**Table S1.** Primers used in this study

|  |  |
| --- | --- |
| Name | Sequence (5’-3’) |
| TRR1-F | TATGATGGCGAACGGTATTGCTG |
| TRR1-R | ACAGGTTCTGCGTCTTCGTTAAATTC |
| TRX2-F | ATGGTCACTCAATTAAAATCCGCTTC |
| TRX2-R | TTGTAGAAGATTAGGGTAGGCATGGAAG |
| GSH1-F | TCCATATTTGAATTACGTGGGTAGTTACG |
| GSH1-R | AAGCGGCATTTTTATGATTCCACG |
| SOD1-F | TGTTAAAGGGTGATGCCGGTGTCTC |
| SOD1-R | TTCGTCAGTTGGAGCACCATGTGTC |
| CTT1-F | TTCCTCAGAGACGCTATTAAGTTTCCC |
| CTT1-R | TCTTTGTTGACCATGATGAAGGAATGAC |
| GPX2-F | AATGCAAGGACAAGAAAGGCGAATC |
| GPX2-R | TTCCTGCTTCCCGAACTGATTACATG |
| PGK1-RT-F | TACGTTGTCTTGGCTTCTCACTTGG |
| PGK1-RT-R | TTGGAAGCCTTGACCTTTTGACC |

