}-HH-cra3-HDV cassette	This study
pAA-P_{AOX2}giF1-P_{ENO1}cra3	pAA derivative containing P_{AOX2}-HH-giF1-HDV and P_{ENO1}-HH-cra3-HDV cassette	This study
pAA-P_{ICL1}giF1-P_{AOX2}cra3	pAA derivative containing P_{ICL1}-HH-giF1-HDV and P_{AOX2}-HH-cra3-HDV cassette	This study
pAA-P_{ICL1}giF1-P_{GPM1}cra3	pAA derivative containing P_{ICL1}-HH-giF1-HDV and P_{GPM1}-HH-cra3-HDV cassette	This study
pAA-P_{ICL1}giF1-P_{ENO1}cra3	pAA derivative containing P_{ICL1}-HH-giF1-HDV and P_{ENO1}-HH-cra3-HDV cassette	This study
pAA-P_{ICL1}giF1-P_{GAP}cra3	pAA derivative containing P_{ICL1}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV cassette	This study
pAA-P_{GPM1}giF1-P_{AOX2}cra3	pAA derivative containing P_{GPM1}-HH-giF1-HDV and P_{AOX2}-HH-cra3-HDV cassette	This study

pAA-P_{GPM1}giF1-P_{ICL1}cra3	pAA derivative containing P_{GPM1}-HH-giF1-HDV and P_{ICL1}-HH-cra3-HDV cassette	This study
pAA-P_{GPM1}giF1-P_{ENO1}cra3	pAA derivative containing P_{GPM1}-HH-giF1-HDV and P_{ENO1}-HH-cra3-HDV cassette	This study
pAA-P_{GPM1}giF1-P_{GAP}cra3	pAA derivative containing P_{GPM1}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV cassette	This study
pAA-P_{ENO1}giF1-P_{AOX2}cra3	pAA derivative containing P_{ENO1}-HH-giF1-HDV and P_{AOX2}-HH-cra3-HDV cassette	This study
pAA-P_{ENO1}giF1-P_{ICL1}cra3	pAA derivative containing P_{ENO1}-HH-giF1-HDV and P_{ICL1}-HH-cra3-HDV cassette	This study
pAA-P_{ENO1}giF1-P_{GPM1}cra3	pAA derivative containing P_{ENO1}-HH-giF1-HDV and P_{GPM1}-HH-cra3-HDV cassette	This study
pAA-P_{ENO1}giF1-P_{GAP}cra3	pAA derivative containing P_{ENO1}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV cassette	This study
pAA-P_{GAP}giF1-P_{AOX2}cra3	pAA derivative containing P_{GAP}-HH-giF1-HDV and P_{AOX2}-HH-cra3-HDV cassette	This study
pAA-P_{GAP}giF1-P_{ICL1}cra3	pAA derivative containing P_{GAP}-HH-giF1-HDV and P_{ICL1}-HH-cra3-HDV cassette	This study
pAA-P_{GAP}giF1-P_{GPM1}cra3	pAA derivative containing P_{GAP}-HH-giF1-HDV and P_{GPM1}-HH-cra3-HDV cassette	This study
pAA-P_{GAP}giF1-P_{ENO1}cra3	pAA derivative containing P_{GAP}-HH-giF1-HDV and P_{ENO1}-HH-cra3-HDV cassette	This study
pAA-P_{LRA3}giF1	pAA derivative containing P_{LRA3}-HH-giF1-HDV cassette	This study
pAA-P_{DAS1}giF1	pAA derivative containing P_{DAS1}-HH-giF1-HDV cassette	This study
pAA-P_{THI11}giF1	pAA derivative containing P_{THI11}-HH-giF1-HDV cassette	This study
pAA-P_{LRA3}giF1-P_{GAP}cra3	pAA derivative containing P_{LRA3}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV cassette	This study
pAA-P_{DAS1}giF1-P_{GAP}cra3	pAA derivative containing P_{DAS1}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV cassette	This study
pAA-P_{THI11}giF1-P_{GAP}cra3	pAA derivative containing P_{THI11}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV cassette	This study
BB3eN_14	Nourseothricin^R	Golden
pPIC9K-Amy	pPIC9K derivative containing P_{AOX1}-Amy expression cassette	(*69*)
pPlacO5cAAmy	pPIC3.5k derivative containing *lacO5*-cP_{AOX1}-Amy cassette	This study
BB3eN-lacO5cAAmy	BB3eN_14 derivative containing *lacO5*-cP_{AOX1}-Amy cassette	This study
Strain	**Genotype**	**Source**
Escherichia coli		
Top 10	F^-[*lacI*^{q} Tn*10* (Tet^r)] *mcrA* Φ80*lacZ* ΔM15 Δ*lac X74 deoR recA1*	Invitrogen
Saccharomyces cerevisiae		
BY4741	*MATα; his3Δ1; leu2Δ0; met15Δ0; ura3Δ0*	(*41*)
Pichia pastoris		
GS115	*his4*	Invitrogen

GS_P_{AOX1}-G	GS115 *his4*::pP-P_{AOX1}G (P_{AOX1}-GFP *HIS4, KAN*)	(*21*)
GS_*O1cA*-G	GS115 *his4*::pPlacO1cAG (*lacO1*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-LP_*O1cA*-G	GS115 *his4*::pPlacO1cAG (*lacO1*-cP_{AOX1}-GFP *HIS4*) P_{GAP}::pGP$_{GAP}$LacIP1AD (P_{GAP}-LacI-Prm1AD *Sh ble*)	This study
GS_P_{GAP}-LX_*O1cA*-G	GS115 *his4*::pPlacO1cAG (*lacO1*-cP_{AOX1}-GFP *HIS4*) P_{GAP}::pGP$_{GAP}$LacIX1AD (P_{GAP}-LacI-Mxr1AD *Sh ble*)	This study
GS_P_{GAP}-LM_*O1cA*-G	GS115 *his4*::pPlacO1cAG (*lacO1*-cP_{AOX1}-GFP *HIS4*) P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*)	This study
GS_P_{GAP}-CM	GS115 P_{GAP}::pGP$_{GAP}$AraCM1AD (P_{GAP}- AraC-Mit1AD *Sh ble*)	This study
GS_P_{GAP}-CM_*aO1cA*-G	GS115 P_{GAP}::pGP$_{GAP}$AraCM1AD (P_{GAP}-AraC-Mit1AD *Sh ble*) *his4*::pParaO1cAG (*araO1*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-CM_*aO2cA*-G	GS115 P_{GAP}::pGP$_{GAP}$AraCM1AD (P_{GAP}-AraC-Mit1AD *Sh ble*) *his4*::pParaO2cAG (*araO2*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-CM_*aIcA*-G	GS115 P_{GAP}::pGP$_{GAP}$AraCM1AD (P_{GAP}-AraC-Mit1AD *Sh ble*) *his4*::pParaIcAG (*araI*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-LM	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}- LacI-Mit1AD *Sh ble*)	This study
GS_P_{GAP}-LM_*O1cD*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*) *his4*::pPlacO1cDG (*lacO1*-cP_{DAS1}-GFP *HIS4*)	This study
GS_P_{GAP}-LM_*O1cG*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*) *his4*::pPlacO1cGG (*lacO1*-cP_{GAP}-GFP *HIS4*)	This study
GS_P_{GAP}-LM_*O1cScG*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*) *his4*::pPlacO1cScGG (*lacO1*-cP_{ScGAP}-GFP *HIS4*)	This study
GS_P_{GAP}-LM_*O2cA*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*) *his4*::pPlacO2cAG (*lacO2*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-LM_*O3cA*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*) *his4*::pPlacO3cAG (*lacO3*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-LM_*O4cA*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*) *his4*::pPlacO4cAG (*lacO4*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-LM_*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*) *his4*::pPlacO5cAG (*lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-LM_*O6cA*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*) *his4*::pPlacO6cAG (*lacO6*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-LM_*O7cA*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*) *his4*::pPlacO7cAG (*lacO7*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-LM_*O8cA*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}-LacI-Mit1AD *Sh ble*) *his4*::pPlacO8cAG (*lacO8*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-LM_*O9cA*-G	GS115 P_{GAP}::pGP$_{GAP}$LacIM1AD (P_{GAP}- LacI-Mit1AD *Sh ble*) *his4*::pPlacO9cAG (*lacO9*-cP_{AOX1}-GFP *HIS4*)	This study
GS_*cA*-G	GS115 *his4*::pPcAG (cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{AOX2}-G	GS115 P_{GAP}::pGP$_{AOX2}$G (P_{AOX2}-GFP *Sh ble*)	This study
GS_P_{ICL1}-G	GS115 P_{GAP}::pGP$_{ICL1}$G (P_{ICL1}-GFP *Sh ble*)	This study
GS_P_{GPM1}-G	GS115 P_{GAP}::pGP$_{GPM1}$G (P_{GPM1}-GFP *Sh ble*)	This study
GS_P_{ENO1}-G	GS115 P_{GAP}::pGP$_{ENO1}$G (P_{ENO1}-GFP *Sh ble*)	This study

