E. coli genotypes

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Nomenclature & Abbreviations

A listed gene name means that gene carries a loss of function mutation, a Δ preceding a gene name means the gene is deleted. If a gene is not listed, it is not known to be mutated. Prophages present in wt K-12 strains (F, λ, e14, rac) are listed only if absent. E. coli B strains are naturally lon- and dcm-.

- F^- = Does not carry the F plasmid
- F^+ = Carries the F plasmid. The cell is able to mate with F^- through conjugation.
- F'[ ] = Carries an F plasmid that has host chromosomal genes on it from a previous recombination event. This cell can also mate with F^- through conjugation. Chromosomal genes carried in the F plasmid are listed in brackets.
- $r_{B/K}^{+/-}$ = The (B/K) defines the strain lineage. The +/- indicates whether the strain has or hasn't got the restriction system.
- $m_{B/K}^{+/-}$ = The (B/K) defines the strain lineage. The +/- indicates whether the strain has or hasn't got the modification (methylation) system.
- hsdS = Both restriction and methylation of certain sequences is deleted from the strain. If you transform DNA from such a strain into a wild type strain, it will be degraded.
- hsdR = For efficient transformation of cloned unmethylated DNA from PCR amplifications
- INV( ) = chromosomal inversion between locations indicated
- ahpC = mutation to alkyl hydroperoxide reductase conferring disulfide reductase activity
- ara-14 = cannot metabolize arabinose
- araD = mutation in L-ribulose-phosphate 4-epimerase blocks arabinose metabolism
- cycA = mutation in alanine transporter; cannot use alanine as a carbon source
- dapD = mutation in succinyl diaminopimelate aminotransferase leads to succinate or (lysine + methionine) requirement
- Δ( ) = chromosomal deletion of genes between the listed genes (may include unlisted genes!)

- dam = adenine methylation at GATC sequences exist; high recombination efficiency; DNA repair turned on
- dcm = cytosine methylation at second C of CCWGG sites exist. dam & dcm are the default properties and always elided, while dam^- or dcm^- should be declare explicitly
- deoR = regulatory gene that allows constitutive expression of deoxyribose synthesis genes; permits uptake of large plasmids. See Hanahan D, US Patent 4,851,348. ***This has been called into question, as the DH10B genome sequence revealed that it is $deoR^+$. See Durfee08, PMID 18245285.
- dnaJ = one of the chaparonins inactivated; stabilizes some mutant proteins
- dut1 = dUTPase activity abolished, leading to increased dUTP concentrations, allowing uracil instead of thymine incorporation in DNA. Stable U incorporation requires ung gene mutation as well.
- endA1 = For cleaner preparations of DNA and better results in downstream applications due to the elimination of non-specific digestion by Endonuclease I
- (e14) = excisable prophage like element containing mcrA gene; present in K-12 but missing in many other strains
- galE = mutations are associated with high competence, increased resistance to phage P1 infection, and 2-deoxygalactose resistance. galE mutations block the production of UDP-galactose, resulting in truncation of LPS glycans to the minimal, "inner core". The exceptional competence of DH10B/ TOP10 is thought to be a result of a reduced interference from LPS in the binding and/or uptake of transforming DNA. galE15 is a point mutation resulting in a Ser123 -> Phe conversion near the enzyme's active site. See van Die, et al. PMID 6373734, Hanahan, et al. PMID 1943786, and EcoSal ISBN 1555811647. --Dcekiert 16:56, 23 January 2008 (CST)
- galk = mutants cannot metabolize galactose and are resistant to 2-deoxygalactose. galK16 is an IS2 insertion ~170bp downstream of the galK start codon. See EcoSal ISBN 1555811647. --Dcekiert 16:56, 23 January 2008 (CST)
- galU = mutants cannot metabolize galactose
- gor = mutation in glutathione reductase; enhances disulphide bond formation
- glnV = suppression of amber (UAG) stop codons by insertion of glutamine; required for some phage growth
- gyrA96 = mutation in DNA gyrase; conveys nalidixic acid resistance
- gyrA462 = mutation in DNA gyrase; conveys resistance to ccdB colicin gene product
- hflA150 = protease mutation stabilizing phage cII protein; high frequency of lysogenization by λ
- Δ (lac)X74 = Deletion of the entire *lac* operon as well as some flanking DNA (complete deletion is Δ cod-mhpF; see Mol.Micro., 6:1335, and J.Bact., 179:2573)
- $lacI^q$ or $lacI^Q$ = overproduction of the lac repressor protein; -35 site in promoter upstream of *lacI* is mutated from GCGCAA to GTGCAA
- $lacI^{Q1}$ = overproduction of the lac repressor protein; contains a 15 bp deletion to create optimal -35 site in promoter upstream of *lacI*
- lacY = deficient in lactose transport; deletion of lactose permease (M protein)
- lacZ Δ M15 = partial deletion of the lacZ gene that allows α complementation of the β -galactosidase gene; required for blue/white selection on XGal plates. Deletes the amino portion of lacZ (aa 11-41).

- leuB = requires leucine
- Δ lon = deletion of the lon protease
- malA = cannot metabolize maltose
- mcrA = Mutation eliminating restriction of DNA methylated at the sequence C^mCGG (possibly ^mCG). Carried on the e14 prophage (q.v.)
- mcrB = Mutation eliminating restriction of DNA methylated at the sequence R^mC
- metB = requires methionine
- metC = requires methionine
- mrr = Mutation eliminating restriction of DNA methylated at the sequence C^mAG or G^mAC
- mtlA = cannot metabilize mannitol
- (Mu) = Mu prophage present. Mu δ means the phage is defective.
- mutS - mutation inhibits DNA repair of mismatches in unmethylated newly synthesized strands
- nupG = same as deoR
- ompT = mutation in outer membrane protein protease VII, reducing proteolysis of expressed proteins
- (P1) = Cell carries a P1 prophage. Cells express the P1 restriction system.
- (P2) = Cell carries a P2 prophage. Allows selection against Red+ Gam+ λ
- (φ80) = Cell carries the lambdoid prophage φ80. A defective version of this phage carrying lacZM15 deletion (as well as wild-type lacI, lacYA, and flanking sequences) is present in some strains. The φ80 attachment site is just adjacent to tonB.
- pLysS = contains pLysS plasmid carrying chloramphenicol resistance and phage T7 lysozyme, effective at attenuating activity of T7 RNA polymerase, for better inhibition of expression under non-induced conditions. The sequence can be found here.
- proA/B = requires proline
- recA1 = For reduced occurrence of unwanted recombination in cloned DNA; cells UV sensitive, deficient in DNA repair
- recA13 = as for recA1, but inserts less stable.
- recBCD = Exonuclease V; mutation in RecB or RecC reduces general recombination by a factor of 100; impaired DNA repair; UV sensitive, easier propagation of inverted repeats
- recJ Exonuclease involved in alternate recombination
- relA = relaxed phenotype; permits RNA synthesis in absence of protein synthesis
- rha = blocked rhamose metabolism
- rnc = encodes RnaseIII (rnc-14 is a common null mutant)
- rne = encodes RnaseE (rne-3071 is a common temperature sensitive mutant)
- rpsL = mutation in ribosomal protein S12 conveying streptomycin resistance; also called strA
- sbcBC = ExoI activity abolished; usually present in recBC strains; recombination proficient, stable inverted repeats
- sr1 = cannot metabolize sorbitol
- supE = glnV
- supF = tyrT