**Table S2.** List of 153 genes whose deletion mutants are sensitive to 2 mM CoCl2

|  |  |  |  |
| --- | --- | --- | --- |
| **Systematic Name** | **Standard Name** | **Cell viability** | |
| **CFU method (%)** | **Spotting test (%)** |
| **Metabolism (16)** | | | |
| YDR007W | *TRP1* | 25.76% | 40.00% |
| YDR504C | *SPG3* | 9.64% | 20.00% |
| YIR026C | *YVH1* | 74.07% | 80.00% |
| YJL183W | *MNN11* | 54.97% | 80.00% |
| YJR105W | *ADO1* | 3.33% | 60.00% |
| YLL026W | *HSP104* | 31.18% | 60.00% |
| YLR020C | *YEH2* | 48.15% | 60.00% |
| YLR081W | *GAL2* | 40.31% | 60.00% |
| YLR087C | *CSF1* | 46.88% | 40.00% |
| YNL129W | *NRK1* | 44.85% | 60.00% |
| YNL220W | *ADE12* | 49.23% | 60.00% |
| YNL322C | *KRE1* | 21.43% | 80.00% |
| YNR052C | *POP2* | 16.13% | 40.00% |
| YOR059C | *LPL1* | 44.44% | 60.00% |
| YOR209C | *NPT1* | 9.85% | 80.00% |
| YPL227C | *ALG5* | 36.31% | 40.00% |
| **Cell cycle and DNA processing (20)** | | | |
| YDR004W | *RAD57* | 70.24% | 80.00% |
| YDR092W | *UBC13* | 21.21% | 60.00% |
| YDR217C | *RAD9* | 54.76% | 60.00% |
| YDR369C | *XRS2* | 86.01% | 60.00% |
| YEL044W | *IES6* | 2.80% | 60.00% |
| YER116C | *SLX8* | 67.71% | 80.00% |
| YGL215W | *CLG1* | 62.50% | 80.00% |
| YGL058W | *RAD6* | 49.75% | 60.00% |
| YJR043C | *POL32* | 0.35% | 20.00% |
| YMR190C | *SGS1* | 22.33% | 60.00% |
| YMR276W | *DSK2* | 12.24% | 40.00% |
| YNL225C | *CNM67* | 13.33% | 60.00% |
| YOL001W | *PHO80* | 11.39% | 20.00% |
| YOR073W | *SGO1* | 17.50% | 20.00% |
| YPL031C | *PHO85* | 28.57% | 20.00% |
| YPL139C | *UME1* | 37.50% | 60.00% |
| YPL152W | *RRD2* | 64.55% | 80.00% |
| YPL200W | *CSM4* | 53.33% | 60.00% |
| YPL256C | *CLN2* | 6.17% | 40.00% |
| YPR179C | *HDA3* | 29.25% | 40.00% |
| **Transcription (22)** | | | |
| YAR003W | *SWD1* | 25.25% | 40.00% |
| YBL008W | *HIR1* | 2.70% | 20.00% |
| YBR289W | *SNF5* | 10.81% | 40.00% |
| YDR159W | *SAC3* | 13.33% | 60.00% |
| YDR448W | *ADA2* | 17.24% | 60.00% |
| YFL001W | *DEG1* | 7.55% | 40.00% |
| YGL025C | *PGD1* | 13.82% | 20.00% |
| YGL071W | *AFT1* | 8.27% | 0.00% |
| YGR063C | *SPT4* | 45.38% | 80.00% |
| YGR092W | *DBF2* | 1.59% | 40.00% |
| YGR248W | *SOL4* | 13.48% | 40.00% |
| YIR033W | *MGA2* | 20.00% | 20.00% |
| YJL176C | *SWI3* | 37.50% | 40.00% |
| YKL009W | *MRT4* | 44.02% | 60.00% |
| YKL190W | *CNB1* | 2.08% | 0.00% |
| YLL029W | *FRA1* | 7.14% | 40.00% |
| YLR398C | *SKI2* | 7.32% | 60.00% |
| YLR403W | *SFP1* | 18.75% | 20.00% |
| YNL229C | *URE2* | 62.50% | 80.00% |
| YML007W | *YAP1* | 34.67% | 60.00% |
| YOR308C | *SNU66* | 35.91% | 80.00% |
| YOR083W | *WHI5* | 46.30% | 80.00% |
| **Protein synthesis, folding, modification and destination (23)** | | | |
| YBL024W | *NCL1* | 10.53% | 60.00% |
| YDL122W | *UBP1* | 11.72% | 80.00% |
| YDR477W | *SNF1* | 17.39% | 40.00% |
| YFR032C-A | *RPL29* | 14.29% | 40.00% |
| YFR049W | *YMR31* | 44.14% | 60.00% |
| YGL211W | *NCS6* | 3.28% | 60.00% |
| YGR027C | *RPS25A* | 1.39% | 40.00% |
| YHR168W | *MTG2* | 12.85% | 40.00% |
| YIL005W | *EPS1* | 7.14% | 80.00% |
| YKL006W | *RPL14A* | 30.51% | 40.00% |
| YKL213C | *DOA1* | 66.67% | 80.00% |
| YLR048W | *RPS0B* | 11.57% | 40.00% |
| YLR061W | *RPL22A* | 47.37% | 60.00% |
| YML013W | *UBX2* | 33.99% | 60.00% |
| YML073C | *RPL6A* | 5.19% | 40.00% |