GS_P$_{GAP}$-G	GS115 P$_{GAP}$::pGP$_{GAP}$G (P$_{GAP}$-GFP *Sh ble*)	This study
GS_*O5cA*-G	GS115 *his4*::pPlacO5cAG (*lacO5*-cP$_{AOX1}$-GFP *HIS4*)	This study
GS_*cA*-LM_*O5cA*-G	GS115 *his4*::pPlacO5cAG (*lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{GAP}$::pGcALacIM1AD (cP$_{AOX1}$-LacI-Mit1AD *Sh ble*)	This study
GS_P$_{ICL1}$-LM_*O5cA*-G	GS115 *his4*::pPlacO5cAG (*lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{GAP}$::pGP$_{ICL1}$LacIM1AD (P$_{ICL1}$-LacI-Mit1AD *Sh ble*)	This study
GS_P$_{GPM1}$-LM_*O5cA*-G	GS115 *his4*::pPlacO5cAG (*lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{GAP}$::pGP$_{GPM1}$LacIM1AD (P$_{GPM1}$-LacI-Mit1AD *Sh ble*)	This study
GS_P$_{ENO1}$-LM_*O5cA*-G	GS115 *his4*::pPlacO5cAG (*lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{GAP}$::pGP$_{ENO1}$LacIM1AD (P$_{ENO1}$-LacI-Mit1AD *Sh ble*)	This study
GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9	GS115 *his4*::pP-P$_{AOX1}$G (P$_{AOX1}$-GFP *HIS4, KAN*) P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*)	This study
GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9_P$_{GAP}$-giF1	GS115 *his4*::pP-P$_{AOX1}$G (P$_{AOX1}$-GFP *HIS4, KAN*) P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) P$_{AOX1}$::pAA-P$_{GAP}$giF1 (P$_{GAP}$-HH-giF1-HDV *hph*)	This study
GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9 _P$_{GAP}$-giF2	GS115 *his4*::pP-P$_{AOX1}$G (P$_{AOX1}$-GFP *HIS4, KAN*) P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) P$_{AOX1}$::pAA-P$_{GAP}$giF2 (P$_{GAP}$-HH-giF2-HDV *hph*)	This study
GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9_P$_{GAP}$-giF3	GS115 *his4*::pP-P$_{AOX1}$G (P$_{AOX1}$-GFP *HIS4, KAN*) P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) P$_{AOX1}$::pAA-P$_{GAP}$giF3 (P$_{GAP}$-HH-giF3-HDV *hph*)	This study
GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9_P$_{GAP}$-giR1	GS115 *his4*::pP-P$_{AOX1}$G (P$_{AOX1}$-GFP *HIS4, KAN*) P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) P$_{AOX1}$::pAA-P$_{GAP}$giR1 (P$_{GAP}$-HH-giR1-HDV *hph*)	This study
GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9_P$_{GAP}$-giR2	GS115 *his4*::pP-P$_{AOX1}$G (P$_{AOX1}$-GFP *HIS4, KAN*) P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) P$_{AOX1}$::pAA-P$_{GAP}$giR2 (P$_{GAP}$-HH-giR2-HDV *hph*)	This study
GS_P$_{AOX1}$-G_P$_{GAP}$-dCas9_P$_{GAP}$-giR3	GS115 *his4*::pP-P$_{AOX1}$G (P$_{AOX1}$-GFP *HIS4, KAN*) P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) P$_{AOX1}$::pAA-P$_{GAP}$giR3 (P$_{GAP}$-HH-giR3-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-giF1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$giF1 (P$_{GAP}$-HH-giF1-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-giR1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$giR1 (P$_{GAP}$-HH-giR1-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-giR2	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$giR2 (P$_{GAP}$-HH-giR2-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-giR1R2	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$giR1R2 (P$_{GAP}$-HH-giR1-HDV-HH-giR2-	This study

	HDV *hph*)	
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-giR1F1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$giR1F1 (P$_{GAP}$-HH-giR1-HDV-HH-giF1-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-giR2F1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$giR2F1 (P$_{GAP}$-HH-giR2-HDV-HH-giF1-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{AOX2}$-giF1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{AOX2}$giF1 (P$_{AOX2}$-HH-giF1-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{ICL1}$-giF1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ICL1}$giF1 (P$_{ICL1}$-HH-giF1-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GPM1}$-giF1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GPM1}$giF1 (P$_{GPM1}$-HH-giF1-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{ENO1}$-giF1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ENO1}$giF1 (P$_{ENO1}$-HH-giF1-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-giF1c	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$giF1c (P$_{GAP}$-giF1c-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{AOX2}$-giF1c	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{AOX2}$giF1c (P$_{AOX2}$-giF1c-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-anti-P$_{AOX2}$-giF1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-Ganti-P$_{AOX2}$giF1 (P$_{GAP}$-HH-antiRNA-HDV and P$_{AOX2}$-HH-giF1-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-nc-P$_{AOX2}$-giF1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$nc-P$_{AOX2}$giF1 (P$_{GAP}$-HH-ncRNA-HDV and P$_{AOX2}$-HH-giF1-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-ribo-P$_{AOX2}$-giF1c	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-Gribo-P$_{AOX2}$giF1c (P$_{GAP}$-HH-riboRNA-HDV and P$_{AOX2}$-HH-giF1c-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9_*cA*-LM-*O5cA*-G_P$_{GAP}$-nc-P$_{AOX2}$-giF1c	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$nc-P$_{AOX2}$giF1c (P$_{GAP}$-HH-ncRNA-HDV and P$_{AOX2}$-HH-giF1c-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9VP16	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9VP16 (P$_{GAP}$-dCas9 *Sh ble*)	This study
GS_P$_{GAP}$-dCas9M1AD	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9M1AD (P$_{GAP}$-dCas9 *Sh ble*)	This study
GS_P$_{GAP}$-dCas9X1AD	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9X1AD (P$_{GAP}$-dCas9 *Sh ble*)	This study

GS_P_{GAP}-dCas9VP16_*fO1cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCas9VP16_*fO1cA*-G_P_{GAP}-gA1	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA1 (P_{GAP}-HH-gA1-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO1cA*-G_P_{GAP}-gA2	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA2 (P_{GAP}-HH-gA2-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO1cA*-G_P_{GAP}-gA3	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA3 (P_{GAP}-HH-gA3-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO1cA*-G_P_{GAP}-gA4	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA4 (P_{GAP}-HH-gA4-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO1cA*-G_P_{GAP}-gA5	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA5 (P_{GAP}-HH-gA5-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO1cA*-G_P_{GAP}-gA6	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA6 (P_{GAP}-HH-gA6-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO1cA*-G_P_{GAP}-gA7	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA7 (P_{GAP}-HH-gA7-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO1cA*-G_P_{GAP}-gA8	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA8 (P_{GAP}-HH-gA8-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO10cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCas9VP16_*fO10cA*-G_P_{GAP}-gA3	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA3 (P_{GAP}-HH-gA3-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO10cA*-G_P_{GAP}-gA4	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA4 (P_{GAP}-HH-gA4-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO10cA*-G_P_{GAP}-gA5	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA5 (P_{GAP}-HH-gA5-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO10cA*-G_P_{GAP}-gA6	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA6 (P_{GAP}-HH-gA6-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO10cA*-G_P_{GAP}-gA7	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA7 (P_{GAP}-HH-gA7-HDV *hph*)	This study
GS_P_{GAP}-dCas9VP16_*fO10cA*-G_P_{GAP}-gA8	GS115 P_{GAP}::pGP$_{GAP}$dCas9VP16 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA8 (P_{GAP}-HH-gA8-HDV *hph*)	This study

GS_P_{GAP}-dCas9M1AD_*fO1cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCas9M1AD_*fO1cA*-G_P_{GAP}-gA3	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA3 (P_{GAP}-HH-gA3-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO1cA*-G_P_{GAP}-gA4	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA4 (P_{GAP}-HH-gA4-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO1cA*-G_P_{GAP}-gA5	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA5 (P_{GAP}-HH-gA5-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO1cA*-G_P_{GAP}-gA6	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA6 (P_{GAP}-HH-gA6-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO1cA*-G_P_{GAP}-gA7	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA7 (P_{GAP}-HH-gA7-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO1cA*-G_P_{GAP}-gA8	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA8 (P_{GAP}-HH-gA8-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO10cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCas9M1AD_*fO10cA*-G_P_{GAP}-gA3	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA3 (P_{GAP}-HH-gA3-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO10cA*-G_P_{GAP}-gA4	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA4 (P_{GAP}-HH-gA4-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO10cA*-G_P_{GAP}-gA5	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA5 (P_{GAP}-HH-gA5-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO10cA*-G_P_{GAP}-gA6	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA6 (P_{GAP}-HH-gA6-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO10cA*-G_P_{GAP}-gA7	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA7 (P_{GAP}-HH-gA7-HDV *hph*)	This study
GS_P_{GAP}-dCas9M1AD_*fO10cA*-G_P_{GAP}-gA8	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mit1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA8 (P_{GAP}-HH-gA8-HDV *hph*)	This study
GS_P_{GAP}-dCas9X1AD_*fO1cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mxr1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCas9X1AD_*fO1cA*-G_P_{GAP}-gA3	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mxr1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}gA3 (P_{GAP}-HH-gA3-HDV *hph*)	This study
GS_P_{GAP}-dCas9X1AD_*fO1cA*-	GS115 P_{GAP}::pGP$_{GAP}$dCas9Mxr1AD (P_{GAP}-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-	This study

G_P$_{GAP}$-gA4	P$_{GAP}$gA4 (P$_{GAP}$-HH-gA4-HDV *hph*)	
GS_P$_{GAP}$-dCas9X1AD_*fO1cA*-G_P$_{GAP}$-gA5	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$gA5 (P$_{GAP}$-HH-gA5-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9X1AD_*fO1cA*-G_P$_{GAP}$-gA6	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$gA6 (P$_{GAP}$-HH-gA6-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9X1AD_*fO1cA*-G_P$_{GAP}$-gA7	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$gA7 (P$_{GAP}$-HH-gA7-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9X1AD_*fO1cA*-G_P$_{GAP}$-gA8	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO1cAG (*fapO1*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$gA8 (P$_{GAP}$-HH-gA8-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9X1AD_*fO10cA*-G	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP$_{AOX1}$-GFP *HIS4*)	This study
GS_P$_{GAP}$-dCas9X1AD_*fO10cA*-G_P$_{GAP}$-gA3	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$gA3 (P$_{GAP}$-HH-gA3-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9X1AD_*fO10cA*-G_P$_{GAP}$-gA4	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$gA4 (P$_{GAP}$-HH-gA4-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9X1AD_*fO10cA*-G_P$_{GAP}$-gA5	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$gA5 (P$_{GAP}$-HH-gA5-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9X1AD_*fO10cA*-G_P$_{GAP}$-gA6	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$gA6 (P$_{GAP}$-HH-gA6-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9X1AD_*fO10cA*-G_P$_{GAP}$-gA7	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$gA7 (P$_{GAP}$-HH-gA7-HDV *hph*)	This study
GS_P$_{GAP}$-dCas9X1AD_*fO10cA*-G_P$_{GAP}$-gA8	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9Mxr1AD (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPfapO10cAG (*fapO10*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$gA8 (P$_{GAP}$-HH-gA8-HDV *hph*)	This study
GS_*cA*-LM-*O5cA*-G	GS115 *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*)	This study
GS_*cA*-LM-*O5cA*-G_P$_{GAP}$-dCpf1	GS115 *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{GAP}$::pGP$_{GAP}$dCpf1 (P$_{GAP}$-dCpf1 *Sh ble*)	This study
GS_*cA*-LM-*O5cA*-G_P$_{GAP}$-dCpf1_P$_{GAP}$-crNT1	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$crNT1 (P$_{GAP}$-HH-crNT1-HDV *hph*)	This study
GS_*cA*-LM-*O5cA*-G_P$_{GAP}$-dCpf1_P$_{GAP}$-crNT2	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$crNT2 (P$_{GAP}$-HH-crNT2-HDV *hph*)	This study
GS_*cA*-LM-*O5cA*-G_ P$_{GAP}$-dCpf1_P$_{GAP}$-crNT3	GS115 P$_{GAP}$::pGP$_{GAP}$dCas9 (P$_{GAP}$-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GAP}$crNT3 (P$_{GAP}$-HH-crNT3-HDV *hph*)	This study