- thi = requires thiamine
- thyA = requires thymidine
- Tn10 = transposon normally carrying Tetracycline resistance
- Tn5 = transposon normally carrying Kanamycin resistance
- tonA = Mutation in outer membrane protein conveying resistance to phage T1 and phage T5
- traD = Mutation eliminating transfer factor; prevents transfer of F plasmid
- trxB = mutation in thioredoxin reductase; enhances disulphide bond formation in the cytoplasm
- tsx = outer membrane protein mutation conveying resistance to phage T6 and colicin K
- tyrT = suppression of amber (UAG) stop codons by insertion of tyrosine; needed for some phage infection such as λ gt11.
- ung1 = allows uracil to exist in plasmid DNA
- xyl-5 = blocked xylose metabolism

- Sm^R = Streptomycin resistance

Methylation Issues in *E. coli*

- Type I methylation systems:
  - *E. coli* K-12 restricts DNA which is not protected by adenine methylation at sites $AA^*C[N_6]GTGC$ or $GCA^*C[N_6]GTT$, encoded by the hsdRMS genes(EcoKI). Deletions in these genes removes either the restriction or methylation or both of these functions.
  - *E. coli* B derivative strains contain an hsdRMS system (EcoBI) restricting and protectiing the sequence $TGA^*[N_8]TGCT$ or $AGCA^*[N_8]TCA$.
- The mcrA gene (carried on the e14 prophage) restricts DNA which is methylated in C^mCWGG or ^mCG sequences (methylation by the dcm gene product).
- The mcrBC genes restrict R^mC sequences.
- The mrr gene product restricts adenine methylated sequences at CAG or GAC sites.
- E. coli methylates the adenine in GATC (and the corresponding A on the opposite strand) with the dam gene product.
- M.EcoKII methylates the first A at the palindromic site ATGCAT (as well as the corresponding A on the opposite strand), see (Kossykh VG (2004) J. Bact 186: 2061-2067 PMID 15028690) Note that this article has been retracted; the retraction appears to center on textual plagarism, not experimental results. The homology to AvaIII is real. I think I believe it. tk 20:28, 9 December 2005 (EST). Rich Roberts reports: "We have tried ourselves to detect activity with this gene product and cannot detect any methyltransferase activity. In our case we used antibodies able to detect N6-methyladenine or N4 methylcytosine in DNA. The ones we have are very sensitive and should have been able to detect 5 methyl groups in the whole E. coli chromosome. Nothing was detected in an over expressing strain."
- For additional information see E. coli restriction-modification system and the NEB technical

information on methylation.

Commonly used strains

AG1

endA1 recA1 gyrA96 thi-1 relA1 glnV44 hsdR17(r_K^- m_K^+)

AB1157

thr-1, araC14, leuB6(Am), Δ (gpt-proA)62, lacY1, tsx-33, qsr'-0, glnV44(AS), galK2(Oc), LAM-, Rac-0, hisG4(Oc), rfbC1, mgl-51, rpoS396(Am), rpsL31(strR), kdgK51, xylA5, mtl-1, argE3(Oc), thi-1

- Bachmann BJ: Derivation and genotypes of some mutant derivatives of Escherichia coli K-12.

Escherichia coli and Salmonella typhimurium. Cellular and Molecular Biology (Edited by: F C Neidhardt J L Ingraham KB Low B Magasanik M Schaechter H E Umbarger). Washington, D.C., American Society for Microbiology 1987, 2:1190-1219.
See CGSC#1157

BL21

E. coli B F- *dcm ompT hsdS*(r_B^- m_B^-) gal [$malB^+$]$_{K-12}$(λ^S)

- The "malB region" was transduced in from the K-12 strain W3110 to make the strain Mal^+ λ^S. See Studier et al. (2009) J. Mol. Biol. 394(4), 653 for a discussion of the extent of the transfer.
- Stratagene E. coli Genotype Strains

BL21(AI)

F^- ompT gal dcm lon $hsdS_B$(r_B^- m_B^-) araB::T7RNAP-tetA

- an *E. coli* B strain carrying the T7 RNA polymerase gene in the *araB* locus of the *araBAD* operonq.
- Transformed plasmids containing T7 promoter driven expression are repressed until L-arabinose induction of T7 RNA polymerase.
- Derived from BL21.
- See the product page for more information.

BL21(DE3)

F $^-$ ompT gal dcm lon hsdS$_B$(r$_B^-$ m$_B^-$) λ (DE3 [lacI lacUV5-T7 gene 1 ind1 sam7 nin5])

- an *E. coli* B strain with DE3, a λ prophage carrying the T7 RNA polymerase gene and lacI^q
- Transformed plasmids containing T7 promoter driven expression are repressed until IPTG induction of T7 RNA polymerase from a lac promoter.
- Derived from B834 (Wood, 1966) by transducing to Met$^+$.
- See the original Studier paper or the summary in Methods in Enzymology for more details.
- Whole genome sequence available [1]

BL21 (DE3) pLysS

F$^-$ ompT gal dcm lon hsdS$_B$(r$_B^-$ m$_B^-$) λ (DE3) pLysS(cm^R)

- pLysS plasmid chloramphenicol resistant; grow with chloramphenicol to retain plasmid
- Chloramphenicol resistant
- The pLysS plasmid encodes T7 phage lysozyme, an inhibitor for T7 polymerase which reduces and almost eliminates expression from transformed T7 promoter containing plasmids when not induced.
- see Moffatt87 for details of pLysS and pLysE plasmids

BNN93

F$^-$ tonA21 thi-1 thr-1 leuB6 lacY1 glnV44 rfbC1 fhuA1 mcrB e14-(mcrA$^-$) hsdR(r$_K^-$m$_K^+$) λ$^-$

- Some C600 strains are really BNN93

BNN97

- BNN93 (λ gt11)
  - A λ gt11 lysogen producing phage at 42C

BW26434, CGSC Strain # 7658

Δ (araD-araB)567, Δ (lacA-lacZ)514(::kan), lacIp-4000(lacI^q), λ$^-$, rpoS396(Am)?, rph-1, Δ (rhaD-rhaB) 568, hsdR514

- This information is from a printout sent by the *E. coli* Genetic Stock Center with the strain.