| YMR022W | *UBC7* | 26.32% | 40.00% |
| YMR264W | *CUE1* | 44.74% | 60.00% |
| YMR275C | *BUL1* | 57.45% | 80.00% |
| YOR001W | *RRP6* | 14.29% | 60.00% |
| YOR039W | *CKB2* | 86.36% | 20.00% |
| YOR312C | *RPL20B* | 38.67% | 40.00% |
| YPL090C | *RPS6A* | 5.56% | 40.00% |
| YPR133W-A | *TOM5* | 63.95% | 80.00% |
| **Protein with binding function or cofactor requirement (structural or catalytic) (13)** | | | |
| YAR014C | *BUD14* | 133.33% | 60.00% |
| YBL079W | *NUP170* | 16.22% | 80.00% |
| YDR479C | *PEX29* | 11.76% | 40.00% |
| YGL195W | *GCN1* | 9.66% | 80.00% |
| YGR250C | *RIE1* | 8.18% | 80.00% |
| YJL204C | *RCY1* | 25.00% | 20.00% |
| YLR065C | *ENV10* | 52.05% | 60.00% |
| YLR324W | *PEX30* | 48.39% | 80.00% |
| YML028W | *TSA1* | 25.86% | 60.00% |
| YMR060C | *SAM37* | 21.95% | 20.00% |
| YOR086C | *TCB1* | 0.73% | 20.00% |
| YPL048W | *CAM1* | 28.00% | 40.00% |
| YPL170W | *DAP1* | 9.66% | 40.00% |
| **Cellular transport (41)** | | | |
| YBR127C | *VMA2* | 66.67% | 40.00% |
| YCR094W | *CDC50* | 8.99% | 0.00% |
| YDL226C | *GCS1* | 16.98% | 20.00% |
| YDR470C | *UGO1* | 76.39% | 80.00% |
| YEL027W | *VMA3* | 13.19% | 20.00% |
| YGL095C | *VPS45* | 80.00% | 20.00% |
| YKL041W | *VPS24* | 52.50% | 60.00% |
| YKR001C | *VPS1* | 66.32% | 80.00% |
| YEL031W | *SPF1* | 20.69% | 80.00% |
| YGL223C | *COG1* | 9.30% | 40.00% |
| YGR105W | *VMA21* | 16.67% | 20.00% |
| YHR026W | *VMA16* | 12.50% | 20.00% |
| YHR039C-B | *VMA10* | 34.52% | 40.00% |
| YKR020W | *VPS51* | 15.08% | 20.00% |
| YLL040C | *VPS13* | 76.54% | 80.00% |
| YLR119W | *VPS37* | 48.55% | 80.00% |
| YJL207C | *LAA1* | 18.57% | 40.00% |
| YKL080W | *VMA5* | 9.88% | 20.00% |
| YKR052C | *MRS4* | 31.77% | 60.00% |
| YLR047C | *FRE8* | 10.98% | 60.00% |
| YLR242C | *ARV1* | 6.15% | 80.00% |
| YLR148W | *VPS18* | 12.24% | 40.00% |
| YLR322W | *VPS65* | 65.12% | 80.00% |
| YML097C | *VPS9* | 47.06% | 80.00% |
| YLR268W | *SEC22* | 16.00% | 60.00% |
| YLR337C | *VRP1* | 66.67% | 80.00% |
| YLR370C | *ARC18* | 3.37% | 20.00% |
| YOL018C | *TLG2* | 2.74% | 0.00% |
| YOR270C | *VPH1* | 11.76% | 40.00% |
| YOR069W | *VPS5* | 145.45% | 60.00% |
| YPL045W | *VPS16* | 16.67% | 40.00% |
| YPL065W | *VPS28* | 5.13% | 20.00% |
| YOR316C | *COT1* | 18.79% | 40.00% |
| YPR036W | *VMA13* | 14.69% | 20.00% |
| YDR495C | *VPS3* | 31.22% | 40.00% |
| YDR456W | *VPS44* | 21.54% | 20.00% |
| YDR486C | *VPS60* | 4.73% | 80.00% |
| YPL084W | *VPS31* | 15.79% | 20.00% |
| YPR173C | *VPS4* | 23.53% | 40.00% |
| **Unclassified proteins (20)** | | | |
| YBL083C |  | 5.71% | 60.00% |
| YCL007C |  | 12.88% | 20.00% |
| YDR442W |  | 28.57% | 80.00% |
| YDR525W | *API2* | 80.00% | 80.00% |
| YFR020W | *CSS2* | 39.19% | 60.00% |
| YGR272C |  | 26.47% | 40.00% |
| YIR016W |  | 0.82% | 60.00% |
| YJL107C |  | 12.90% | 60.00% |
| YKL044W | *MMO1* | 55.06% | 60.00% |
| YKL118W |  | 11.05% | 20.00% |
| YLL038C | *ENT4* | 4.00% | 60.00% |
| YLR374C |  | 32.73% | 40.00% |
| YML013C-A |  | 10.98% | 40.00% |
| YMR265C |  | 33.85% | 60.00% |
| YNL296W |  | 17.47% | 20.00% |
| YOR062C |  | 50.35% | 80.00% |
| YOR135C | *IRC14* | 27.78% | 40.00% |
| YOR331C |  | 8.82% | 20.00% |
| YPL102C |  | 37.50% | 60.00% |
| YPL257W |  | 45.45% | 60.00% |
|  | WT | 79.11% | 100.00% |