GS_*cA*-LM-*O5cA*-G_ P_{GAP}-dCpf1_P_{GAP}-crT1	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}crT1 (P_{GAP}-HH-crT1-HDV *hph*)	This study
GS_*cA*-LM-*O5cA*-G_ P_{GAP}-dCpf1_P_{GAP}-crT2	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}crT2 (P_{GAP}-HH-crT2-HDV *hph*)	This study
GS_*cA*-LM-*O5cA*-G_ P_{GAP}-dCpf1_P_{GAP}-crT3	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}crT3 (P_{GAP}-HH-crT3-HDV *hph*)	This study
GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G_P_{GAP}-ga1-P_{AOX2}-giF1	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1-P_{GAP}ga1 (P_{AOX2}-HH-giF1-HDV and P_{GAP}-HH-ga1-HDV *hph*)	This study
GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G_P_{GAP}-ga2-P_{AOX2}-giF1	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1-P_{GAP}ga2 (P_{AOX2}-HH-giF1-HDV and P_{GAP}-HH-ga2-HDV *hph*)	This study
GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G_P_{GAP}-ga3-P_{AOX2}-giF1c	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1c-P_{GAP}ga3 (P_{AOX2}-HH-giF1c-HDV and P_{GAP}-HH-ga3-HDV *hph*)	This study
GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G_P_{GAP}-giF1m	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}giF1m (P_{GAP}-HH-giF1m-HDV *hph*)	This study
GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G_P_{AOX2}-giF1m	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1m (P_{AOX2}-HH-giF1m-HDV *hph*)	This study
GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G_P_{GAP}-cra1-P_{AOX2}-giF1	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1-P_{GAP}cra1 (P_{AOX2}-HH-giF1-HDV and P_{GAP}-HH-cra1-HDV *hph*)	This study
GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G_P_{GAP}-cra2-P_{AOX2}-giF1m	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1m-P_{GAP}cra2 (P_{AOX2}-HH-giF1m-HDV and P_{GAP}-HH-cra2-HDV *hph*)	This study
GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G_P_{GAP}-cra3-P_{AOX2}-giF1	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1-P_{GAP}cra3 (P_{AOX2}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV *hph*)	This study
GS_P_{GAP}-dCas9_*cA*-LM-*O5cA*-G_P_{GAP}-ncRNA-P_{AOX2}-giF1m	GS115 P_{GAP}::pGP$_{GAP}$dCas9 (P_{GAP}-dCas9 *Sh ble*) *his4*::pPcALMO5 (cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1m-P_{GAP}ncRNA (P_{AOX2}-HH-giF1m-HDV and P_{GAP}-HH-ncRNA-HDV *hph*)	This study
GS_P_{GAP}-VRERVP16	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga1	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga1 (P_{GAP}-HH-ga1-HDV *hph*)	This study
GS_P_{GAP}-VRERVP16_	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*)	This study

P_{GAP}-ga2	P_{AOX1}::pAA-P_{GAP}ga2 (P_{GAP}-HH-ga2-HDV *hph*)	
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga3	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga3 (P_{GAP}-HH-ga3-HDV *hph*)	This study
GS_P_{GAP}-dCpf1VP16	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra1	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra1 (P_{GAP}-HH-cra1-HDV *hph*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra2	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra2 (P_{GAP}-HH-cra2-HDV *hph*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra3	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra3 (P_{GAP}-HH-cra3-HDV *hph*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga1_*g1cA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga1 (P_{GAP}-HH-ga1-HDV *hph*) *his4*:: pPg1cAG (g1-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga1_*g1rcA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga1 (P_{GAP}-HH-ga1-HDV *hph*) *his4*:: pPg1rcAG (g1r-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga2_*g2cA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga2 (P_{GAP}-HH-ga2-HDV *hph*) *his4*:: pPg2cAG (g2-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga2_*g2rcA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga2 (P_{GAP}-HH-ga2-HDV *hph*) *his4*:: pPg2rcAG (g2r-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga3_*g3cA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga3 (P_{GAP}-HH-ga3-HDV *hph*) *his4*:: pPg3cAG (g3-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga3_*g3rcA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga3 (P_{GAP}-HH-ga3-HDV *hph*) *his4*:: pPg3rcAG (g3r-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra1_*cr1cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra1 (P_{GAP}-HH-cra1-HDV *hph*) *his4*:: pPcr1cAG (cr1-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra1_*cr1rcA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra1 (P_{GAP}-HH-cra1-HDV *hph*) *his4*:: pPcr1rcAG (cr1r-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra2_*cr2cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra2 (P_{GAP}-HH-cra2-HDV *hph*) *his4*:: pPcr2cAG (cr2-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra2_*cr2rcA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra2 (P_{GAP}-HH-cra2-HDV *hph*) *his4*:: pPcr2rcAG (cr2r-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra3_*cr3cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra3 (P_{GAP}-HH-cra3-HDV *hph*) *his4*:: pPcr3cAG (cr3-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra3_*cr3rcA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra3 (P_{GAP}-HH-cra3-HDV *hph*) *his4*:: pPcr3rcAG (cr3r-cP_{AOX1}-GFP *HIS4*)	This study

GS_P_{GAP}-VRERVP16_ P_{GAP}-ga1_*g1cA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga1 (P_{GAP}-HH-ga1-HDV *hph*) *his4*::pPg1cALMO5 (g1-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga1_*g1rcA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga1 (P_{GAP}-HH-ga1-HDV *hph*) *his4*::pPg1rcALMO5 (g1r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga2_*g2cA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga2 (P_{GAP}-HH-ga2-HDV *hph*) *his4*::pPg2cALMO5 (g2-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga2_*g2rcA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga2 (P_{GAP}-HH-ga2-HDV *hph*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga3_*g3cA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga3 (P_{GAP}-HH-ga3-HDV *hph*) *his4*::pPg3cALMO5 (g3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-VRERVP16_ P_{GAP}-ga3_*g3rcA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$VRERVP16 (P_{GAP}-VRER-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}ga3 (P_{GAP}-HH-ga3-HDV *hph*) *his4*::pPg3rcALMO5 (g3r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra1_*cr1cA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra1 (P_{GAP}-HH-cra1-HDV *hph*) *his4*::pPcr1cALMO5 (cr1-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra1_*cr1rcA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra1 (P_{GAP}-HH-cra1-HDV *hph*) *his4*::pPcr1rcALMO5 (cr1r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra2_*cr2cA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra2 (P_{GAP}-HH-cra2-HDV *hph*) *his4*::pPcr2cALMO5 (cr2-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra2_*cr2rcA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra2 (P_{GAP}-HH-cra2-HDV *hph*) *his4*::pPcr2rcALMO5 (cr2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra3_*cr3cA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra3 (P_{GAP}-HH-cra3-HDV *hph*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
GS_P_{GAP}-dCpf1VP16_ P_{GAP}-cra3_*cr3rcA*-LM-*O5cA*-G	GS115 P_{GAP}::pGP$_{GAP}$dCpf1VP16 (P_{GAP}-dCpf1-VP16 *Sh ble*) P_{AOX1}::pAA-P_{GAP}cra3 (P_{GAP}-HH-cra3-HDV *hph*) *his4*::pPcr3rcALMO5 (cr3r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
Δ*ku70*	*his4*; GS115 *KU70*Δ	(*32*)

Δ*ku*_P$_{GAP}$-dCas9	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G_P$_{AOX2}$-giF1-P$_{ICL1}$-ga2	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{AOX2}$giF1-P$_{ICL1}$ga2 (P$_{AOX2}$-HH-giF1-HDV and P$_{ICL1}$-HH-ga2-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G_P$_{AOX2}$-giF1-P$_{GPM1}$-ga2	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{AOX2}$giF1-P$_{GPM1}$ga2 (P$_{AOX2}$-HH-giF1-HDV and P$_{GPM1}$-HH-ga2-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G_P$_{AOX2}$-giF1-P$_{ENO1}$-ga2	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{AOX2}$giF1-P$_{ENO1}$ga2 (P$_{AOX2}$-HH-giF1-HDV and P$_{ENO1}$-HH-ga2-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G_P$_{AOX2}$-giF1-P$_{GAP}$-ga2	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{AOX2}$giF1-P$_{GAP}$ga2 (P$_{AOX2}$-HH-giF1-HDV and P$_{GAP}$-HH-ga2-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G_P$_{ICL1}$-giF1-P$_{AOX2}$-ga2	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ICL1}$giF1-P$_{AOX2}$ga2 (P$_{ICL1}$-HH-giF1-HDV and P$_{AOX2}$-HH-ga2-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G_P$_{ICL1}$-giF1-P$_{GPM1}$-ga2	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ICL1}$giF1-P$_{GPM1}$ga2 (P$_{ICL1}$-HH-giF1-HDV and P$_{GPM1}$-HH-ga2-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G_P$_{ICL1}$-giF1-P$_{ENO1}$-ga2	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ICL1}$giF1-P$_{ENO1}$ga2 (P$_{ICL1}$-HH-giF1-HDV and P$_{ENO1}$-HH-ga2-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G_P$_{ICL1}$-giF1-P$_{GAP}$-ga2	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ICL1}$giF1-P$_{GAP}$ga2 (P$_{ICL1}$-HH-giF1-HDV and P$_{GAP}$-HH-ga2-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G_P$_{GPM1}$-giF1-P$_{AOX2}$-ga2	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GPM1}$giF1-P$_{AOX2}$ga2 (P$_{GPM1}$-HH-giF1-HDV and P$_{AOX2}$-HH-ga2-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-VRERVP16_*g2rcA*-LM-*O5cA*-G_P$_{GPM1}$-giF1-P$_{ICL1}$-ga2	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 dCas9::(P$_{GAP}$-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GPM1}$giF1-P$_{ICL1}$ga2 (P$_{GPM1}$-HH-giF1-HDV and P$_{ICL1}$-HH-ga2-HDV *hph*)	This study

Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G_P_{GPM1}-giF1-P_{ENO1}-ga2	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 dCas9::(P_{GAP}-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GPM1}giF1-P_{ENO1}ga2 (P_{GPM1}-HH-giF1-HDV and P_{ENO1}-HH-ga2-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G_P_{GPM1}-giF1-P_{GAP}-ga2	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 dCas9::(P_{GAP}-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GPM1}giF1-P_{GAP}ga2 (P_{GPM1}-HH-giF1-HDV and P_{GAP}-HH-ga2-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G_P_{ENO1}-giF1-P_{AOX2}-ga2	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 dCas9::(P_{GAP}-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{ENO1}giF1-P_{AOX2}ga2 (P_{ENO1}-HH-giF1-HDV and P_{AOX2}-HH-ga2-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G_P_{ENO1}-giF1-P_{ICL1}-ga2	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 dCas9::(P_{GAP}-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{ENO1}giF1-P_{ICL1}ga2 (P_{ENO1}-HH-giF1-HDV and P_{ICL1}-HH-ga2-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G_P_{ENO1}-giF1-P_{GPM1}-ga2	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 dCas9::(P_{GAP}-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{ENO1}giF1-P_{GPM1}ga2 (P_{ENO1}-HH-giF1-HDV and P_{GPM1}-HH-ga2-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G_P_{ENO1}-giF1-P_{GAP}-ga2	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 dCas9::(P_{GAP}-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{ENO1}giF1-P_{GAP}ga2 (P_{ENO1}-HH-giF1-HDV and P_{GAP}-HH-ga2-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G_P_{GAP}-giF1-P_{AOX2}-ga2	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 dCas9::(P_{GAP}-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1-P_{AOX2}ga2 (P_{GAP}-HH-giF1-HDV and P_{AOX2}-HH-ga2-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G_P_{GAP}-giF1-P_{ICL1}-ga2	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 dCas9::(P_{GAP}-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}giF1-P_{ICL1}ga2 (P_{GAP}-HH-giF1-HDV and P_{ICL1}-HH-ga2-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G_P_{GAP}-giF1-P_{GPM1}-ga2	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 dCas9::(P_{GAP}-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}giF1-P_{GPM1}ga2 (P_{GAP}-HH-giF1-HDV and P_{GPM1}-HH-ga2-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-VRERVP16_*g2rcA*-LM-*O5cA*-G_P_{GAP}-giF1-P_{ENO1}-ga2	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 dCas9::(P_{GAP}-VRER-VP16 *Sh ble*) *his4*::pPg2rcALMO5 (g2r-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}giF1-P_{ENO1}ga2 (P_{GAP}-HH-giF1-HDV and P_{ENO1}-HH-ga2-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{AOX2}-giF1-P_{ICL1}-cra3	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1-P_{ICL1}cra3 (P_{AOX2}-HH-giF1-HDV and P_{ICL1}-HH-cra3-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh*	This study

dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{AOX2}$-giF1-P$_{GPM1}$-cra3	*ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{AOX2}$giF1-P$_{GPM1}$cra3 (P$_{AOX2}$-HH-giF1-HDV and P$_{GPM1}$-HH-cra3-HDV *hph*)	
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{AOX2}$-giF1-P$_{ENO1}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{AOX2}$giF1-P$_{ENO1}$cra3 (P$_{AOX2}$-HH-giF1-HDV and P$_{ENO1}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{AOX2}$-giF1-P$_{GAP}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{AOX2}$giF1-P$_{GAP}$cra3 (P$_{AOX2}$-HH-giF1-HDV and P$_{GAP}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{ICL1}$-giF1-P$_{AOX2}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ICL1}$giF1-P$_{AOX2}$cra3 (P$_{ICL1}$-HH-giF1-HDV and P$_{AOX2}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{ICL1}$-giF1-P$_{GPM1}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ICL1}$giF1-P$_{GPM1}$cra3 (P$_{ICL1}$-HH-giF1-HDV and P$_{GPM1}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{ICL1}$-giF1-P$_{ENO1}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ICL1}$giF1-P$_{ENO1}$cra3 (P$_{ICL1}$-HH-giF1-HDV and P$_{ENO1}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{ICL1}$-giF1-P$_{GAP}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ICL1}$giF1-P$_{GAP}$cra3 (P$_{ICL1}$-HH-giF1-HDV and P$_{GAP}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{GPM1}$-giF1-P$_{AOX2}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GPM1}$giF1-P$_{AOX2}$cra3 (P$_{GPM1}$-HH-giF1-HDV and P$_{AOX2}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{GPM1}$-giF1-P$_{ICL1}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GPM1}$giF1-P$_{ICL1}$cra3 (P$_{GPM1}$-HH-giF1-HDV and P$_{ICL1}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{GPM1}$-giF1-P$_{ENO1}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GPM1}$giF1-P$_{ENO1}$cra3 (P$_{GPM1}$-HH-giF1-HDV and P$_{ENO1}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{GPM1}$-giF1-P$_{GAP}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{GPM1}$giF1-P$_{GAP}$cra3 (P$_{GPM1}$-HH-giF1-HDV and P$_{GAP}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P$_{ENO1}$-giF1-P$_{AOX2}$-cra3	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP$_{AOX1}$-LacI-Mit1AD and *lacO5*-cP$_{AOX1}$-GFP *HIS4*) P$_{AOX1}$::pAA-P$_{ENO1}$giF1-P$_{AOX2}$cra3 (P$_{ENO1}$-HH-giF1-HDV and P$_{AOX2}$-HH-cra3-HDV *hph*)	This study
Δ*ku*_P$_{GAP}$-dCas9_P$_{GAP}$-	Δ*ku70* P$_{TEF1}$UP-g1::P$_{GAP}$-dCas9 P$_{GAP}$::(P$_{GAP}$-dCpf1-VP16 *Sh*	This study

dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{ENO1}-giF1-P_{ICL1}-cra3	*ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{ENO1}giF1-P_{ICL1}cra3 (P_{ENO1}-HH-giF1-HDV and P_{ICL1}-HH-cra3-HDV *hph*)	
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{ENO1}-giF1-P_{GPM1}-cra3	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{ENO1}giF1-P_{GPM1}cra3 (P_{ENO1}-HH-giF1-HDV and P_{GPM1}-HH-cra3-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{ENO1}-giF1-P_{GAP}-cra3	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{ENO1}giF1-P_{GAP}cra3 (P_{ENO1}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{GAP}-giF1-P_{AOX2}-cra3	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{AOX2}giF1-P_{AOX2}cra3 (P_{GAP}-HH-giF1-HDV and P_{AOX2}-HH-cra3-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{GAP}-giF1-P_{ICL1}-cra3	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}giF1-P_{ICL1}cra3 (P_{GAP}-HH-giF1-HDV and P_{ICL1}-HH-cra3-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{GAP}-giF1-P_{GPM1}-cra3	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}giF1-P_{GPM1}cra3 (P_{GAP}-HH-giF1-HDV and P_{GPM1}-HH-cra3-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{GAP}-giF1-P_{ENO1}-cra3	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{GAP}giF1-P_{ENO1}cra3 (P_{GAP}-HH-giF1-HDV and P_{ENO1}-HH-cra3-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{LRA3}-giF1-P_{GAP}-cra3	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{LRA3}giF1-P_{GAP}cra3 (P_{LRA3}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{DAS1}-giF1-P_{GAP}-cra3	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{DAS1}giF1-P_{GAP}cra3 (P_{DAS1}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV *hph*)	This study
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{THI11}-giF1-P_{GAP}-cra3	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{THI11}giF1-P_{GAP}cra3 (P_{THI11}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV *hph*)	This study
GS_P_{AOX1}-Amy	GS115 *his4*::pPIC9K-Amy (P_{AOX1}-Amy *HIS4 KAN*)	(*69*)
Δ*ku*_P_{GAP}-dCas9_P_{GAP}-dCpf1VP16_*cr3cA*-LM-*O5cA*-G_P_{LRA3}-giF1-P_{GAP}-cra3_*O5cA*-Amy	Δ*ku70* P_{TEF1}UP-g1::P_{GAP}-dCas9 P_{GAP}::(P_{GAP}-dCpf1-VP16 *Sh ble*) *his4*::pPcr3cALMO5 (cr3-cP_{AOX1}-LacI-Mit1AD and *lacO5*-cP_{AOX1}-GFP *HIS4*) P_{AOX1}::pAA-P_{LRA3}giF1-P_{GAP}cra3 (P_{LRA3}-HH-giF1-HDV and P_{GAP}-HH-cra3-HDV *hph*) P_{ENO1}::BB3eN-lacO5cAAmy (*lacO1*-cP_{AOX1}-GFP *nat1*)	This study

Table S3. Primers used in this study.

Primer	Sequence (5'-3')
cA F	GGGAACACTGCTAACCCCTACTTGACAGCA
cA R	TAGGGGTTAGCAGTGTTCCCGATCTGCGTC
pP F	TGATCCTTCAGTAACATCAGAGATTTTGAG
pP R	CTGATGTTACTGAAGGATCAGATCACGCAT
lacO1cA F	GAATTGTGAGCGGATAACAATTTCACACAGGGCCCCTAACCCCTACTTGACAGCA
lacO1cA R	TTGTTATCCGCTCACAATTCCACACACTCGAGGAGCTCGTTCCCGATCTGCGTCTA
araO1cA F	CTATAATCACGGCAGAAAAGTCCACATTGAGGGCCCCTAACCCCTACTTGACAGCA
araO1cA R	CTTTTCTGCCGTGATTATAGACACTTTTGTCTCGAGGAGCTCGTTCCCGATCTGCGTCTA
araO2cA F	AATATGGACAATTGGTTTCTGGGCCCCTAACCCCTACTTGACAGCA
araO2cA R	AGAAACCAATTGTCCATATTCTCGAGGAGCTCGTTCCCGATCTGCGTCTA
araIcA F	TTATCCATAAGATTAGCGGATCCTACCTGGGGCCCCTAACCCCTACTTGACAGCA
araIcA R	TCCGCTAATCTTATGGATAAAAATGCTATCTCGAGGAGCTCGTTCCCGATCTGCGTCTA
GFPUP F	GGATCCTACACCATGGGTTC
lacO R	TGTGTGAAATTGTTATCCGCTC
lacO-DAS1 F	GCGGATAACAATTTCACACAGGGCCCGGATGCCTGATATATAAATCCCAGA
GFP-DAS1 R	GAACCCATGGTGTAGGATCCTTTGTTCGATTATTCTCCAGATAAAATCAA
lacO-GAP F	GCGGATAACAATTTCACACAGGGCCCCAGAATCGAATATAAAAGGCGAACACCTT
GFP-GAP R	GAACCCATGGTGTAGGATCCTGTGTTTTGATAGTTGTTCAATTGATTGAAATAGG
lacO-ScGAP F	GCGGATAACAATTTCACACAGGGCCCGACTAATAAGTATATAAAGACGGTAGGTATTGA
GFP-ScGAP R	GAACCCATGGTGTAGGATCCTTTGTTTGTTTATGTGTGTTTATTCGAAAC
lacO1 F	CCTCGAGTGTGTGGAATTGTGAGCGGATAACAATTTCACACAG
lacO1 R	TCGACTGTGTGAAATTGTTATCCGCTCACAATTCCACACACTCGAGGAGCT
pG F	GCCAGCTTTCTAGAACAAAAACT
LacI-GAP R	ACACCCATGGTGGATCCATAGTTGTTCAATTGATTGAAATAGGG
GAP-LacI F	GAACAACTATGGATCCACCATGGGTGTTAAGCCAGT
LacI R	TTGTCCAGACTCCAATCTAGAG
LacI-P1AD F	CTCTAGATTGGAGTCTGGACAAGGTGGCGGCGGCTCTGGACAATCTCTGAGTCTGAGT
pG-P1AD R	TTTTGTTCTAGAAAGCTGGCGGCCGCCGCGGCTCGAGTTAACTGTCAAAATTTATTGTATCTGGC
LacI-X1AD F	CTCTAGATTGGAGTCTGGACAAGGTGGCGGCGGCTCTAGCAACTGCTCTGATGC
pG-X1AD R	TTTTGTTCTAGAAAGCTGGCGGCCGCCGCGGCTCGAGTTAGCATGATAACGTGTTAGAGAAAG