- B.L. Wanner strain
- rph-1 is a 1bp deletion that results in a frameshift over last 15 codons and has a polar effect on pyrE leading to suboptimal pyrimidine levels on minimal medium. (Jensen 1993 J Bact. 175:3401)
- Δ(araD-araB)567 was formerly called $\Delta araBAD_{AH33}$ by Datsenko and Wanner
- Am = amber(UAG) mutation
- Reference: Datsenko and Wanner, 2000, PNAS, 97:6640

NOTE:

- This promoter driving the expression of lacI was sequenced in this strain using a primer in mhpR (upstream of lacI) and a primer in the opposite orientation in lacI. The lac promoter was found to be identical to wildtype. Thus, the -35 sequence was GCGCAA not GTGCAA as expected with $lacI^q$. Therefore this strain (or at least the version obtained from the *E. coli* Genetic Stock Center) does NOT appear to be $lacI^q$. According to Barry Wanner, this is an unexpected result. -Reshma 13:19, 5 May 2005 (EDT)
- "We have now confirmed that BW25113, BW25141, and BW26434 are all $lacI^+$, and not $lacI^q$. We thank you for alerting us to the error with respect to BW26434. Apparently, the lacI region was restored to wild-type in a predecessor of BW25113." (from Barry Wanner November 18, 2005)
- The genotype has been corrected at the CGSC

C600

F^- tonA21 thi-1 thr-1 leuB6 lacY1 glnV44 rfbC1 fhuA1 λ^-

- There are strains circulating with both e14+($mcrA^+$) and e14-($mcrA^-$)
- General purpose host
- See CGSC#3004
- References: Appleyard, R.K. (1954) Genetics 39, 440; Hanahan, D. (1983) J. Mol. Biol. 166, 577.

C600 hflA150 (Y1073, BNN102)

F^- thi-1 thr-1 leuB6 lacY1 tonA21 glnV44 λ^- hflA150(chr::Tn10)

- host for repressing plaques of λ gt10 when establishing cDNA libraries
- Reference Young R.A. and Davis, R. (1983) Proc. Natl. Acad. Sci. USA 80, 1194.
- Tetracycline resistance from the Tn10 insertion

CSH50

F^- λ^- ara Δ(lac-pro) rpsL thi fimE::IS1

- See CGSC#8085
- References: Miller, J.H. 1972. Expts.in Molec.Genetics, CSH 0:14-0; Blomfeld et al., J.Bact. 173: 5298-5307, 1991.

D1210

HB101 $lacI^q$ $lacY^+$

DB3.1

F- gyrA462 endA1 glnV44 Δ (sr1-recA) mcrB mrr hsdS20(r_B^-, m_B^-) ara14 galK2 lacY1 proA2 rpsL20(Sm^r) xyl5 Δ leu mtl1

- useful for propagating plasmids containing the ccdB operon.
- gyrA462 enables ccdB containing plasmid propagation
- streptomycin resistant
- appears to NOT contain lacI (based on a colony PCR) --Austin Che 16:16, 18 June 2007 (EDT)

1. Bernard P and Couturier M. *Cell killing by the F plasmid CcdB protein involves poisoning of DNA-topoisomerase II complexes.* J Mol Biol 1992 Aug 5; 226(3) 735-45. pmid:1324324. PubMed HubMed [Bernard-JMolBiol-1992]
2. Miki T, Park JA, Nagao K, Murayama N, and Horiuchi T. *Control of segregation of chromosomal DNA by sex factor F in Escherichia coli. Mutants of DNA gyrase subunit A suppress letD (ccdB) product growth inhibition.* J Mol Biol 1992 May 5; 225(1) 39-52. pmid:1316444. PubMed HubMed [Miki-JMolBiol-1992]

All Medline abstracts: PubMed HubMed

DH1

endA1 recA1 gyrA96 thi-1 glnV44 relA1 hsdR17(r_K^- m_K^+) λ -

- parent of DH5 α
- An Hoffman-Berling 1100 strain derivative (Meselson68)
- more efficient at transforming large (40-60Kb) plasmids
- nalidixic acid resistant
- Reference: Meselson M. and Yuan R. (1968) Nature 217:1110 PMID 4868368.

DH5 α

F- endA1 glnV44 thi-1 recA1 relA1 gyrA96 deoR nupG Φ80d*lacZ*Δ M15 Δ (*lacZYA-argF*)U169, hsdR17 (r_K^- m_K^+), λ –

- An Hoffman-Berling 1100 strain derivative (Meselson68)
- Promega also lists phoA
- nalidixic acid resistant
- References:
  - FOCUS (1986) 8:2, 9.
  - Hanahan, D. (1985) in DNA Cloning: A Practical Approach (Glover, D.M., ed.), Vol. 1, p. 109, IRL Press, McLean, Virginia.
  - Grant, S.G.N. et al. (1990) Proc. Natl. Acad. Sci. USA 87: 4645-4649 PMID 2162051.
  - Meselson M. and Yuan R. (1968) Nature 217:1110 PMID 4868368.

DH10B (Invitrogen)

F- endA1 recA1 galE15 galK16 nupG rpsL Δ lacX74 Φ80lacZ Δ M15 araD139 Δ (ara,leu)7697 mcrA Δ (mrr-hsdRMS-mcrBC) λ -

- suitable for cloning methylated cytosine or adenine containing DNA
- an MC1061 derivative (Casadaban80). Prepare cells for chemical transformation with CCMB80 buffer
- blue/white selection
- While DH10B has been classically reported to be galU galK, the preliminary genome sequence for DH10B indicates that DH10B (and by their lineage also TOP10 and any other MC1061 derivatives) is actually galE galK galU+. Dcekiert 16:37, 23 January 2008 (CST)
- Genome sequence indicates that DH10B is actually deoR+. Presumably TOP10 and MC1061 are also deoR+.
- Streptomycin resistant
- References:
  - Casdaban, M. and Cohen, S. (1980) J Mol Biol 138:179 PMID 6997493.
  - Grant, S.G.N. et al. (1990) Proc. Natl. Acad. Sci. USA 87: 4645-4649 PMID 2162051.
  - E. coli Genetic Stock Center, MC1061 Record
  - DH10B Genome Sequencing Project, Baylor College of Medicine
  - Complete sequence is available, see Durfee08, PMID 18245285.

DH12S (Invitrogen)

mcrA Δ (mrr-hsdRMS-mcrBC) φ80d lacZ Δ M15 Δ lacX74 recA1 deoR Δ (ara, leu)7697 araD139 galU

galK rpsL F' [proAB^{+} lacI^{q}Z Δ M15]

- host for phagemid and M13 vectors
- useful for generating genomic libraries containing methylated cytosine or adenine residues
- streptomycin resistant
- References: Lin, J.J., Smith, M., Jessee, J., and Bloom, F. (1991) FOCUS 13, 96.; Lin, J.J., Smith, M., Jessee, J., and Bloom, F. (1992) BioTechniques 12, 718.

DM1 (Invitrogen)

F- dam-13::Tn9(Cm^{R}) dcm- mcrB hsdR-M+ gal1 gal2 ara- lac- thr- leu- tonR tsxR Su0

- Host for pBR322 and other non-pUC19 plasmids; useful for generating plasmids that can be cleaved with dam and dcm sensitive enzymes
- Chloramphenicol resistant
- Promega lists as F' not F-
- Reference: Lorow-Murray D and Bloom F (1991) Focus 13:20

E. cloni(r) 5alpha (Lucigen)

fhuA2 Δ *(argF-lacZ)U169 phoA glnV44* Φ *80* Δ *(lacZ)M15 gyrA96 recA1 relA1 endA1 thi-1 hsdR17*

- Common cloning strain.