Gene names are listed alphabetically according to their systemic names and underlined if the cobalt sensitivity of its mutant is sensitive to 1 mΜ CoCl2. 58 cobalt-sensitive mutants (grey background) are also sensitive to 1 μg/mL tunicamycin. In the case of the spotting test, cell viability is scored as a present of 20%, 40%, 60%, 80%, 100% by the number of spots in a serially diluted spot assay for the mutants on YPD plate containing 2 mΜ CoCl2. While in the case of CFU method, cell viability is determined by the number of colonies on YPD plates as described in the material and method.

**Table S3.** List of 77 genes whose deletion mutants were also sensitive to oxidative stress response reported previously

|  |  |  |  |
| --- | --- | --- | --- |
| **Gene** | **ORF** | **Chemicals** | **Reference** |
| **Metabolism** | | | |
| ADO1 | YJR105W | 0.12 mM CHP, 5 mM menadione | [[1](#_ENREF_1)] |
| CSF1 | YLR087C | 1.5 mM diamide | [[1](#_ENREF_1)] |
| CSF1 | YLR087C | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| MNN11 | YJL183W | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| NPT1 | YOR209C | 1 mM paraquat | [[3](#_ENREF_3)] |
| NPT1 | YOR209C | 0.9 mM hydrogen peroxide | [[4](#_ENREF_4)] |
| POP2 | YNR052C | 1.5 mM diamide | [[1](#_ENREF_1)] |
| TRP1 | YDR007W | 1.5 mM diamide, 5 mM menadione | [[1](#_ENREF_1)] |
| YVH1 | YIR026C | 1.5 mM diamide | [[1](#_ENREF_1)] |
| **Cell cycle and DNA processing** | | | |
| CNM67 | YNL225C | 1.5 mM diamide, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| CNM67 | YNL225C | 4 mM hydrogen peroxide | [[5](#_ENREF_5)] |
| CNM67 | YNL225C | 0.125 mM cumene hydroperoxide | [[5](#_ENREF_5)] |
| CNM67 | YNL225C | 0.2 mM linoleic acid hydroperoxide | [[5](#_ENREF_5)] |
| COG1 | YGL223C | 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| PHO85 | YPL031C | 100% dioxygen | [[6](#_ENREF_6)] |
| RAD57 | YDR004W | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| RAD57 | YDR004W | 1 mM hydrogen peroxide | [[7](#_ENREF_7)] |
| RAD9 | YDR217C | 100% dioxygen | [[6](#_ENREF_6)] |
| RAD9 | YDR217C | 1 mM hydrogen peroxide | [[7](#_ENREF_7)] |
| SLX8 | YER116C | 0.12 mM CHP, 3.5mM H2O2, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| UME1 | YPL139C | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| **Transcription** | | | |
| ADA2 | YDR448W | 0.12 mM CHP, 1.5 mM diamide, 3.5mM H2O2, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| AFT1 | YGL071W | 5 mM hydrogen peroxide | [[8](#_ENREF_8)] |
| AFT1 | YGL071W | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| DBF2 | YGR092W | 0.12 mM CHP, 1.5 mM diamide, 3.5mM H2O2, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| DEG1 | YFL001W | 2 mM hydrogen peroxide | [[9](#_ENREF_9)] |
| DEG1 | YFL001W | 100% dioxygen | [[6](#_ENREF_6)] |
| DEG1 | YFL001W | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| DEG1 | YFL001W | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| DEG1 | YFL001W | 0.12 mM CHP, 1.5 mM diamide, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| FRA1 | YLL029W | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| MGA2 | YIR033W | 3.5mM H2O2 | [[1](#_ENREF_1)] |
| MRT4 | YKL009W | 0.12 mM CHP, 1.5 mM diamide, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| PGD1 | YGL025C | 100% dioxygen | [[6](#_ENREF_6)] |
| PGD1 | YGL025C | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| PGD1 | YGL025C | 0.12 mM CHP, 1.5 mM diamide, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| SFP1 | YLR403W | 0.12 mM CHP, 1.5 mM diamide | [[1](#_ENREF_1)] |
| SNF5 | YBR289W | 0.12 mM CHP, 0.08 mM LoaOOH, 5 mM menadione | [[1](#_ENREF_1)] |
| SPT4 | YGR063C | 100% dioxygen | [[6](#_ENREF_6)] |
| SPT4 | YGR063C | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| SPT4 | YGR063C | 5 mM paraquat | [[10](#_ENREF_10)] |
| SPT4 | YGR063C | 0.12 mM CHP, 1.5 mM diamide, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| SWD1 | YAR003W | 3.5mM H2O2 | [[1](#_ENREF_1)] |
| SWI3 | YJL176C | 0.12 mM CHP, 1.5 mM diamide, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| URE2 | YNL229C | 3 mM hydrogen peroxide | [[11](#_ENREF_11)] |
| URE2 | YNL229C | 0.12 mM CHP, 1.5 mM diamide, 3.5mM H2O2, 0.08 mM LoaOOH, 5 mM menadione | [[1](#_ENREF_1)] |
| YAP1 | YML007W | 5 mM hydrogen peroxide | [[12](#_ENREF_12)] |
| YAP1 | YML007W | 35% hydrogen peroxide, 10 mM cadmium dichloride | [[13](#_ENREF_13)] |
| YAP1 | YML007W | 3 mM hydrogen peroxide | [[2](#_ENREF_2), [14](#_ENREF_14)] |
| YAP1 | YML007W | 1 mM hydrogen peroxide, 1 mM paraquat | [[15](#_ENREF_15)] |
| **Protein sorting** | | | |
| VPS1 | YKR001C | 1.5 mM diamide | [[1](#_ENREF_1)] |
| VPS13 | YLL040C | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| VPS16 | YPL045W | 1 mM paraquat | [[3](#_ENREF_3)] |
| VPS24 | YKL041W | 1.5 mM diamide | [[1](#_ENREF_1)] |
| VPS28 | YPL065W | 1 mM paraquat | [[3](#_ENREF_3)] |
| VPS3 | YDR495C | 1.5 mM diamide, 3.5mM H2O2 | [[1](#_ENREF_1)] |
| VPS51 | YKR020W | 1.5 mM diamide | [[1](#_ENREF_1)] |
| VPS60 | YDR486C | 1.5 mM diamide, 3.5mM H2O2 | [[1](#_ENREF_1)] |
| VPS65 | YLR322W | 1.5 mM diamide | [[1](#_ENREF_1)] |
| VPS9 | YML097C | 1.5 mM diamide | [[1](#_ENREF_1)] |
| **Protein synthesis, folding, modification and destination** | | | |
| NCL1 | YBL024W | 4 mM hydrogen peroxide | [[5](#_ENREF_5)] |
| NCL1 | YBL024W | 0.125 mM cumene hydroperoxide | [[5](#_ENREF_5)] |