LacI-M1AD F	CTCTAGATTGGAGTCTGGACAAGGTGGCGGCGGCTCTGTTAACAACTCCATGAAGGATTT
pG-M1AD R	TTTTGTTCTAGAAAGCTGGCGGCCGCCGCGGCTCGAGTTATTCTTCAACATTCCAGTAGTCAATTAAC
M1AD F	GTTAACAACTCCATGAAGGATTTC
SV-GAP R	CTTCTTTTTTGGAGGAGTGCAACCCATGGTATAGTTGTTCAATTGATTGAAATAG
SV-AraC F	GCACTCCTCCAAAAAAGAAGAGAAAGGTCATGGCTGAAGCGCAAAATG
M1AD-AraC R	GAAATCCTTCATGGAGTTGTTAACAGAGCCGCCGCCACCTGACAACTTGACGGCTACATC
pGGFP F	ACCATGGGTTCTAAAGGTGAAG
pG R	GATCTCATGCATGACCAAAATCC
pG-AOX2 F	TTTTGGTCATGCATGAGATCGCTTAAAGGACTCCATTTCCTAAAAT
GFP-AOX2 R	TCACCTTTAGAACCCATGGTTTTTCTCAGTTGATTTGTTTGTGGG
pG-ICL1 F	TTTTGGTCATGCATGAGATCTCATCTAACACTTTGTATAGCACATCG
GFP-ICL1 R	TCACCTTTAGAACCCATGGTTCTTGATATACTTGATACTGTGTTCTTTGA
pG-GPM1 F	TTTTGGTCATGCATGAGATCCCTTGGGTTATTAGTAGTGTCC
GFP-GPM1 R	TCACCTTTAGAACCCATGGTTGTTTGTTTGTGTAATTGAAAGTTGTTAC
pG-ENO1 F	TTTTGGTCATGCATGAGATCATGAAAGAGTGAGAGGAAAGTAC
GFP-ENO1 R	TCACCTTTAGAACCCATGGTTTTTAGATGTAGATTGTTATAATTGTGTGTTTC
pGAP F	AATGTCTTGGTGTCCTCGTC
pGAP R	GACGAGGACACCAAGACATT
3AOX1F	GGATGTCAGAATGCCATTTG
3AOX1	GCAAATGGCATTCTGACATCC
LacI F	ACCATGGGTGTTAAGCCAG
LacI-cAOX1 R	ACTGGCTTAACACCCATGGTACTAGTTTCGAATAATTAGTTGTTTTTTGATC
LacI-ICL1 R	ACTGGCTTAACACCCATGGTTCTTGATATACTTGAT
LacI-GPM1 R	ACTGGCTTAACACCCATGGTTGTTTGTTTGT
LacI-ENO1 R	ACTGGCTTAACACCCATGGTTTTTAGATGTAGATTG
dCas9-pG F	GAGACAGCAGGGCTGACTAAGTCGACCATCATCATCATCATC
dCas9-SV R	TTGTGCCGATAGCGAGCCCAATGGAGTACTTCTTGTCCATGACCTTTCTCTTCTTTTTTGGAGG
dCas9 F1	TGGGCTCGCTATCGGCACAAACAG
dCas9 R1	CACGATGGCATCCACGTCGTAGTC
dCas9 F2	ACGACGTGGATGCCATCGTGCC
dCas9 R2	TTAGTCAGCCCTGCTGTC
pA-AOX1 F	TCCAGTGTCGAAAACGAGCTAGATCTAACATCCAAAGACGAAAG
pA-AOX1 R	GCGGCCGCATAGGCCACTAGATAATTAGTTGTTTTTTGATCTTCTCAAGT
pAA-GAP F	CGCGCCTTAATTAACCCGGGGATCCCTCGAGAGATCTTTTTTGTAGAAATGTCTTGGTG
HHgiF1-GAP R	CACGGACTCATCAGTGACAGTCTAGAGGTACCATAGTTGTTCAATTGATTGAAATAGGGAC

giF1HH F	CTGTCACTGATGAGTCCG
TT-HDV R	CAAATGGCATTCTGACATCCACTAGTGTCCCATTCGCCATG
pAA-TT R	GAAGCTTCGTACGCTGCAGGTCGACAAGCTTGCACAAACGAACGTCTCACTTAATCTTC
inOri F	TACCTGTCCGCCTTTCTCCC
inOri R	GGGAGAAAGGCGGACAGGTA
HHgiF2-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCCTTACTTTCATAATTGCGACGTTTTAGAGCTAGAAATAGC
giF2HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGCTTACTTCTAGAGGTACCATAGTTGTTCAATTGATTG
HHgiF3-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCAAAAACAACTAATTATTCGAGTTTTAGAGCTAGAAATAGC
giF3HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGAAAAACTCTAGAGGTACCATAGTTGTTCAATTGATTG
HHgiR1-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCTTTATATATTGCTGTCAAGTGTTTTAGAGCTAGAAATAGC
giR1HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGTTTATATCTAGAGGTACCATAGTTGTTCAATTGATTG
HHgiR2-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCAATAATGATGATAAAAAAAAGTTTTAGAGCTAGAAATAGC
giR2HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGAATAATTCTAGAGGTACCATAGTTGTTCAATTGATTG
HHgiR3-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCAAAATCAAAAGCTTGTCAATGTTTTAGAGCTAGAAATAGC
giR3HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGAAAATCTCTAGAGGTACCATAGTTGTTCAATTGATTG
pP-cA F	ACGCAGATCGGGAACGAGCTCCTCGAGCTAACCCCTACTTGACAGCA
lacO-TT R	CCGCTCACAATTCCACACACTCGATCTCACTTAATCTTCTGTACTCTGAAG
pAA-AOX2 F	TTAATTAACCCGGGGATCCCTCGAGGCTTAAAGGACTCCATTTCCTAAAAT
HH-AOX2 R	TCATCAGTGACAGTCTAGAGGTACCTTTTCTCAGTTGATTTGTTTG
pAA-ICL1 F	TTAATTAACCCGGGGATCCCTCGAGTCATCTAACACTTTGTATAGCACATC
HH-ICL1 R	TCATCAGTGACAGTCTAGAGGTACCTCTTGATATACTTGATACTGTGTTCTTTGA
pAA-GPM1 F	TTAATTAACCCGGGGATCCCTCGAGCCTTGGGTTATTAGTAGTGTCCGTTATTTT
HH-GPM1 R	TCATCAGTGACAGTCTAGAGGTACCTGTTTGTTTGTGTAATTGAAAGTTGTTAC
pAA-ENO1 F	TTAATTAACCCGGGGATCCCTCGAGATGAAAGAGTGAGAGGAAAGTACCT
HH-ENO1 R	TCATCAGTGACAGTCTAGAGGTACCTTTTAGATGTAGATTGTTATAATTGTGTGTTTCAA
inCas9DO F	TACGGGGCTCTATGAAACAAG
inCas9DO R	TTGTTTCATAGAGCCCCGTAAT
Cas9-Mit1AD F	TACGGGGCTCTATGAAACAAGAATCGACCTCTCTCAGCTCGGTGGAGACAGCAGGGCTGACGGTGGCGGCGGCTCTGTTAACAAC
Cas9-Mxr1AD F	TACGGGGCTCTATGAAACAAGAATCGACCTCTCTCAGCTCGGTGGAGACAGCAGGGCTGAC GGTGGCGGCGGCTCTAGCAAC
pGTTout F	GTTTTAGCCTTAGACATGACTGTTC
pGTTout R	GTCATGTCTAAGGCTAAAACTCAATG
Xho-fapO-Apa F	TCGAGAATTATATACTACTATTAGTACCTAGTCTTAATTGGGCC

Apa-fapO-Xho R	CAATTAAGACTAGGTACTAATAGTAGTATATAATTC
fapO1 F	CCTCGAGAATTATATACTACTATTAGTACCTAGTCTTAATTG
fapO1 R	TCGACAATTAAGACTAGGTACTAATAGTAGTATATAATTCTCGAGGAGCT
HHgA1-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCTGCTGTCAAGTAGGGGTTAGGTTT TAGAGCTAGAAATAGC
gA1HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGTGCTGTTCTAGAGGTACCATAGT TGTTCAATTGATTG
HhgA2-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCATTAGTACCTAGTCTTAATTGTTTT AGAGCTAGAAATAGC
gA2HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGATTAGTTCTAGAGGTACCATAGT TGTTCAATTGATTG
HhgA3-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCATTGTGAAATAGACGCAGATGTTT TAGAGCTAGAAATAGC
gA3HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGATTGTGTCTAGAGGTACCATAGT TGTTCAATTGATTG
HhgA4-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCTGACATTAACCTATAAAAATGTTTT AGAGCTAGAAATAGC
gA4HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGTGACATTCTAGAGGTACCATAGT TGTTCAATTGATTG
HhgA5-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCACTTTTCGGGGAAATGTGCGGTTT TAGAGCTAGAAATAGC
gA5HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGACTTTTTCTAGAGGTACCATAGT TGTTCAATTGATTG
HhgA6-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCATGCCGCAAAAAAGGGAATAGTTT TAGAGCTAGAAATAGC
gA6HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGATGCCGTCTAGAGGTACCATAGT TGTTCAATTGATTG
HhgA7-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCATCGAACTGGATCTCAACAGGTTT TAGAGCTAGAAATAGC
gA7HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGATCGAATCTAGAGGTACCATAGT TGTTCAATTGATTG
HhgA8-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCCATTCTGAGAATAGTGTATGGTTTT AGAGCTAGAAATAGC
gA8HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGCATTCTTCTAGAGGTACCATAGT TGTTCAATTGATTG
inSV R	CTTCTTTTTGGAGGAGTGCAAC
SV-LbCpf1 F	GCACTCCTCCAAAAAAGAAGAGAAAGGTCATGAGCAAGCTGGAGAAGTT
dCpf1-R	TCGCCTCTGGCAATGCCGAT
dCpf1-F	ATCGGCATTGCCAGAGGCGAG
TTout-LbCpf1 R	GTCATGTCTAAGGCTAAAACTTAGTGTTTCACGCTGGTC
2Bbs-HDV F	AGGTCTTCAGTCGAAGACACGGCCGGCATGGTCCCAG
2Bbs-GAP R	GTGTCTTCGACTGAAGACCTCTAGAGGTACCATAGTTGTTCAATTGATTG
HH-HR-2Bbs F	CTAGAAATTCTGATGAGTCCGTGAGGACGAAACGAGTAAGCTCGTCAATTTC TACTAAGTGTAGATAGGTCTTCAGTCGAAGACAC
HH-HR-2Bbs R	GGCCGTGTCTTCGACTGAAGACCTATCTACACTTAGTAGAAATTGACGAGCT TACTCGTTTCGTCCTCACGGACTCATCAGAATTT
crRNA-T1-F	AGATTCATCATTATTAGCTTACTT
crRNA-T1-R	GGCCAAGTAAGCTAATAATGATGA