E. cloni(r) 10G (Lucigen)

F- *mcrA* Δ (*mrr-hsd*RMS-*mcr*BC) *end*A1 *rec*A1 Φ80*dlac*Z Δ M15 Δ *lac*X74 *ara*D139 Δ (*ara,leu*)7697 *gal*U *gal*K *rps*L *nup*G λ - *ton*A

- Common cloning strain.
- Resistant to phage T1.

E. cloni(r) 10GF' (Lucigen)

[F ´ *pro* A+B+ *lac*IqZ Δ M15::Tn10 (TetR)] /*mcr*A Δ (*mrr-hsd*RMS-*mcr*BC) *end*A1 *rec*A1 Φ80d*lac*Z Δ M15 Δ *lac*X74 *ara*D139 Δ (*ara, leu*)7697 *gal*U *gal*K *rps*L *nup*G λ *ton*A

- Strain for cloning and single-strand DNA production.

E. coli K12 ER2738 (NEB)

F ´ proA+B+ lacIq Δ(lacZ)M15 zzf::Tn10(TetR)/ fhuA2 glnV Δ(lac-proAB) thi-1 Δ(hsdS-mcrB)5

- Phage propagation strain
- Also available from Lucigen Corporation.

ER2566 (NEB)

F- λ - fhuA2 [lon] ompT lacZ::T7 gene 1 gal sulA11 Δ(mcrC-mrr)114::IS10 R(mcr-73::miniTn10-TetS)2 R(zgb-210::Tn10)(TetS) endA1 [dcm]

- Host strain for the expression of a target gene cloned in the pTYB vectors.
- Carry a chromosomal copy of the T7 RNA polymerase gene inserted into *lacZ* gene and thus under the control of the lac promoter. In the absence of IPTG induction expression of T7 RNA polymerase is suppressed by the binding of *lac* I repressor to the *lac* promoter.
- Deficient in both *lon* and *ompT* proteases.

ER2267 (NEB)

F ´ proA+B+ lacIq Δ(lacZ)M15 zzf::mini-Tn10 (KanR)/ Δ(argF-lacZ)U169 glnV44 e14-(McrA-) rfbD1? recA1 relA1? endA1 spoT1? thi-1 Δ(mcrC-mrr)114::IS10

- Commonly used for titering M13 phage because of the strain's F' plasmid, which carries KanR, and its slow growth, which promotes easy visualization of plaques.

HB101

F^- mcrB mrr hsdS20(r_B^- m_B^-) recA13 leuB6 ara-14 proA2 lacY1 galK2 xyl-5 mtl-1 rpsL20(Sm^R) glnV44 λ -

Please note that different sources have different genotypes so treat this information with caution.

- From a GIBCO BRL list of competent cells.

- Hybrid of E. coli K12 and E. coli B (but 98% K strain AB266 according to Smith *et al.*)
- Host for pBR322 and many plasmids
- Sigma lists the deletion Δ(gpt,proA). Check this.
- Promega does not list F-, mcrB, or mrr
- Streptomycin resistant
- References:
    - Boyer, H.W. and Roulland-Dussoix, D. (1969) J. Mol. Biol. 41, 459.
    - Smith, M., Lorow, D., and Jessee, J. (1989) FOCUS 11, 56 - pdf version from Invitrogen

- Lacks S and Greenberg JR (1977) J Mol Biol 114:153.

HMS174(DE3)

F- recA1 hsdR(rK12- mK12+) (DE3) (Rif R)

- HMS174 strains provide the recA mutation in a K-12 background. Like BLR, these strains may stabilize certain target genes whose products may cause the loss of the DE3 prophage.
- DE3 indicates that the host is a lysogen of lDE3, and therefore carries a chromosomal copy of the T7 RNA polymerase gene under control of the lacUV5 promoter. Such strains are suitable for production of protein from target genes cloned in pET vectors by induction with IPTG.

High-Control(tm) BL21(DE3) (Lucigen)

F $^-$ ompT gal dcm hsdS_B(r_B^- m_B^-) (DE3)/Mini-F *lacI*^{q1}(Gent^r)

- The HI-Control BL21(DE3) cells contain a single-copy BAC plasmid harboring a specially engineered version of the *lacI*^{q1} repressor allele. The *lacI*^{q1} allele expresses ~170-fold more lac repressor protein than the wild-type *lacI* gene.
- The increased pool of lac repressor in HI-Control BL21(DE3) cells maintains tight control over the expression of T7 RNA polymerase from the lacUV5 promoter, reducing leaky expression of genes cloned under a T7 promoter.
- an *E. coli* B strain with DE3, a λ prophage carrying the T7 RNA polymerase gene and lacI^q
- Transformed plasmids containing T7 promoter driven expression are repressed until IPTG induction of T7 RNA polymerase from a lac promoter.

High-Control(tm) 10G (Lucigen)

F- *mcrA* Δ(*mrr-hsd*RMS-*mcr*BC) *end*A1 *rec*A1 Φ80*dlac*Z Δ M15 Δ *lac*X74 *ara*D139 Δ(*ara,leu*)7697 *gal*U *gal*K *rps*L *nup*G λ - *ton*A/Mini-F *lacI*^{q1}(Gent^r)

- The HI-Control 10G cells contain a single-copy BAC plasmid harboring a specially engineered version of the *lacI*^{q1} repressor allele. The *lacI*^{q1} allele expresses ~170-fold more lac repressor protein than the wild-type *lacI* gene.
- For stable cloning of T7 protein expression plasmids.
- Resistant to phage T1.

IJ1126

E. coli K-12 recB21 recC22 sbcA5 endA gal thi Su+ Δ (mcrC-mrr)102::Tn10
See Endy:IJ1126

IJ1127

IJ1126 lacUV5 lacZ::T7 gene1-Knr
See Endy:IJ1127

JM83

rpsL ara Δ (lac-proAB) Φ80dlacZ Δ M15

- Sigma lists thi. Check this.
- streptomycin resistant

JM101

glnV44 thi-1 Δ (lac-proAB) F'[lacIqZ Δ M15 traD36 proAB+]

- host for M13mp vectors
- recA+, r_K^+
- original blue/white cloning strain
- has all wt restriction systems
- References: Messing, J. et al. (1981) Nucleic Acids Res. 9, 309; Yanisch-Perron, C., Vieira, J., and Messing, J. (1985) Gene 33, 103.

JM103

endA1 glnV44 sbcBC rpsL thi-1 Δ (lac-proAB) F'[traD36 proAB+ lacIq lacZ Δ M15]

- streptomycin resistant
- References: Hanahan, D. (1983) J. Mol. Biol. 166:557-80.
- NEB says this strain encodes a prophage encoded EcoP1 endonuclease.
- Sigma lists (P1) ($r_K^-m_K^+$ rP1+ mP1+)

JM105

endA1 glnV44 sbcB15 rpsL thi-1 Δ (lac-proAB) [F' traD36 proAB+ lacIq lacZ Δ M15] hsdR4($r_K^-m_K^+$)

- Sigma lists sbcC
- streptomycin resistant
- References: Yanisch-Perron, C., Vieira, J., and Messing, J. (1985) Gene 33, 103.