| NCL1 | YBL024W | 0.2 mM linoleic acid hydroperoxide | [[5](#_ENREF_5)] |
| NCL1 | YBL024W | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| NCS6 | YGL211W | 1.5 mM diamide, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| RAD6 | YGL058W | 3.5mM H2O2, 0.08 mM LoaOOH, 5 mM menadione | [[1](#_ENREF_1)] |
| RPL14A | YKL006W | 1.5 mM diamide | [[1](#_ENREF_1)] |
| RPL22A | YLR061W | 5 mM hydrogen peroxide | [[16](#_ENREF_16)] |
| UBX2 | YML013W | 3.5mM H2O2 | [[1](#_ENREF_1)] |
| **Protein with binding function or cofactor requirement (structural or catalytic)** | | | |
| RCY1 | YJL204C | 4 mM hydrogen peroxide | [[5](#_ENREF_5)] |
| RCY1 | YJL204C | 0.125 mM cumene hydroperoxide | [[5](#_ENREF_5)] |
| RCY1 | YJL204C | 0.2 mM linoleic acid hydroperoxide | [[5](#_ENREF_5)] |
| RCY1 | YJL204C | 1.5 mM diamide, 0.08 mM LoaOOH, 5 mM menadione | [[1](#_ENREF_1)] |
| SAM37 | YMR060C | hydrogen peroxide | [[17](#_ENREF_17)] |
| TCB1 | YOR086C | 1.5 mM diamide | [[1](#_ENREF_1)] |
| **Cellular transport** | | | |
| ARC18 | YLR370C | 1.5 mM diamide, 3.5mM H2O2 | [[1](#_ENREF_1)] |
| ARV1 | YLR242C | 0.12 mM CHP, 1.5 mM diamide, 3.5mM H2O2, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| CDC50 | YCR094W | 1.5 mM diamide | [[1](#_ENREF_1)] |
| FRE8 | YLR047C | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| GCS1 | YDL226C | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| SAC3 | YDR159W | 1.5 mM diamide | [[1](#_ENREF_1)] |
| SEC22 | YLR268W | 0.12 mM CHP, 1.5 mM diamide, 0.08 mM LoaOOH, 5 mM menadione | [[1](#_ENREF_1)] |
| SPF1 | YEL031W | 1.5 mM diamide | [[1](#_ENREF_1)] |
| TLG2 | YOL018C | 1.5 mM diamide | [[1](#_ENREF_1)] |
| VMA10 | YHR039C-A | 100% dioxygen | [[6](#_ENREF_6)] |
| VMA10 | YHR039C-A | 2 mM hydrogen peroxide | [[6](#_ENREF_6)] |
| VMA10 | YHR039C-A | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| VMA10 | YHR039C-A | 0.12 mM CHP, 1.5 mM diamide | [[1](#_ENREF_1)] |
| VMA13 | YPR036W | 1 mM paraquat | [[3](#_ENREF_3)] |
| VMA13 | YPR036W | 2 mM hydrogen peroxide | [[9](#_ENREF_9)] |
| VMA13 | YPR036W | 100% dioxygen | [[6](#_ENREF_6)] |
| VMA13 | YPR036W | 2 mM hydrogen peroxide | [[6](#_ENREF_6)] |
| VMA13 | YPR036W | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| VMA13 | YPR036W | 5 mM menadione | [[1](#_ENREF_1)] |
| VMA16 | YHR026W | 1 mM paraquat | [[3](#_ENREF_3)] |
| VMA16 | YHR026W | 100% dioxygen | [[6](#_ENREF_6)] |
| VMA16 | YHR026W | 2 mM hydrogen peroxide | [[6](#_ENREF_6)] |
| VMA16 | YHR026W | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| VMA2 | YBR127C | 2 mM hydrogen peroxide | [[9](#_ENREF_9)] |
| VMA2 | YBR127C | 100% dioxygen | [[6](#_ENREF_6)] |
| VMA2 | YBR127C | 2 mM hydrogen peroxide | [[6](#_ENREF_6)] |
| VMA2 | YBR127C | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| VMA2 | YBR127C | hydrogen peroxide | [[18](#_ENREF_18)] |
| VMA2 | YBR127C | 0.12 mM CHP, 1.5 mM diamide, 3.5mM H2O2, 0.08 mM LoaOOH, 5 mM menadione | [[1](#_ENREF_1)] |
| VMA21 | YGR105W | 1 mM paraquat | [[3](#_ENREF_3)] |
| VMA21 | YGR105W | 2 mM hydrogen peroxide | [[9](#_ENREF_9)] |
| VMA21 | YGR105W | 100% dioxygen | [[6](#_ENREF_6)] |
| VMA21 | YGR105W | 2 mM hydrogen peroxide | [[6](#_ENREF_6)] |
| VMA21 | YGR105W | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| VMA3 | YEL027W | 1 mM paraquat | [[3](#_ENREF_3)] |
| VMA3 | YEL027W | 2 mM hydrogen peroxide | [[9](#_ENREF_9)] |
| VMA3 | YEL027W | 5 mM hydrogen peroxide | [[8](#_ENREF_8)] |
| VMA3 | YEL027W | 100% dioxygen | [[6](#_ENREF_6)] |
| VMA3 | YEL027W | 2 mM hydrogen peroxide | [[6](#_ENREF_6)] |
| VMA3 | YEL027W | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| VMA3 | YEL027W | hydrogen peroxide | [[18](#_ENREF_18)] |
| VMA5 | YKL080W | 100% dioxygen | [[6](#_ENREF_6)] |
| VMA5 | YKL080W | 2 mM hydrogen peroxide | [[6](#_ENREF_6)] |
| VMA5 | YKL080W | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| VPH1 | YOR270C | 0.12 mM CHP, 3.5mM H2O2, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| VRP1 | YLR337C | 5 mM hydrogen peroxide | [[8](#_ENREF_8)] |
| **Unclassified proteins** | | | |
| CWH36 | YCL007C | 0.12 mM CHP, 1.5 mM diamide, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| IRC14 | YOR135C | 0.08 mM LoaOOH, 5 mM menadione | [[1](#_ENREF_1)] |
| KAP114 | YGL241W | 1.5 mM diamide, 0.08 mM LoaOOH | [[1](#_ENREF_1)] |
| POP2 | YNR052C | 1.5 mM diamide | [[1](#_ENREF_1)] |
| YBL083C | YBL083C | 3 mM hydrogen peroxide | [[2](#_ENREF_2)] |
| YCL007C | YCL007C | 1 mM paraquat | [[3](#_ENREF_3)] |
| YCL007C | YCL007C | 2 mM hydrogen peroxide | [[9](#_ENREF_9)] |
| YCL007C | YCL007C | 100% dioxygen | [[6](#_ENREF_6)] |
| YCL007C | YCL007C | 2 mM hydrogen peroxide | [[6](#_ENREF_6)] |
| YCL007C | YCL007C | 0.5 mM paraquat | [[6](#_ENREF_6)] |
| YCL007C | YCL007C | tert-butyl hydroperoxide | [[19](#_ENREF_19)] |
| YDR209C | YDR209C | 3.5mM H2O2 | [[1](#_ENREF_1)] |
| YGL218W | YGL218W | 3.5mM H2O2 | [[1](#_ENREF_1)] |
| YKL118W | YKL118W | 1 mM paraquat | [[3](#_ENREF_3)] |
| YNL226W | YNL226W | 0.12 mM CHP, 1.5 mM diamide, 3.5mM H2O2 | [[1](#_ENREF_1)] |
| YNL296W | YNL296W | 1.5 mM diamide, 3.5mM H2O2 | [[1](#_ENREF_1)] |
| YOR331C | YOR331C | 1 mM paraquat | [[3](#_ENREF_3)] |
| YOR331C | YOR331C | 2 mM hydrogen peroxide | [[9](#_ENREF_9)] |
| YOR331C | YOR331C | 5 mM hydrogen peroxide | [[8](#_ENREF_8)] |
| YPL102C | YPL102C | 1.5 mM diamide | [[1](#_ENREF_1)] |