crRNA-T2-F	AGATATAATTGCGACTGGTTCCAA
crRNA-T2-R	GGCCTTGGAACCAGTCGCAATTAT
crRNA-T3-F	AGATACGACAACTTGAGAAGATCA
crRNA-T3-R	GGCCTGATCTTCTCAAGTTGTCGT
crRNA-NT1-F	AGATTATATTGCTGTCAAGTAGGG
crRNA-NT1-R	GGCCCCCTACTTGACAGCAATATA
crRNA-NT2-F	AGATAGACAGGGCAGCTTCCTTCT
crRNA-NT2-R	GGCCAGAAGGAAGCTGCCCTGTCT
crRNA-NT3-F	AGATATCTTCTCAAGTTGTCGTTA
crRNA-NT3-R	GGCCTAACGACAACTTGAGAAGAT
ga1-handle F	CGTGAGGACGAAACGAGTAAGCTCGTCTCTGTTTATATATTGCTGTCAGTTTT AGAGCTAGAAATAGC
ga1HH-GAP R	TTACTCGTTTCGTCCTCACGGACTCATCAGTCTGTTCTCGAATAGTTGTTCAA TTGATTG
HH-ga2-2Bbs F	CTAGAGCTACTGATGAGTCCGTGAGGACGAAACGAGTAAGCTCGTCAGGTC TTCAGTCGAAGACACACTTGAAAAAGTGGCACCGAGTCGGTGCTTTT
HH-ga2-2Bbs R	GGCCAAAAGCACCGACTCGGTGCCACTTTTTCAAGTGTGTCTTCGACTGAA GACCTGACGAGCTTACTCGTTTCGTCCTCACGGACTCATCAGTAGCT
ga2 F	CGTCTAGCTCTTAAAGTCTGTTTATGTTTTAGAGTCAGAAATGACAAGTTAA AATAAGGCTAGTCCGTTATCA
ga2 R	AAGTTGATAACGGACTAGCCTTATTTTAACTTGTCATTTCTGACTCTAAAACA TAAACAGACTTTAAGAGCTA
2Bbs-handle F	AGGTCTTCAGTCGAAGACACGTTTTAGAGCTAGAAATAGCAAGTTAAAATAA G
ga3HH-2Bbs F	CTAGATTGGGTCTGATGAGTCCGTGAGGACGAAACGAGTAAGCTCGTCAGG TCTTCAGTCGAAGACAC
ga3HH-2Bbs R	AAACGTGTCTTCGACTGAAGACCTGACGAGCTTACTCGTTTCGTCCTCACGG ACTCATCAGACCCAAT
ga3 F	CGTCACCCAATATATATTGCTCTCTGAAAATGGTGGTTAATGAAAATTAACTT ACTATTTTCTGACAGCAAAGAAATTGTGCTATCAGATC
ga3 R	AAACGATCTGATAGCACAATTTCTTTGCTGTCAGAAAATAGTAAGTTAATTTT CATTAACCACCATTTTCAGAGAGCAATATATATTGGGT
HH-giF1m-2Bbs F	CTAGACTGTCACTGATGAGTCCGTGAGGACGAAACGAGTAAGCTCGTCTGA CAGCAATATATAAACAGAAGGTCTTCAGTCGAAGACAC
HH-giF1m-2Bbs R	GGCCGTGTCTTCGACTGAAGACCTTCTGTTTATATATTGCTGTCAGACGAGCT TACTCGTTTCGTCCTCACGGACTCATCAGTGACAGT
F1m F	CAGAGTTTTAGAGCTAGAAATAGCAAGTTAAAATAAGGCTAGTCCGTTATCA ACTTGAAAAAGTGTCTGCTAGTAGCAGATATT
F1m R	GGCCAATATCTGCTACTAGCAGACACTTTTTCAAGTTGATAACGGACTAGCC TTATTTTAACTTGCTATTTCTAGCTCTAAAAC
cra1 F	AGATGCACAAACTCGGACCCACTT
cra1 R	GGCCAAGTGGGTCCGAGTTTGTGC
cra2 F	AGATACTTTTTCACATTGATAACGGA
cra2 R	GGCCTCCGTTATCAATGTGAAAAAGT
cra3 F	AGATTTGATAACGGACTAGCCTTA
cra3 R	GGCCTAAGGCTAGTCCGTTATCAA

dCas9V F	GGCGGATTCGTTTCTCCTACAGTCGCT
dCas9V R	GTAGGAGAAACGAATCCGCCGTATTTC
dCas9R F	TAGTGCGCGCGAGCTGCAGAAAGGTA
dCas9R R	TCTGCAGCTCGCGCGCACTAGCGAGC
dCas9ER R	TTGTTTCATAGAGCCCCGTAATTGACTGATGAATCAGTGTGGCGTCCAGGAC CTCCTTTGTAGACCTGTACTCCTTTCTGTCTAT
LbCpf1-linker F	CTCAGACCAGCGTGAAACACGGTGGCGGCGGCTCT
inLbCpf1DO R	GTGTTTCACGCTGGTCTGAG
g1-cA F	GCTCCTCGAGTCTGTTTATATATTGCTGTCAAGCGCTAACCCCTACTTGACAG CA
g1-pP R	TATAAACAGACTCGAGGAGCTCGTTCCCGATCTGCGTC
g1r-cA F	TCGAGCGCTTGACAGCAATATATAAACAGACTAACCCCTACTTGACAGCA
g1r-pP R	TATTGCTGTCAAGCGCTCGAGGAGCTCGTTCCCGATCTGCGTC
g2-cA F	CTTAAAGTCTGTTTATCGCGCTAACCCCTACTTGACAGCA
g2-pP R	CGCGATAAACAGACTTTAAGAGCTACTCGAGGAGCTCGTTCCCGATCTGCGT C
g2r-cA F	CGCGATAAACAGACTTTAAGAGCTACTAACCCCTACTTGACAGCA
g2r-pP R	CTTAAAGTCTGTTTATCGCGCTCGAGGAGCTCGTTCCCGATCTGCGTC
g3-cA F	ATTGTGCTATCAGATCAGCGCTAACCCCTACTTGACAGCA
g3-pP R	CGCTGATCTGATAGCACAATTTCTCTCGAGGAGCTCGTTCCCGATCTGCGTC
g3r-cA F	AGCGCTGATCTGATAGCACAATTTCTCTAACCCCTACTTGACAGCA
g3r-pP R	TGTGCTATCAGATCAGCGCTCGAGGAGCTCGTTCCCGATCTGCGTC
cr1-cA F	TTTAGCACAAACTCGGACCCACTTCTAACCCCTACTTGACAGCA
cr1-pP R	GGGTCCGAGTTTGTGCTAAACTCGAGGAGCTCGTTCCCGATCTGCGTC
cr1r-cA F	AAGTGGGTCCGAGTTTGTGCTAAACTAACCCCTACTTGACAGCA
cr1r-pP R	GCACAAACTCGGACCCACTTCTCGAGGAGCTCGTTCCCGATCTGCGTC
cr2-cA F	CCTCGAGTTTGACTTTTTCACATTGATAACGGACTAACCCCTACTTGACAGCA
cr2-pP R	TGAAAAAGTCAAACTCGAGGAGCTCGTTCCCGATCTGCGTC
cr2r-cA F	TCGAGTCCGTTATCAATGTGAAAAAGTCAAACTAACCCCTACTTGACAGCA
cr2r-pP R	CACATTGATAACGGACTCGAGGAGCTCGTTCCCGATCTGCGTC
cr3-cA F	GTTGATAACGGACTAGCCTTACTAACCCCTACTTGACAGCA
cr3-pP R	AAGGCTAGTCCGTTATCAACAAACTCGAGGAGCTCGTTCCCGATCTGCGTC
cr3r-cA F	GTAAGGCTAGTCCGTTATCAACAAACTAACCCCTACTTGACAGCA
cr3r-pP R	TGATAACGGACTAGCCTTACTCGAGGAGCTCGTTCCCGATCTGCGTC
5AOX1	GACTGGTTCCAATTGACAAGC
5AOX1R	GCTTGTCAATTGGAACCAGTC
CN-LacI F	TTCTGCTAGATTGAGATTGGCCGGA
CN-LacI R	TCCGGCCAATCTCAATCTAGCAGAA
HAPTg1UP-F	CTATGACCATGATTACGAATTCGAGCT

HAPTg1DO-R	TGCCTGCAGGTCGACTCTAG
pAA-LRA3 F	TTAATTAACCCGGGGATCCCTCGAGAACTGACAGAATGACTGACTCCCTA
HHgiF1-LRA3 R	TCATCAGTGACAGTCTAGAGGTACCATTTTTAGGAGATAAAAATTCTGGGGTAAAT
pAA-DAS1 F	TTAATTAACCCGGGGATCCCTCGAGAATAAAAAAACGTTATAGAAAGAAATTGGACTAC
HHgiF1-DAS1 R	TCATCAGTGACAGTCTAGAGGTACCTTTGTTCGATTATTCTCCAGATAAAATCAAC
pAA-THI11 F	TTAATTAACCCGGGGATCCCTCGAGATCTTTTCAGCTTCATCGTCAG
HHgiF1-THI11 R	TCATCAGTGACAGTCTAGAGGTACCGATGATTTATTGAAGTTTCCAAAGTTGAG
TT-BB3 F	CCTTCGTTCTCGAGGAAGACGCCGC
BB3-TT R	GTCTTCCTCGAGAACGAAGGTCTCACTTAATCTTCTGTACTCTGAAGAGGAG
CN-gHisUP F	GTGCTCGGGCTACTCTCCTTTGATG
CN-gHisDO R	CAACGCAGAAGCAAGATGAAAC
CN-pHisUP F	GCCCAGTCCTGCTCGCTTCGCTACT
CN-pHisDO R	CACGCATCTTCCCGACAACGCAGAC
CN-gGAPUP F	CTCAATCCCGACTGTCAATCATTCATCC
CN-gGAPDO R	TCGGAAGCAGCCTTGATAACAGA
CN-pGAPUP F	ACGAAAACTCACGTTAAGGGATTTTGGTCA
CN-AraC R	CGGCAAACAAATTCTCGTCCCTGAT
gAOX1UP5-2	GGTCCCTACCCTCTAAAATCA
CN-gAOX1DOR	CTTGTAAGCCCAAACCATAGGAGC
CN-pApUP F	TCGTATGTGAATGCTGGTCGCTATAC
pAOX1UP F	TCTCATGTTTGACAGCTTATCATC
pAApUP F	TCTGGCGCGCCTTAATTAAC
CN-Mit1AD R	TCTCCCTGTTGGACAGCATTT
CN-M1AD F	GTCATCTCCATCGGACAACAAAG
GFPUP R	GAACCCATGGTGTAGGATCC
pAOXTTDO R	GCTGTGCTTGGGTGTTTTG
inCas9 F1	GGGACCTGAACCCAGACAACAG
inCas9 R1	CCGAGTGACAGGGCGATAAGA
inCas9 F2	GAAGGGATGAGAAAGCCAGCAT
inCas9 R2	CAATCATCTCCCTATCTTCAAACAACG
inCas9 R2r	CGTTGTTTGAAGATAGGGAGATGATTG
inCas9 F3	GCCCAAATTCTCGATTCACGC
inCas9 R3	CTTGCCTATTTCCTGCTCAGACTTT
inCpf1 R1	CTTGTCCCATCCGCCCATAAAC
CN-Cpf1 F	GGCGGATGGGACAAGGATAAGG
inVP16 F	CTTGGACGGTGAAGATGTTGCC