JM106

endA1 glnV44 thi-1 relA1 gyrA96 Δ (lac-proAB) F^- hsdR17($r_K^-m_K^+$)

- References: Yanisch-Perron, C., Vieira, J., and Messing, J. (1985) Gene 33, 103.

JM107

endA1 glnV44 thi-1 relA1 gyrA96 Δ (lac-proAB) [F' traD36 $proAB^+$ $lacI^q$ lacZ Δ M15] hsdR17(R_K^- m_K^+) λ -

- host for M13mp vectors
- recA+, r_K+
- Sigma lists e14- (McrA-)
- nalidixic acid resistant
- References: Yanisch-Perron, C., Vieira, J., and Messing, J. (1985) Gene 33, 103.

JM108

endA1 recA1 gyrA96 thi-1 relA1 glnV44 Δ (lac-proAB) hsdR17 (r_K^- m_K^+)

- nalidixic acid resistant
- deficient in expression of the lon protease due to IS186 transposon insertion -- J Mairhofer 18:59, 24 March 2010 (CET)

3. Mairhofer J, Cserjan-Puschmann M, Striedner G, Nöbauer K, Razzazi-Fazeli E, and Grabherr R. *Marker-free plasmids for gene therapeutic applications--lack of antibiotic resistance gene substantially improves the manufacturing process.* J Biotechnol 2010 Apr 1; 146(3) 130-7. doi:10.1016/j.jbiotec.2010.01.025 pmid:20138928. PubMed HubMed [Reference]

JM109

endA1 glnV44 thi-1 relA1 gyrA96 recA1 $mcrB^+$ Δ (lac-proAB) e14- [F' traD36 $proAB^+$ $lacI^q$ lacZ Δ M15] hsdR17($r_K^-m_K^+$)

- From NEB
- Partly restriction-deficient; good strain for cloning repetitive DNA (RecA $^-$).
- Suppresses many amber mutations when glutamine is acceptable but not the S_{100} or S_7 mutations of λ , e.g., λ gt11.
- Can also be used for M13 cloning/sequencing and blue/white screening.
- Sigma lists e14-
- nalidixic acid resistant
- deficient in expression of the lon protease due to IS186 transposon insertion -- J Mairhofer 18:59, 24 March 2010 (CET)
- From C. Yanisch-Perron, J. Vieira, and J. Messing. Improved M13 phage cloning vectors and host strains: nucleotide sequences of the M13mp18 and pUC19 vectors. *Gene*, 33(1):103 – 19, 1985.
- Some information from Mary Berlyn at the *E. coli* Genetic Stock Center: One of the reasons the original curator of this collection did not accession the JM109, JM103, etc. strains was because she found it impossible to be sure of the derivation and therefore the details of the genotype. But I think it's safe to assume that the F' in this strain is derived from or similar to F128 which extends from the proBA region through the lac operon. It thus carries the wildtype genes for all loci in that region except those indicated as mutant for the genotype of the F'. So it carries the lacZ (alpha-complementation) deletion lacZ58(M150 and the lacI mutation lacIq, but it has the lacY+ gene also on the F-prime. On the chromosome it lacks all the lac operon genes.

NOTE: The promoter driving the expression of lacI was sequenced in this strain using a primer in mhpR (upstream of lacI) and a primer in the opposite orientation in lacI. The lac promoter was found to be identical to wildtype. Thus, the -35 sequence was GCGCAA not GTGCAA as expected with lacI^Q. Therefore this strain (or at least the version we have) does NOT appear to be lacI^Q unless there is another copy of lacI elsewhere. This result is somewhat confirmed by the fact that a lacI regulated promoter driving expression of YFP on a medium copy vector does not repress completely. -Reshma 13:48, 5 May 2005 (EDT)

JM109(DE3)

JM109 + λ (DE3)

- DE3 prophage carrying T7 polymerase expression cassette
- Same cassette as BL21(DE3) carrying a lac inducible T7 RNA polymerase and lacI^q
- nalidixic acid resistant

JM110

rpsL thr leu thi lacY galK galT ara tonA tsx dam dcm glnV44 Δ (lac-proAB) e14- [F' traD36 proAB$^+$ lacI^q

lacZ Δ M15] hsdR17($r_K^-m_K^+$)

- Sigma fails to list tonA tsx e14 fhuA hsdR17
- (e14-) status uncertain
- streptomycin resistant

JM2.300

lacI22, LAM-, e14-, rpsL135(strR), malT1(LamR), xyl-7, mtl-1, thi-1

- Some folks have been using this strain (i.e., Elowitz, Gardner) and it took me too long to find the CGSC#.
- This strain is no longer available from the CGSC

LE392

glnV44 supF58 (lacY1 or Δ lacZY) galK2 galT22 metB1 trpR55 hsdR514($r_K^-m_K^+$)

- Sigma lists F- e14-

Mach1

Δ recA1398 endA1 tonA Φ80 Δ lacM15 Δ lacX74 hsdR(r_K^- m_K^+)

- From Invitrogen
- Doubling time approx. 50 min and supposedly fastest growing chemically competent cloning strain available
- Mach1 cells are derivatives of E. coli W strains (ATCC 9637, S. A. Waksman), rather than E. coli K-12. This may have implications for BL-1 status for some facilities (apparently not for MIT).
- See Bloom04 patent for details on the construction and properties of this strain.

MC1061

F^- Δ (ara-leu)7697 $[araD139]_{B/r}$ Δ (codB-lacI)3 galK16 galE15 λ - e14- mcrA0 relA1 rpsL150(strR) spoT1 mcrB1 hsdR2(r^-m^+)

- Streptomycin resistant
- The thr-leu region was transduced from an E. coli B/r strain (SB3118) in early steps of strain construction.

- Parent of DH10B/TOP10 and derived strains
- References:
  - E. coli Genetic Stock Center, MC1061 Record
  - Casdaban, M. and Cohen, S. (1980) J Mol Biol 138:179 PMID 6997493.
  - Complete DH10B sequence is available, see Durfee08, PMID 18245285.

MC4100

F$^-$ [araD139]$_{B/r}$ Δ (argF-lac)169* &lambda$^-$ e14- flhD5301 Δ (fruK-yeiR)725 (fruA25) ‡ relA1 rpsL150 (strR) rbsR22 Δ (fimB-fimE)632(::IS1) deoC1

- The thr-leu region was transduced from an E. coli B/r strain (SB3118) in early steps of strain construction.
- This paper compares MC4100 to MG1655 and describes the significant deletions.

- *The paper referenced above showed that this deletion was larger than previously known. The deletion now covers ykfD-b0350.

- ‡ The fruA25 allele is attributed to the deletion of fruK-yeiR. This means fruA is present but its promoter has been deleted.