**Table S4.** List of 72 genes whose deletion mutants were also sensitive to other the metals in addition to cobalt.

|  |  |  |  |
| --- | --- | --- | --- |
| **Gene** | **Systematic Name** | **Chemical** | **Reference** |
| *ADA2* | YDR448W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *ADA2* | YDR448W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *ADO1* | YJR105W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *AFT1* | YGL071W | 2 mM arsenate(2-) | [[21](#_ENREF_21)] |
| *AFT1* | YGL071W | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *AFT1* | YGL071W | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *AFT1* | YGL071W | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *AFT1* | YGL071W | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *AFT1* | YGL071W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *AFT1* | YGL071W | 1.5 mM cobalt dichloride | [[23](#_ENREF_23)] |
| *AFT1* | YGL071W | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *AFT1* | YGL071W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *AFT1* | YGL071W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *AFT1* | YGL071W | 4 mM zinc dichloride | [[26](#_ENREF_26)] |
| *BRO1* | YPL084W | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *BRO1* | YPL084W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *BRO1* | YPL084W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *BUL1* | YMR275C | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *CDC50* | YCR094W | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *CDC50* | YCR094W | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *CDC50* | YCR094W | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *CDC50* | YCR094W | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *CDC50* | YCR094W | 4 mM zinc dichloride | [[24](#_ENREF_24)] |
| *CKB2* | YOR039W | 60 nM methylmercury chloride | [[28](#_ENREF_28)] |
| *CNB1* | YKL190W | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *CNB1* | YKL190W | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *COT1* | YOR316C | cobalt(2+) | [[30](#_ENREF_30)] |
| *COT1* | YOR316C | 2.5 mM copper(II) sulfate | [[31](#_ENREF_31)] |
| *CUE1* | YMR264W | nickel(2+) | [[25](#_ENREF_25)] |
| *DBF2* | YGR092W | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *DBF2* | YGR092W | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *DBF2* | YGR092W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *DBF2* | YGR092W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *DBF2* | YGR092W | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *DOA1* | YKL213C | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *DSK2* | YMR276W | 13 mM ZnSO4 zinc(2+) | [[32](#_ENREF_32)] |
| *GCS1* | YDL226C | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *GCS1* | YDL226C | 4 mM zinc dichloride | [[24](#_ENREF_24)] |
| *GCS1* | YDL226C | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *IES6* | YEL044W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *MGA2* | YIR033W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *MGA2* | YIR033W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *MNN11* | YJL183W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *MNN11* | YJL183W | 0.6 mM aluminium(3+) | [[33](#_ENREF_33)] |
| *MRS4* | YKR052C | 2.5 mM copper(II) sulfate | [[31](#_ENREF_31)] |
| *MRT4* | YKL009W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *NHX1* | YDR456W | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *NHX1* | YDR456W | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *NHX1* | YDR456W | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *NPT1* | YOR209C | 6 mM zinc dichloride | [[24](#_ENREF_24)] |
| *NUP170* | YBL079W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *NUP170* | YBL079W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *PEP3* | YLR148W | 13 mM ZnSO4 zinc(2+) | [[32](#_ENREF_32)] |
| *PEP3* | YLR148W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *PEP3* | YLR148W | 1000 µM zinc sulfate | [[34](#_ENREF_34)] |
| *PEP3* | YLR148W | 400 µM chromium trioxide | [[34](#_ENREF_34)] |
| *PEP3* | YLR148W | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *PEP3* | YLR148W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *PEP3* | YLR148W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *PHO80* | YOL001W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *PHO80* | YOL001W | 100 mM calcium dichloride | [[35](#_ENREF_35)] |
| *PHO80* | YOL001W | 0.5 M sodium chloride | [[35](#_ENREF_35)] |
| *PHO80* | YOL001W | 2 mM manganese(2+) | [[35](#_ENREF_35)] |
| *PHO80* | YOL001W | 10 mM copper(II) chloride | [[35](#_ENREF_35)] |
| *PHO80* | YOL001W | 3 mM zinc dichloride | [[35](#_ENREF_35)] |
| *PHO80* | YOL001W | 0.25 mM cobalt(2+) sulfate | [[35](#_ENREF_35)] |
| *PHO85* | YPL031C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *PHO85* | YPL031C | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *PHO85* | YPL031C | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *PHO85* | YPL031C | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *PHO85* | YPL031C | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *PHO85* | YPL031C | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *POP2* | YNR052C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *POP2* | YNR052C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *POP2* | YNR052C | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *POP2* | YNR052C | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *POP2* | YNR052C | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *POP2* | YNR052C | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *POP2* | YNR052C | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *POP2* | YNR052C | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *POP2* | YNR052C | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *RAD6* | YGL058W | cadmium(2+) | [[25](#_ENREF_25)] |
| *RAD6* | YGL058W | 25 mM tin dichloride (anh.) | [[36](#_ENREF_36)] |
| *RAD9* | YDR217C | 0.6-10 mM disodium selenite | [[37](#_ENREF_37)] |
| *RCY1* | YJL204C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *RCY1* | YJL204C | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *RCY1* | YJL204C | 4 mM zinc dichloride | [[24](#_ENREF_24)] |
| *RCY1* | YJL204C | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *RPL14A* | YKL006W | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *RPL14A* | YKL006W | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *RPL14A* | YKL006W | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *RPL14A* | YKL006W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *RPL14A* | YKL006W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *RPL22A* | YLR061W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *RPL6A* | YML073C | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *RPS6A* | YPL090C | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *SAC3* | YDR159W | nickel(2+) | [[25](#_ENREF_25)] |
| *SAM37* | YMR060C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *SAM37* | YMR060C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *SAM37* | YMR060C | nickel(2+) | [[25](#_ENREF_25)] |
| *SEC22* | YLR268W | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *SEC22* | YLR268W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *SEC22* | YLR268W | 4 mM zinc dichloride | [[24](#_ENREF_24)] |
| *SND2* | YLR065C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *SND2* | YLR065C | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *SNF1* | YDR477W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *SNF1* | YDR477W | 13 mM ZnSO4 zinc(2+) | [[32](#_ENREF_32)] |
| *SNF5* | YBR289W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *SNF5* | YBR289W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *SNF5* | YBR289W | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *SRN2* | YLR119W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *SWI3* | YJL176C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *SWI3* | YJL176C | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *SWI3* | YJL176C | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *SWI3* | YJL176C | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *SWI3* | YJL176C | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *SWI3* | YJL176C | 4 mM zinc dichloride | [[24](#_ENREF_24)] |
| *SWI3* | YJL176C | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *SWI3* | YJL176C | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *TLG2* | YOL018C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *TLG2* | YOL018C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *TLG2* | YOL018C | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *TLG2* | YOL018C | 13 mM ZnSO4 zinc(2+) | [[32](#_ENREF_32)] |
| *TLG2* | YOL018C | 0.6 mM aluminium(3+) | [[33](#_ENREF_33)] |
| *TLG2* | YOL018C | 6 mM zinc dichloride | [[24](#_ENREF_24)] |
| *TSA1* | YML028W | 5 mM ZnCl2 zinc(2+) | [[38](#_ENREF_38)] |
| *UBC7* | YMR022W | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *UBC7* | YMR022W | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *UBC7* | YMR022W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *UBC7* | YMR022W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *URE2* | YNL229C | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *URE2* | YNL229C | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *URE2* | YNL229C | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *VMA13* | YPR036W | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VMA13* | YPR036W | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *VMA13* | YPR036W | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *VMA13* | YPR036W | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *VMA13* | YPR036W | 1000 uM zinc sulfate | [[34](#_ENREF_34)] |