inVP16 R	GCAACATCTTCACCGTCCA

Table S4. Methanol feeding profiles in 3-L bioreactor fermentations*

Feeding 1: P_{AOX1} M 75 mmol/h/L		**Feeding 2:** P_{AOX1} M 150 mmol/h/L		**Feeding 3:** P_{AOX1} M 300 mmol/h/L	
Feeding rate (mmol/h/L broth)	**Continued time** (min)	**Feeding rate** (mmol/h/L broth)	**Continued time** (min)	**Feeding rate** (mmol/h/L broth)	**Continued time** (min)
37.5	30	37.5	30	37.5	30
75	Until the end	75	25	75	25
		100	25	100	25
		125	20	125	20
		150	Until the end	150	20
				200	15
				250	15
				300	Until the end

* Feeding 1~3 refer to Fig. 7 in text.

REFERENCES AND NOTES

1. E. Çelik, P. Çalık, Production of recombinant proteins by yeast cells. *Biotechnol. Adv.* **30**, 1108–1118 (2012).

2. B. G. Ergün, D. Hüccetoğulları, S. Öztürk, E. Çelik, P. Çalık, Established and upcoming yeast expression systems. *Methods Mol. Biol.* **1923**, 1–79 (2019).

3. R. Baghban, S. Farajnia, M. Rajabibazl, Y. Ghasemi, A. A. Mafi, R. H. R. Hoseinpoor, L. Rahbarnia, M. Aria, Yeast expression systems: Overview and recent advances. *Mol. Biotechnol.* **61**, 365–384 (2019).

4. O. P. Ward. Production of recombinant proteins by filamentous fungi. *Biotechnol. Adv.* **30**, 1119–1139 (2012).

5. Q. Wang, C. Zhong, H. Xiao, Genetic engineering of filamentous fungi for efficient protein expression and secretion. *Front. Bioeng. Biotechnol.* **8**, 293 (2020).

6. A. M. Davy, H. F. Kildeg, M. R. Andersen, Cell factory engineering. *Cell Syst.* **4**, 262 (2017).

7. J. M. Cregg, K. R. Madden, Development of the methylotrophic yeast, *Pichia pastoris*, as a host system for the production of foreign proteins. *Dev. Ind. Microbiol.* **29**, 33–41 (1988).

8. K. de Schutter, Y. C. Lin, P. Tiels, A. V. Hecke, S. Glinka, J. Weber-Lehmann, P. Rouzé, Y. van de Peer, N. Callewaert, Genome sequence of the recombinant protein production host *Pichia pastoris*. *Nat. Biotechnol.* **27**, 561–566 (2009).

9. T. Gassler, M. Sauer, B. Gasser, M. Egermeier, M. G. Steiger, The industrial yeast *Pichia pastoris* is converted from a heterotroph into an autotroph capable of growth on CO_2. *Nat. Biotechnol.* **38**, 210–216 (2020).

10. J. P. Schwarzhans, T. Luttermann, M. Geier, J. Kalinowski, K. Friehs, Towards systems metabolic engineering in *Pichia pastoris*. *Biotechnol. Adv.* **35**, 681–710. (2017).

11. D. A. Peña, B. Gasser, J. Zanghellini, M. G. Steiger, D. Mattanovich, Metabolic engineering of *Pichia pastoris*. *Metab. Eng.* **50**, 2–15 (2018).

12. Z. Yang, Z. Zhang, Engineering strategies for enhanced production of protein and bio-products in *Pichia pastoris*: A review. *Biotechnol. Adv.* **36**, 182–195 (2018).

13. P. Perez-Pinera, N. Han, S. Cleto, J. Cao, O. Purcell, K. A. Shah, K. Lee, R. Ram, T. K. Lu, Synthetic biology and microbioreactor platforms for programmable production of biologics at the point-of-care. *Nat. Commun.* **7**, 12211 (2016).

14. R. M. Bill, Playing catch-up with *Escherichia coli*: Using yeast to increase success rates in recombinant protein production experiments. *Front. Microbiol.* **5**, 85 (2014).

15. T. Vogl, L. Sturmberger, T. Kickenweiz, R. Wasmayer, C. Schmid, A. M. Hatzl, M. A. Gerstmann, J. Pitzer, M. Wagner, G. G. Thallinger, M. Geier, A. Glieder, A toolbox of diverse promoters related to methanol utilization: Functionally verified parts for heterologous pathway expression in *Pichia pastoris*. *ACS Synth. Biol.* **5**, 172–186 (2016).

16. B. Gasser, M. G. Steiger, D. Mattanovich, Methanol regulated yeast promoters: Production vehicles and toolbox for synthetic biology. *Microb. Cell Factories* **14**, 196 (2015).

17. B. Gasser, D. Mattanovich, A yeast for all seasons—Is *Pichia pastoris* a suitable chassis organism for future bioproduction? *FEMS Microbiol. Lett.* **365**, 365 (2018).

18. F. S. Hartner, C. Ruth, D. Langenegger, S. N. Johnson, A. Glieder, Promoter library designed for fine-tuned gene expression in *Pichia pastoris*. *Nucleic Acids Res.* **36**, e76 (2008).

19. H. Redden, H. S. Alper, The development and characterization of synthetic minimal yeast promoters. *Nat. Commun.* **6**, 7810 (2015).

20. T. Vogl, A. Glieder, Regulation of *Pichia pastoris* promoters and its consequences for protein production. *New Biotechnol.* **30**, 385–404 (2013).

21. Y. Xuan, X. Zhou, W. Zhang, Z. Xiao, Z. Song, Y. Zhang, An upstream activation sequence controls the expression of *AOX1* gene in *Pichia pastoris*. *FEMS Yeast Res.* **9**, 1271–1282 (2009).

22. T. Yuan, Y. Guo, J. Dong, T. Li, T. Zhou, K. Sun, M. Zhang, Q. Wu, Z. Xie, Y. Cai, L. Cao J. Dai, Construction, characterization and application of a genome-wide promoter library in *Saccharomyces cerevisiae*. *Front. Chem. Sci. Eng.* **11**, 107–116 (2017).

23. T. Vogl, L. Sturmberger, P. C. Fauland, P. Hyden, J. E. Fischer, C. Schmid, G. G. Thallinger, M. Geier, A. Glieder, Methanol independent induction in *Pichia pastoris* by simple derepressed overexpression of single transcription factors. *Biotechnol. Bioeng.* **115**, 1037–1050 (2018).

24. J. Wang, X. Wang, L. Shi, F. Qi, P. Zhang, Y. Zhang, X. Zhou, Z. Song, M. Cai, Methanol-independent protein expression by *AOX1* promoter with trans-acting elements engineering and glucose-glycerol-shift induction in *Pichia pastoris*. *Sci. Rep.* **7**, 41850 (2017).

25. E. Cámara, S. Monforte, J. Albiol, P. Ferrer, Deregulation of methanol metabolism reverts transcriptional limitations of recombinant *Pichia pastoris* (*Komagataella spp*) with multiple expression cassettes under control of the *AOX1* promoter. *Biotechnol. Bioeng.* **116**, 1710–1720 (2019).

26. E. M. Zhao, Y. Zhang, J. Mehl, H. Park, M. A. Lalwani, J. E. Toettcher, J. L. Avalos, Optogenetic regulation of engineered cellular metabolism for microbial chemical production. *Nature* **555**, 683–687 (2018).

27. A. Rantasalo, C. P. Landowski, J. Kuivanen, A. Korppoo, L. Reuter, O. Koivistoinen, M. Valkonen, M. Penttilä, J. Jäntti, D. Mojzita, A universal gene expression system for fungi. *Nucleic Acids Res.* **46**, e111 (2018).

28. G. P. Lin-Cereghino, L. Godfrey, B. J. de la Cruz, S. Johnson, S. Khuongsathiene, I. Tolstorukov, M. Yan, J. Lin-Cereghino, M. Veenhuis, S. Subramani, J. M. Cregg, Mxr1p, a key regulator of the methanol utilization pathway and peroxisomal genes in *Pichia pastoris*. *Mol. Cell. Biol.* **26**, 883–897 (2006).

29. U. Sahu, K. K. Rao, P. N. Rangarajan, Trm1p, a Zn(II)$_2$Cys$_6$-type transcription factor, is essential for the transcriptional activation of genes of methanol utilization pathway, in *Pichia pastoris*. *Biochem. Biophys. Res. Commun.* **451**, 158–164 (2014).

30. X. Wang, Q. Wang, J. Wang, P. Bai, L. Shi, W. Shen, M. Zhou, X. Zhou, Y. Zhang, M. Cai, Mit1 transcription factor mediates methanol signaling and regulates the Alcohol Oxidase 1 (*AOX1*) promoter in *Pichia pastoris*. *J. Biol. Chem.* **291**, 6245–6261 (2016).

31. X. Wang, M. Cai, L. Shi, Q. Wang, J. Zhu, J. Wang, M. Zhou, X. Zhou, Y. Zhang, *Pp*Nrg1 is a transcriptional repressor for glucose and glycerol repression of *AOX1* promoter in methylotrophic yeast *Pichia pastoris*. *Biotechnol. Lett.* **38**, 291–298 (2016).

32. Q. Liu, X. Shi, L. Song, H. Liu, X. Zhou, Q. Wang, Y. Zhang, M. Cai, CRISPR-Cas9-mediated genomic multiloci integration in *Pichia pastoris*. *Microb. Cell Factories* **18**, 144 (2019).

33. R. Prielhofer, J. J. Barrero, S. Steuer, T. Gassler, R. Zahrl, K. Baumann, M. Sauer, D. Mattanovich, B. Gasser, H. Marx, Golden*Pi*CS: A Golden Gate-derived modular cloning system for applied synthetic biology in the yeast *Pichia pastoris*. *BMC Syst. Biol.* **11**, 123 (2017).