- The paper also shows that the e14 element is deleted in MC4100. One of the genes removed by this deletion is mcrA, which encodes an enzyme that restricts DNA containing methylcytosine. However, other *E. coli* K-12 restriction/modification systems are still present in MC4100. MC4100 still encodes the McrBC 5-methylcytosine=specific restriction enzyme and the HsdR/HsdS/HsdM type I restriction-modification complex.

- Table three of the paper lists all genes believed to be deleted in MC4100. The methods used in the paper can detect deletions but not loss of function mutations.

- See CGSC#6152

MG1655

F$^-$ λ$^-$ ilvG- rfb-50 rph-1

This is the "wild type" K-12 strain which was sequenced, and should be used when PCRing genes from the sequenced genome. It also looks very healthy under the microscope -- a dramatic difference from most of the cloning strains, which appear sick.

- See CGSC#6300
- See ATCC 700926

4. Blattner FR, Plunkett G 3rd, Bloch CA, Perna NT, Burland V, Riley M, Collado-Vides J, Glasner JD, Rode CK, Mayhew GF, Gregor J, Davis NW, Kirkpatrick HA, Goeden MA, Rose DJ, Mau B, and Shao Y. *The complete genome sequence of Escherichia coli K-12.* Science 1997 Sep 5; 277(5331) 1453-62. pmid:9278503. PubMed HubMed [Blattner-Science-1997]

- More accurate sequence correcting 243 errors in the original sequencing[5]. New Genbank accession number U00096.2

OmniMAX2

From Invitrogen: "This strain overexpresses the Lac repressor (lacIq gene). For blue/white screening, you will need to add IPTG to induce expression from the lac promoter. Strain is resistant to T1 bacteriophage."

F ′ {proAB+ lacIq lacZ Δ M15 Tn10(TetR) Δ (ccdAB)} mcrA Δ (mrr-hsdRMS-mcrBC) φ80(lacZ) Δ M15 Δ (lacZYA-argF) U169 endA1 recA1 supE44 thi-1 gyrA96 relA1 tonA panD

OverExpress(tm)C41(DE3) (Lucigen)

F⁻ ompT gal dcm hsdS_B(r_B^- m_B^-)(DE3)

- The OverExpress strains contain genetic mutations phenotypically selected for conferring tolerance to toxic proteins. The strain C41(DE3) was derived from BL21(DE3). This strain has at least one uncharacterized mutation, which prevents cell death associated with expression of many recombinant toxic proteins. The strain C43(DE3) was derived from C41(DE3) by selecting for resistance to a different toxic protein and can express a different set of toxic proteins to C41(DE3).
- an *E. coli* B strain with DE3, a λ prophage carrying the T7 RNA polymerase gene and $lacI^q$
- Transformed plasmids containing T7 promoter driven expression are repressed until IPTG induction of T7 RNA polymerase from a lac promoter.

OverExpress(tm)C41(DE3)pLysS (Lucigen)

F⁻ ompT gal dcm hsdS_B(r_B^- m_B^-)(DE3)pLysS (Cm^r)

- The OverExpress strains contain genetic mutations phenotypically selected for conferring tolerance to toxic proteins. The strain C41(DE3) was derived from BL21(DE3). This strain has at least one uncharacterized mutation, which prevents cell death associated with expression of many recombinant

toxic proteins. The strain C43(DE3) was derived from C41(DE3) by selecting for resistance to a different toxic protein and can express a different set of toxic proteins to C41(DE3).

- an *E. coli* B strain with DE3, a λ prophage carrying the T7 RNA polymerase gene and $lacI^q$
- Transformed plasmids containing T7 promoter driven expression are repressed until IPTG induction of T7 RNA polymerase from a lac promoter.
- The pLysS plasmid encodes T7 phage lysozyme, an inhibitor for T7 polymerase which reduces and almost eliminates expression from transformed T7 promoter containing plasmids when not induced.

OverExpress(tm)C43(DE3) (Lucigen)

F^- ompT gal dcm $hsdS_B(r_B^- m_B^-)$(DE3)

- The OverExpress strains contain genetic mutations phenotypically selected for conferring tolerance to toxic proteins. The strain C41(DE3) was derived from BL21(DE3). This strain has at least one uncharacterized mutation, which prevents cell death associated with expression of many recombinant toxic proteins. The strain C43(DE3) was derived from C41(DE3) by selecting for resistance to a different toxic protein and can express a different set of toxic proteins to C41(DE3).
- an *E. coli* B strain with DE3, a λ prophage carrying the T7 RNA polymerase gene and $lacI^q$
- Transformed plasmids containing T7 promoter driven expression are repressed until IPTG induction of T7 RNA polymerase from a lac promoter.

OverExpress(tm)C43(DE3)pLysS (Lucigen)

F^- ompT gal dcm $hsdS_B(r_B^- m_B^-)$(DE3)pLysS (Cm^r)

- The OverExpress strains contain genetic mutations phenotypically selected for conferring tolerance to toxic proteins. The strain C41(DE3) was derived from BL21(DE3). This strain has at least one uncharacterized mutation, which prevents cell death associated with expression of many recombinant toxic proteins. The strain C43(DE3) was derived from C41(DE3) by selecting for resistance to a different toxic protein and can express a different set of toxic proteins to C41(DE3).
- an *E. coli* B strain with DE3, a λ prophage carrying the T7 RNA polymerase gene and $lacI^q$
- Transformed plasmids containing T7 promoter driven expression are repressed until IPTG induction of T7 RNA polymerase from a lac promoter.
- The pLysS plasmid encodes T7 phage lysozyme, an inhibitor for T7 polymerase which reduces and almost eliminates expression from transformed T7 promoter containing plasmids when not induced.

Rosetta(DE3)pLysS

F^- ompT $hsdS_B(R_B^- m_B^-)$ gal dcm λ (DE3 [lacI lacUV5-T7 gene 1 ind1 sam7 nin5]) pLysSRARE (Cam^R)

- an *E. coli* B strain with DE3, a λ prophage carrying the T7 RNA polymerase gene and lacI^q
- Transformed plasmids containing T7 promoter driven expression are repressed until IPTG induction of T7 RNA polymerase from a lac promoter.
- Chloramphenicol resistant
- pLysSRARE contains tRNA genes argU, argW, ileX, glyT, leuW, proL, metT, thrT, tyrU, and thrU. The rare codons AGG, AGA, AUA, CUA, CCC, and GGA are supplemented.
- The pLysS plasmid encodes T7 phage lysozyme, an inhibitor for T7 polymerase which reduces and almost eliminates expression from transformed T7 promoter containing plasmids when not induced.
- see Moffatt87 for details of pLysS and pLysE plasmids
- Novagen strain manual

Rosetta-gami(DE3)pLysS

Δ(ara-leu)7697 ΔlacX74 ΔphoA PvuII phoR araD139 ahpC galE galK rpsL (DE3) F'[lac$^+$ lacI^q pro] gor522::Tn10 trxB pLysSRARE (Cam^R, Str^R, Tet^R)