| *VMA13* | YPR036W | 400 uM chromium trioxide | [[34](#_ENREF_34)] |
| *VMA13* | YPR036W | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VMA13* | YPR036W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *VMA13* | YPR036W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *VMA13* | YPR036W | 2.5 mM copper(II) sulfate | [[31](#_ENREF_31)] |
| *VMA13* | YPR036W | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *VMA16* | YHR026W | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VMA16* | YHR026W | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *VMA16* | YHR026W | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *VMA16* | YHR026W | 1000 uM zinc sulfate | [[34](#_ENREF_34)] |
| *VMA16* | YHR026W | 400 uM chromium trioxide | [[34](#_ENREF_34)] |
| *VMA16* | YHR026W | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VMA16* | YHR026W | nickel(2+) | [[25](#_ENREF_25)] |
| *VMA2* | YBR127C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VMA2* | YBR127C | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *VMA2* | YBR127C | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *VMA2* | YBR127C | 25 µM AlCl3  aluminium ion | [[39](#_ENREF_39)] |
| *VMA2* | YBR127C | 1000 µM zinc sulfate | [[34](#_ENREF_34)] |
| *VMA2* | YBR127C | 400 µM chromium trioxide | [[34](#_ENREF_34)] |
| *VMA2* | YBR127C | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VMA2* | YBR127C | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *VMA2* | YBR127C | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *VMA2* | YBR127C | lead nitrate | [[40](#_ENREF_40)] |
| *VMA2* | YBR127C | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *VMA21* | YGR105W | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *VMA21* | YGR105W | 1000 µM zinc sulfate | [[34](#_ENREF_34)] |
| *VMA21* | YGR105W | 400 µM chromium trioxide | [[34](#_ENREF_34)] |
| *VMA21* | YGR105W | 0.6 mM aluminium(3+) | [[33](#_ENREF_33)] |
| *VMA21* | YGR105W | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VMA21* | YGR105W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *VMA21* | YGR105W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *VMA3* | YEL027W | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VMA3* | YEL027W | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *VMA3* | YEL027W | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *VMA3* | YEL027W | 1000 µM zinc sulfate | [[34](#_ENREF_34)] |
| *VMA3* | YEL027W | 400 µM chromium trioxide | [[34](#_ENREF_34)] |
| *VMA3* | YEL027W | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VMA3* | YEL027W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *VMA3* | YEL027W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *VMA3* | YEL027W | 4 mM zinc dichloride | [[26](#_ENREF_26)] |
| *VMA3* | YEL027W | lead nitrate | [[40](#_ENREF_40)] |
| *VMA5* | YKL080W | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VMA5* | YKL080W | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *VMA5* | YKL080W | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *VMA5* | YKL080W | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *VMA5* | YKL080W | 1000 uM zinc sulfate | [[34](#_ENREF_34)] |
| *VMA5* | YKL080W | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VMA5* | YKL080W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *VMA5* | YKL080W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *VMA5* | YKL080W | zinc(2+) | [[29](#_ENREF_29)] |
| *VMA5* | YKL080W | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *VPH1* | YOR270C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VPH1* | YOR270C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *VPH1* | YOR270C | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *VPH1* | YOR270C | 4 mM ZnCl2 zinc(2+) | [[41](#_ENREF_41)] |
| *VPH1* | YOR270C | 4 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VPH1* | YOR270C | nickel(2+) | [[25](#_ENREF_25)] |
| *VPH1* | YOR270C | lead nitrate | [[40](#_ENREF_40)] |
| *VPS1* | YKR001C | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *VPS1* | YKR001C | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *VPS13* | YLL040C | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *VPS16* | YPL045W | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VPS16* | YPL045W | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *VPS16* | YPL045W | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *VPS16* | YPL045W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *VPS16* | YPL045W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *VPS16* | YPL045W | 400 µM chromium trioxide | [[34](#_ENREF_34)] |
| *VPS16* | YPL045W | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VPS16* | YPL045W | 50 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *VPS16* | YPL045W | 2.5 mM nickel(2+) | [[25](#_ENREF_25)] |
| *VPS16* | YPL045W | 4 mM zinc dichloride | [[26](#_ENREF_26)] |
| *VPS16* | YPL045W | lead nitrate | [[40](#_ENREF_40)] |
| *VPS24* | YKL041W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *VPS24* | YKL041W | 6 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VPS24* | YKL041W | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *VPS28* | YPL065W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *VPS28* | YPL065W | 40 µM cadmium(2+) | [[25](#_ENREF_25)] |
| *VPS3* | YDR495C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VPS3* | YDR495C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *VPS3* | YDR495C | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *VPS3* | YDR495C | 6 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VPS4* | YPR173C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VPS4* | YPR173C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *VPS4* | YPR173C | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *VPS4* | YPR173C | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *VPS45* | YGL095C | 13 mM ZnSO4 zinc(2+) | [[32](#_ENREF_32)] |
| *VPS45* | YGL095C | 0.4 mM aluminium(3+) | [[33](#_ENREF_33)] |
| *VPS45* | YGL095C | 4 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VPS45* | YGL095C | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *VPS5* | YOR069W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *VPS51* | YKR020W | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VPS51* | YKR020W | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *VPS51* | YKR020W | 12 mM manganese(2+) | [[27](#_ENREF_27)] |
| *VPS51* | YKR020W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *VPS51* | YKR020W | 0.6 mM aluminium(3+) | [[33](#_ENREF_33)] |
| *VPS51* | YKR020W | 4 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VPS51* | YKR020W | cadmium(2+) | [[25](#_ENREF_25)] |
| *VPS60* | YDR486C | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *VPS60* | YDR486C | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *VPS65* | YLR322W | 4 mM zinc dichloride | [[24](#_ENREF_24)] |
| *VPS65* | YLR322W | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *VPS9* | YML097C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *VPS9* | YML097C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *VPS9* | YML097C | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *VPS9* | YML097C | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *VRP1* | YLR337C | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *VRP1* | YLR337C | 400 µM chromium trioxide | [[34](#_ENREF_34)] |
| *YAP1* | YML007W | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *YAP1* | YML007W | 2-8 mM disodium selenite | [[37](#_ENREF_37)] |
| *YAP1* | YML007W | 25 mM tin dichloride (anh.) | [[36](#_ENREF_36)] |
| *YAP1* | YML007W | mercury dichloride | [[42](#_ENREF_42)] |
| *YAP1* | YML007W | 100 µM cadmium sulfate | [[43](#_ENREF_43)] |
| *YAP1* | YML007W | 10 mM ZnCl2 zinc(2+) | [[43](#_ENREF_43)] |
| *YCL007C* | YCL007C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *YCL007C* | YCL007C | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *YCL007C* | YCL007C | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *YCL007C* | YCL007C | 55 µM cadmium dichloride | [[3](#_ENREF_3)] |
| *YCL007C* | YCL007C | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *YDR442W* | YDR442W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *YKL118W* | YKL118W | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *YKL118W* | YKL118W | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *YKL118W* | YKL118W | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *YKL118W* | YKL118W | 2 mM zinc dichloride | [[24](#_ENREF_24)] |
| *YKL118W* | YKL118W | 10 mM manganese(2+) | [[29](#_ENREF_29)] |
| *YNL296W* | YNL296W | 100 µM cadmium dichloride | [[20](#_ENREF_20)] |
| *YNL296W* | YNL296W | 1000 µM zinc sulfate | [[34](#_ENREF_34)] |
| *YNL296W* | YNL296W | 6 mM zinc dichloride | [[24](#_ENREF_24)] |
| *YOR062C* | YOR062C | 2.5 mM copper(II) sulfate | [[31](#_ENREF_31)] |
| *YOR331C* | YOR331C | 7 mM ZnCl2 zinc(2+) | [[22](#_ENREF_22)] |
| *YOR331C* | YOR331C | 2.5 mM CoCl2 cobalt(2+) | [[22](#_ENREF_22)] |
| *YOR331C* | YOR331C | 4 mM MnCl2 manganese(2+) | [[22](#_ENREF_22)] |
| *YOR331C* | YOR331C | 3 mM NiCl2 nickel(2+) | [[22](#_ENREF_22)] |
| *YOR331C* | YOR331C | 1000 µM zinc sulfate | [[34](#_ENREF_34)] |
| *YOR331C* | YOR331C | 400 µM chromium trioxide | [[34](#_ENREF_34)] |
| *YOR331C* | YOR331C | 2 mM zinc dichloride | [[24](#_ENREF_24)] |