34. A. Weninger, A. M. Hatzl, C. Schmid, T. Vogl, A. Glieder, Combinatorial optimization of CRISPR/Cas9 expression enables precision genome engineering in the methylotrophic yeast *Pichia pastoris*. *J. Biotechnol.* **235**, 139–149 (2016).

35. A. Weninger, J. E. Fischer, H. Raschmanová, C. Kniely, T. Vogl, A. Glieder, Expanding the CRISPR/Cas9 toolkit for *Pichia pastoris* with efficient donor integration and alternative resistance markers. *J. Cell. Biochem.* **119**, 3183–3198 (2018).

36. Y. Yang, G. Liu, X. Chen, M. Liu, C. Zhan, X. Liu, Z. Bai, High efficiency CRISPR/Cas9 genome editing system with an eliminable episomal sgRNA plasmid in *Pichia pastoris*. *Enzym. Microb. Technol.* **138**, 109556 (2020).

37. M. Baumschabl, R. Prielhofer, D. Mattanovich, M. G. Steiger, Fine-tuning of transcription in *Pichia pastoris* using dCas9 and RNA scaffolds. *ACS Synth. Biol.* **9**, 3202–3209 (2020).

38. L. S. Qi, M. H. Larson, L. A. Gilbert, J. A. Doudna, J. S. Weissman, A. P. Arkin, W. A. Lim. Repurposing CRISPR as an RNA-guided platform for sequence-specific control of gene expression. *Cell* **152**, 1173–1183 (2013).

39. L. A. Gilbert, M. H. Larson, L. Morsut, Z. Liu, G. A. Brar, S. E. Torres, N. Stern-Ginossar, O. Brandman, E. H. Whitehead, J. A. Doudna, W. A. Lim, J. S. Weissman, L. S. Qi. CRISPR-mediated modular RNA-guided regulation of transcription in eukaryotes. *Cell* **154**, 442–451 (2013).

40. A. W. Cheng, H. Wang, H. Yang, L. Shi, Y. Katz, T. W. Theunissen, S. Rangarajan, C. S. Shivalila, D. B. Dadon, R. Jaenisch, Multiplexed activation of endogenous genes by CRISPR-on, an RNA-guided transcriptional activator system. *Cell Res.* **23**, 1163–1171 (2013).

41. Y. Liu, C. Bai, Q. Liu, Q. Xu, Z. Qian, Q. Peng, J. Yu, M. Xu, X. Zhou, Y. Zhang, M. Cai, Engineered ethanol-driven biosynthetic system for improving production of acetyl-CoA derived drugs in Crabtree-negative yeast. *Metab. Eng.* **54**, 275–284 (2019).

42. Y. Liu, X. Tu, Q. Xu, C. Bai, C. Kong, Q. Liu, J. Yu, Q. Peng, X. Zhou, Y. Zhang, M. Cai, Engineered monoculture and co-culture of methylotrophic yeast for *de novo* production of monacolin J and lovastatin from methanol. *Metab. Eng.* **45**, 189–199 (2018).

43. J. Blazeck, H. S. Alper. Promoter engineering: Recent advances in controlling transcription at the most fundamental level. *Biotechnol. J.* **8**, 46–58 (2013).

44. J. Heyland, J. Fu, L. M. Blank, A. Schmid, Carbon metabolism limits recombinant protein production in *Pichia pastoris*. *Biotechnol. Bioeng.* **108**, 1942–1953 (2011).

45. E. Cámara, N. Landes, J. Albiol, B. Gasser, D. Mattanovich, P. Ferrer, Increased dosage of *AOX1* promoter-regulated expression cassettes leads to transcription attenuation of the methanol metabolism in *Pichia pastoris*. *Sci. Rep.* **7**, 44302 (2017).

46. S. Jang, S. Jang, J. Yang, S. W. Seo, G. Y. Jung, RNA-based dynamic genetic controllers: Development strategies and applications. *Curr. Opin. Biotechnol.* **53**, 1–11 (2018).

47. B. P. Kleinstiver, M. S. Prew, S. Q. Tsai, V. V. Topkar, N. T. Nguyen, Z. Zheng, A. P. Gonzales, Z. Li, R. T. Peterson, J. R. Yeh, M. J. Aryee, J. K. Joung, Engineered CRISPR-Cas9 nucleases with altered PAM specificities. *Nature* **523**, 481–485 (2015).

48. J. Lian, M. HamediRad, S. Hu, H. Zhao, Combinatorial metabolic engineering using an orthogonal tri-functional CRISPR system. *Nat. Commun.* **8**, 1688 (2017).

49. B. Zetsche, J. S. Gootenberg, O. O. Abudayyeh, I. M. Slaymaker, K. S. Makarova, P. Essletzbichler, S. E. Volz, J. Joung, J. van der Oost, A. Regev, E. V. Koonin, F. Zhang, Cpf1 is a single RNA-guided endonuclease of a class 2 CRISPR-Cas system. *Cell* **163**, 759–771 (2015).

50. B. Liu, Y. Zhang, X. Zhang, C. Yan, Y. Zhang, X. Xu, W. Zhang, Discovery of a rhamnose utilization pathway and rhamnose-inducible promoters in *Pichia pastoris*. *Sci. Rep.* **6**, 27352 (2016).

51. N. Landes, B. Gasser, K. Vorauer-Uhl, G. Lhota, D. Mattanovich, M. Maurer, The vitamin-sensitive promoter P_{THI11} enables pre-defined autonomous induction of recombinant protein production in *Pichia pastoris*. *Biotechnol. Bioeng.* **113**, 2633–2643 (2016).

52. M. Huang, Y. Gao, X. Zhou, Y. Zhang, M. Cai. Regulating unfolded protein response activator HAC1p for production of thermostable raw-starch hydrolyzing α-amylase in *Pichia pastoris*. *Bioprocess Biosyst. Eng.* **40**, 341–350 (2017).

53. R. M. Portela, T. Vogl, C. Kniely, J. E. Fischer, R. Oliveira, A. Glieder, Synthetic core promoters as universal parts for fine-tuning expression in different yeast species. *ACS Synth. Biol.* **6**, 471–484 (2017).

54. R. M. C. Portela, T. Vogl, K. Ebner, R. Oliveira, A. Glieder, *Pichia pastoris* alcohol oxidase 1 (*AOX1*) core promoter engineering by high resolution systematic mutagenesis. *Biotechnol. J.* **13**, e1700340 (2018).

55. C.-H. Chang, H.-A. Hsiung, K.-L. Hong, C.-T. Huang, Enhancing the efficiency of the *Pichia pastoris AOX1* promoter via the synthetic positive feedback circuit of transcription factor Mxr1. *BMC Biotechnol.* **18**, 81 (2018).

56. S. P. Collins, W. Rostain, C. Liao, C. L. Beisel, Sequence-independent RNA sensing and DNA targeting by a split domain CRISPR-Cas12a gRNA switch. *Nucleic Acids Res.* **49**, 2985–2999 (2021).

57. K. H. Siu, W. Chen, Riboregulated toehold-gated gRNA for programmable CRISPR-Cas9 function. *Nat. Chem. Biol.* **15**, 217–220 (2019).

58. Y. J. Lee, A. Hoynes-O'Connor, M. C. Leong, T. S. Moon, Programmable control of bacterial gene expression with the combined CRISPR and antisense RNA system. *Nucleic Acids Res.* **44**, 2462–2473 (2016).

59. A. Küberl, J. Schneider, G. G. Thallinger, I. Anderl, D. Wibberg, T. Hajek, S. Jaenicke, K. Brinkrolf, A. Goesmann, R. Szczepanowski, A. Pühler, H. Schwab, A. Glieder, H. Pichler, High-quality genome sequence of *Pichia pastoris* CBS7435. *J. Biotechnol.* **154**, 312–320 (2011).

60. L. Sturmberger, T. Chappell, M. Geier, F. Krainer, K. J. Day, U. Vide, S. Trstenjak, A. Schiefer, T. Richardson, L. Soriaga, B. Darnhofer, R. Birner-Gruenberger, B. S. Glick, I. Tolstorukov, J. Cregg, K. Madden, A. Glieder, Refined *Pichia pastoris* reference genome sequence. *J. Biotechnol.* **235**, 121–131 (2016).

61. T. Vogl, T. Kickenweiz, J. Pitzer, L. Sturmberger, A. Weninger, B. W. Biggs, E. M. Köhler, A. Baumschlager, J. E. Fischer, P. Hyden, M. Wagner, M. Baumann, N. Borth, M. Geier, P. K. Ajikumar, A. Glieder, Engineered bidirectional promoters enable rapid multi-gene co-expression optimization. *Nat. Commun.* **9**, 3589 (2018).

62. J. Wen, L. Tian, M. Xu, X. Zhou, Y. Zhang, M. Cai. A synthetic malonyl-CoA metabolic oscillator in *Komagataella phaffii*. *ACS Synth. Biol.* **9**, 1059–1068 (2020).

63. T. K. Ghose, Measurement of cellulase activities. *Pure Appl. Chem.* **59**, 257–268 (1987).

64. D. H. Mathews, Using the RNAstructure software package to predict conserved RNA structures. *Curr. Protoc. Bioinformatics* **46**, 12.4.1–12.4.22 (2014).

65. F. Isaacs, D. Dwyer, C. Ding, D. D. Pervouchine, C. R. Cantor, J. J. Collins, Engineered riboregulators enable post-transcriptional control of gene expression. *Nat. Biotechnol.* **22**, 841–847 (2004).

66. A. L. Goldstein, J. H. McCusker, Three new dominant drug resistance cassettes for gene disruption in *Saccharomyces cerevisiae*. *Yeast* **15**, 1541–1553 (1999).

67. J. E. DiCarlo, J. E. Norville, P. Mali, X. Rios, J. Aach, G. M. Church, Genome engineering in *Saccharomyces cerevisiae* using CRISPR-Cas systems. *Nucleic Acids Res.* **41**, 4336–4343 (2013).

68. M. Liang, Z. Li, W. Wang, J. Liu, L. Liu, G. Zhu, L. Karthik, M. Wang, K. Wang, Z. Wang, J. Yu, Y. T. Shui, J. Yu, L. Zhang, Z. Yang, C. Li, Q. Zhang, T. Shi, L. Zhou, F. Xie, H. Dai, X. Liu, J. Zhang, G. Liu, Y. Zhuo, B. Zhang, C. Liu, S. Li, X. Xia, Y. Tong, Y. Liu, G. Alterovitz, G. Tan, L. Zhang, L.-X. Zhang, A CRISPR-Cas12a-derived biosensing platform for the highly sensitive detection of diverse small molecules. *Nat. Commun.* **10**, 3672 (2019).

69. W. Shen, Y. Xue, Y. Liu, C. Kong, X. Wang, M. Huang, M. Cai, X. Zhou, Y. Zhang, M. Zhou, A novel methanol-free *Pichia pastoris* system for recombinant protein expression. *Microb. Cell Factories* **15**, 178 (2016).