- an *E. coli* K-12 strain with DE3, a λ prophage carrying the T7 RNA polymerase gene and lacI^q
- Transformed plasmids containing T7 promoter driven expression are repressed until IPTG induction of T7 RNA polymerase from a lac promoter.
- ahpC mutation allows trxB/gor double mutants to grow in the absence of reducing medium
- pLysSRARE contains tRNA genes argU, argW, ileX, glyT, leuW, proL, metT, thrT, tyrU, and thrU. The rare codons AGG, AGA, AUA, CUA, CCC, and GGA are supplemented.
- The pLysS plasmid encodes T7 phage lysozyme, an inhibitor for T7 polymerase which reduces and almost eliminates expression from transformed T7 promoter containing plasmids when not induced.
- see Moffatt87 for details of pLysS and pLysE plasmids
- Chloramphenicol resistant
- Kanamycin resistant
- Tetracycline resistant
- Streptomycin resistant
- Novagen strain manual

RR1

HB101 recA$^+$

SOLR (Stratagene)

e14-(McrA-) Δ(*mcrCB-hsdSMR-mrr*)*171 sbcC recB recJ uvrC umuC::*Tn5 (Kan^r) *lac gyrA96 relA1 thi-1 endA1* λ^R [*F' proAB lacI^{q}Z ΔM15*]^C Su-

- Used in phagemid recovery (LambdaZap)

- Kanamycin resistant
- Stratagene E. coli Genotype Strains

SS320 (Lucigen)

F'[*proAB+lacIqlacZ*Δ M15 *Tn10* (tet^r)]*hsdR mcrB araD139 Δ (araABC-leu)*7679 Δ *lac*X74 *galUgalK rpsL thi*

- Useful for phage display.
- Sidhu, S.S., Weiss, G.A., and Wells, J.A. (2000) J. Mol. Biol. 296, 487-495.

STBL2 (Invitrogen)

F- endA1 glnV44 thi-1 recA1 gyrA96 relA1 Δ (lac-proAB) mcrA Δ (mcrBC-hsdRMS-mrr) λ $^-$

- host for unstable sequences such as retroviral sequences and direct repeats
- nalidixic acid resistant
- References: Trinh, T., Jessee, J., Bloom, F.R., and Hirsch, V. (1994) FOCUS 16, 78.

STBL3 (Invitrogen)

F- glnV44 recA13 mcrB mrr hsdS20(rB-, mB-) ara-14 galK2 lacY1 proA2 rpsL20 xyl-5 leu mtl-1

- Streptomycin resistant
- endA+, use care in preparing DNA from this strain

STBL4

endA1 glnV44 thi-1 recA1 gyrA96 relA1 Δ (lac-proAB) mcrA Δ (mcrBC-hsdRMS-mrr) λ $^-$ gal F'[proAB$^+$ lacI^q lacZ Δ M15 Tn10]

- Tetracycline resistant (from Tn10 insertion)
- STBL2 + blue/white selection

SURE (Stratagene)

endA1 glnV44 thi-1 gyrA96 relA1 lac recB recJ sbcC umuC::Tn5 uvrC e14- Δ (mcrCB-hsdSMR-mrr)171 F'[proAB$^+$ lacI^q lacZ Δ M15 Tn10]

- uncertain status of TraD36 in F plasmid
- increased stability for inverted repeats and Z-DNA
- nalidixic acid resistant
- kanamycin resistant
- tetracycline resistant

SURE2 (Stratagene)

endA1 glnV44 thi-1 gyrA96 relA1 lac recB recJ sbcC umuC::Tn5 uvrC e14- Δ (mcrCB-hsdSMR-mrr)171 F'[$proAB^+$ $lacI^q$ lacZ Δ M15 Tn10 Amy Cm^R]

- increased stability for inverted repeats and Z-DNA
- nalidixic acid resistant
- kanamycin resistant
- tetracycline resistant
- chloramphenicol resistant for < 40 μg/ml, sensitive for > 100 μg/ml

TG1 (Lucigen)

F' [*traD36 $proAB^+$ $lacI^q$ lacZ Δ M15*] *supE thi-1 Δ (lac-proAB) Δ (mcrB-hsdSM)5, ($r_K^-m_K^-$)*

- Useful for phage display.

TOP10 (Invitrogen)

F- mcrA Δ (mrr-hsdRMS-mcrBC) φ80lacZ Δ M15 Δ lacX74 nupG recA1 araD139 Δ (ara-leu)7697 galE15 galK16 $rpsL(Str^R)$ endA1 λ -

- Very similar to DH10B
  - I actually emailed Invitrogen and asked if DH10B and TOP10 are the same strain or what. Their response: "Thank you for contacting Invitrogen Technical Support.TOP10 and DH10B competent cells are closely related. They have the same genotypes and can used for the same applications. You can also choose from those that are Chemically competent or electrocomp cells. I hope this information answers your questions." So either there is a difference that they don't want to put out there, or they have rebranded DH10B as TOP10 for marketing purposes... --Dcekiert 18:55, 23 January 2008 (CST)
- While DH10B has been classically reported to be galU galK, the preliminary genome sequence for DH10B indicates that DH10B (and by their lineage also TOP10 and any other MC1061 derivatives) is actually galE galK $galU^+$. --Dcekiert 16:45, 23 January 2008 (CST)
- Previously reported to be deoR, but genome sequence indicates that DH10B is actually $deoR^+$.

Presumably TOP10 and MC1061 are also deoR$^+$.

- Streptomycin resistant
- an MC1061 derivative [6]
- Streptomycin resistant
- Prepare cells for chemical transformation with CCMB80 buffer Here
- Contain lacI based on a colony PCR (even though lacX74 supposedly deletes the lac operon) --Austin Che 16:16, 18 June 2007 (EDT)
    - φ80lacZΔM15 actually contains the entire lac operon, including lacI^q --Dcekiert 16:45, 23 January 2008 (CST)
        - Analysis of the published DH10B sequence (Genbank CP000948) suggests the φ80lacZΔM15 insertion has the wild-type lacI -35 sequence, not the lacI^q -35 sequence (gtgcaa) --BC 15:01, 29 March 2008 (EDT)
- References:
    - E. coli Genetic Stock Center, MC1061 Record
    - DH10B Genome Sequencing Project, Baylor College of Medicine

6. Casadaban MJ and Cohen SN. *Analysis of gene control signals by DNA fusion and cloning in Escherichia coli.* J Mol Biol 1980 Apr; 138(2) 179-207. pmid:6997493. PubMed HubMed [Casadaban-JMolBiol-1980]
7. Durfee T, Nelson R, Baldwin S, Plunkett G 3rd, Burland V, Mau B, Petrosino JF, Qin X, Muzny DM, Ayele M, Gibbs RA, Csörgo B, P ó sfai G, Weinstock GM, and Blattner FR. *The complete genome sequence of Escherichia coli DH10B: insights into the biology of a laboratory workhorse.* J Bacteriol 2008 Apr; 190(7) 2597-606. doi:10.1128/JB.01695-07 pmid:18245285. PubMed HubMed [Durfee]

Complete DH10B sequence is available

8. Grant SG, Jessee J, Bloom FR, and Hanahan D. *Differential plasmid rescue from transgenic mouse DNAs into Escherichia coli methylation-restriction mutants.* Proc Natl Acad Sci U S A 1990 Jun; 87 (12) 4645-9. pmid:2162051. PubMed HubMed [Grant-PNAS-1990]