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**Supplementary Figures**

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**Figure S1.** Increased intracellular cobalt content of 30 cobalt-sensitive gene mutants in response to cobalt stress for 2 h (A) and the rest 52 cobalt-sensitive gene mutants in response to cobalt stress for 12 h (B). Log-phase cells were cultured with 1 mM CoCl2 for 2 h or 12 h before harvesting and measurement of intracellular cobalt content. The relative cobalt content of these cobalt-sensitive mutants is normalized against wild-type BY4743 cells (given an arbitrary value of 1). Results are the average of three independent assays for each strain. Bars indicate SD. Bars in (A) show P< 0.01 for the comparison of the intracellular cobalt content between each mutants and the wild type strain.



**Figure S2.** Increased intracellular ROS levels of cobalt-sensitive gene mutants in response to cobalt stress for 2 h. Log-phase cells were grown with or without 1 mM CoCl2 for 2 h before harvesting and measurement of intracellular ROS levels using dihydroethidium. Results are averages of three independent assays for each strain. Bars indicate SD, P< 0.01 for the comparison the intracellular ROS level of each mutant grown with or without 1 mM CoCl2 for 2 h.



**Figure S3.** β-galactosidase activities of UPRE-lacZ in wild-type (WT) and tunicamycin-sensitive mutant cells subjected to cobalt stress. Results are averages of six independent assays for each strain. The asterisks of “\*”and “\*\*” show statistically significant differences of P< 0.05 and P< 0.01, respectively.



**Figure S4.** Intracellular cobalt content (A) and ROS levels (B) of cobalt-tolerant gene mutants in response to cobalt stress. Log-phase cells were grown with or without 1 mM CoCl2 for 12 h before harvesting and measurement of intracellular cobalt and ROS levels. Results are averages of three independent assays for each strain. Bars indicate SD. The asterisks of “\*”and “\*\*” show statistically significant differences of P< 0.05 and P< 0.01, respectively.



**Figure S5.** Heatmap of the top 12 enriched GO terms across gene list shared by the two clusters of ROS level and Cobalt content-increased, coloured by -log 10 *p*-value. The dominant term within each group is used as a group heading.

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**Figure S6.** List of the growth phenotypes of strains that are sensitive to other the metals in addition to cobalt.