All Medline abstracts: PubMed HubMed

Top10F' (Invitrogen)

F'[lacI^q Tn10(tet^R)] mcrA Δ(mrr-hsdRMS-mcrBC) φ80lacZΔM15 ΔlacX74 deoR nupG recA1 araD139 Δ(ara-leu)7697 galU galK rpsL(Str^R) endA1 λ$^-$

- Very similar to DH10B with F plasmid containing lacI^q and Tn10

- While DH10B has been classically reported to be galU galK, the preliminary genome sequence for DH10B indicates that DH10B (and by their lineage also TOP10 and any other MC1061 derivatives) is actually galE galK galU$^+$. --Dcekiert 16:45, 23 January 2008 (CST)
- Previously reported to be deoR, but genome sequence indicates that DH10B is actually deoR$^+$. Presumably TOP10 and MC1061 are also deoR$^+$.
- Tetracycline resistant
- Streptomycin resistant
- an MC1061 derivative [6]
- References:
  - E. coli Genetic Stock Center, MC1061 Record
  - DH10B Genome Sequencing Project, Baylor College of Medicine
  - Complete DH10B sequence is available, see Durfee08, PMID 18245285.

W3110

F$^-$ λ$^-$ rph-1 INV(rrnD, rrnE)

- See CGSC#4474
- See ATCC 39936
- See [9]. Briefly, there are 8 site (9nt) differences between W3110 and MG1655. They reside in 7 orgs and one rRNA gene. Two are nonfunctional (*rpoS* and *dcuA*) and 5 are unknown missense mutations.
- New annotation has accession number DDBJ AP009048.

XL1-Blue (Stratagene)

endA1 gyrA96(nal^R) thi-1 recA1 relA1 lac glnV44 F'[::Tn10 proAB$^+$ lacI^q Δ (lacZ)M15] hsdR17(r_K^- m_K^+)

- nalidixic acid resistant
- tetracycline resistant (carried on the F plasmid)

XL1-Blue MRF' (Stratagene)

Δ (*mcrA*)*183* Δ (*mcrCB-hsdSMR-mrr*)*173 endA1 supE44 thi-1 recA1* gyrA96 relA1 lac *[F ′* proAB lacI^q*Z*Δ M15 *Tn*10 *(Tet^r)]*

- Used in lambda phage infection, amplification, expression
- Tetracyline resistant
- Stratagene E. coli Genotype Strains

XL2-Blue (Stratagene)

endA1 gyrA96(nal^R) thi-1 recA1 relA1 lac glnV44 F'[::Tn10 proAB$^+$ lacI^q Δ (lacZ)M15 Amy Cm^R] hsdR17 (r_K^- m_K^+)

- nalidixic acid resistant
- tetracycline resistant (carried on the F plasmid)
- chloramphenicol resistant for <40 μg/ml; sensitive for >100 μg/ml

XL2-Blue MRF' (Stratagene)

endA1 gyrA96(nal^R) thi-1 recA1 relA1 lac glnV44 e14- Δ (mcrCB-hsdSMR-mrr)171 recB recJ sbcC umuC::Tn5 uvrC F'[::Tn10 proAB$^+$ lacI^q Δ (lacZ)M15 Amy Cm^R]

- Minus Restriction strain (minus mcrA mcrCB mcrF mrr hsdR)
- nalidixic acid resistant
- kanamycin resistant
- tetracycline resistant (carried on the F plasmid)
- chloramphenicol resistant <40 μg/ml, sensitive >100 μg/ml

XL1-Red (Stratagene)

F- endA1 gyrA96(nal^R) thi-1 relA1 lac glnV44 hsdR17(r_K^- m_K^+) mutS mutT mutD5 Tn10

- nalidixic acid resistant
- tetracycline resistant
- mutator strain, produces highly unstable DNA changes
- colonies grow and mutate so quickly that the strain is sick and mutated constructs must be moved rapidly to stable strains for plasmid isolation

XL10-Gold (Stratagene)

endA1 glnV44 recA1 thi-1 gyrA96 relA1 lac Hte Δ (mcrA)183 Δ (mcrCB-hsdSMR-mrr)173 tet^R F'[proAB lacI^{q}Z Δ M15 Tn10(Tet^R Amy Cm^R)]

- Tetracycline and Chloramphenicol resistant
- Nalidixic acid resistant
- Hte phenotype allows high transformation with large plasmid inserts

XL10-Gold KanR (Stratagene)

endA1 glnV44 recA1 thi-1 gyrA96 relA1 lac Hte Δ (mcrA)183 Δ (mcrCB-hsdSMR-mrr)173 tet^R F'[proAB $lacI^qZ$ Δ M15 Tn10(Tet^R Amy Tn5(Kan^R)]

- Tetracycline and Kanamycin resistant
- Nalidixic acid resistant
- Hte phenotype allows high transformation with large plasmid inserts

Other genotype information sources

- Bachmann B, Bacteriol Rev. 1972 Dec;36(4):525-57. Pedigrees of some mutant strains of Escherichia coli K-12. PMID 4568763
    - History of the derivation of most lab strains of E. coli
- Strains at EcoliWiki.org
    - Provides information about common *E. coli* laboratory strains, allowing for annotation of the genotype, plasmids, phages and source information of a particular strain.

- E. coli Genetic Stock Center
- E. coli genotypes/Exhibit: Test of moving information on this page into a wiki database

- NEB strains Other NEB strains
- NEB genotype information
- Teknova
- Promega
- EMBL
- Novagen/EMD
- Sigma

- EcoCyc, EcoCyc Query Page, and EcoCyc Genome Browser
- EcoliWiki strains and EcoliWiki home
- Escherichia coli K12 genome browser

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9. Hayashi K, Morooka N, Yamamoto Y, Fujita K, Isono K, Choi S, Ohtsubo E, Baba T, Wanner BL, Mori H, and Horiuchi T. *Highly accurate genome sequences of Escherichia coli K-12 strains MG1655 and W3110.* Mol Syst Biol 2006; 2 2006.0007. doi:10.1038/msb4100049 pmid:16738553. PubMed HubMed [Horiuchi-MSB-2006]

10. Novick RP, Clowes RC, Cohen SN, Curtiss R 3rd, Datta N, and Falkow S. *Uniform nomenclature for bacterial plasmids: a proposal.* Bacteriol Rev 1976 Mar; 40(1) 168-89. pmid:1267736. PubMed HubMed [Novick-BacteriolRev-1976]
11. Lim A, Dimalanta ET, Potamousis KD, Apodaca J, Ananthara-man TS, and Witkin, EM. *Inherited differences in sensitivity to radiation in Escherichia coli.* Proc Natl Acad Sci USA 1946 32:59-68 (the original B strain reference).

    [Lim46]

12. Moffatt BA and Studier FW. *T7 lysozyme inhibits transcription by T7 RNA polymerase.* Cell 1987 Apr 24; 49(2) 221-7. pmid:3568126. PubMed HubMed [Moffatt87]

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