CLAIMS

1. A vector for expressing a recombinant protein comprising a site-specifically incorporated non-naturally encoded amino acid, comprising:

    i. a nucleic acid sequence encoding the recombinant protein;

    ii. a nucleic acid sequence comprising a partition B (parB) locus having the nucleobase sequence of SEQ ID NO: 12; and

    iii. a nucleic acid sequence encoding a chaperone, wherein the nucleic acid sequence encodes a Skp chaperone having the polypeptide sequence of SEQ ID NO:18 and/or the nucleic acid sequence encodes an FkpA chaperone having the polypeptide sequence of SEQ ID NO: 16.

2. The vector of claim 1, wherein the parB locus is positioned in:

    i. a forward transcriptional orientation relative to the nucleic acid sequence encoding the recombinant protein; or

    ii. a reverse transcriptional orientation relative to the nucleic acid sequence encoding the recombinant protein; and/or

    wherein the parB locus is positioned:

    a. upstream relative to the nucleic acid sequence encoding the recombinant protein; or

    b. downstream relative to the nucleic acid sequence encoding the recombinant protein.

3. The vector of claim 1, comprising:

    i. a nucleic acid sequence having an Afe1 and a Not1 restriction enzyme site upstream of the nucleic acid sequence encoding the recombinant protein, wherein the parB locus is positioned between the Afe1 and Not1 restriction enzyme sites in a forward transcriptional orientation relative to the nucleic acid sequence encoding the recombinant protein;

ii. a nucleic acid sequence having an Afe1 restriction enzyme site upstream of the nucleic acid sequence encoding the recombinant protein, wherein the parB locus is positioned at the Afe1 restriction enzyme site in either a forward or reverse transcriptional orientation relative to the nucleic acid sequence encoding the recombinant protein; or

iii. a nucleic acid sequence having a Zra1 restriction enzyme site downstream of the nucleic acid sequence encoding the recombinant protein, wherein the parB locus is positioned at the Zra1 restriction enzyme site in either a forward or reverse transcriptional orientation relative to the nucleic acid sequence encoding the recombinant protein.

4. The vector of any one of claims 1-3, wherein the nucleic acid sequence encoding the chaperone comprises the chaperone's native promoter sequence.

5. The vector of claim 4, wherein the vector comprises a nucleic acid sequence encoding a Skp chaperone wherein the nucleic acid sequence comprises the nucleobase sequence of SEQ ID NO: 17, and/or an FkpA chaperone wherein the nucleic acid sequence comprises the nucleobase sequence of SEQ ID NO: 15.

6. The vector of claim 5, wherein the Skp or FkpA chaperone is positioned in:

i. a forward transcriptional orientation relative to the parB locus; or

ii. a reverse transcriptional orientation relative to the parB locus; and/or

wherein the Skp or FkpA chaperone is positioned:

a. upstream relative to the parB locus; or

b. downstream relative to the parB locus.

7. The vector of any one of claims 4-6, wherein the nucleic acid sequence encoding the recombinant protein, the nucleic acid sequence comprising the parB locus, and the nucleic acid sequence encoding the chaperone are:

i. included in a single expression plasmid having a native promoter; or

ii. included in a two plasmid system having an inducible promoter.

8. The vector of claim 4, wherein the vector comprises a nucleic acid sequence encoding a Skp chaperone wherein the nucleic acid sequence comprises the nucleobase sequence of SEQ ID NO: 17, and an FkpA chaperone wherein the nucleic acid sequence comprises the nucleobase sequence of SEQ ID NO: 15.

9. The vector of any one of claims 1-8, comprising an antibody heavy chain C-terminal extension variant.

10. The vector of claim 9, wherein the heavy chain C-terminal extension comprises 1, 2, 3, 4, 5 or more amino acids.

11. The vector of any one of claims 1-10, wherein the recombinant protein is selected from a biotherapeutic, immunogen, antibody, antibody fragment and variants thereof.

12. The vector of claim 11, wherein:

    i. the biotherapeutic is a vaccine;

    ii. the recombinant protein is a cytokine, chemokine, growth factor, growth factor receptor, interferon, interleukin, inflammatory molecule, oncogene product, peptide hormone, signal transduction molecule, or steroid hormone receptor;

    iii. the recombinant protein is HER2, CD-70, PSMA, 5T4, EGFR, TROP2, CD3, IL-2, IL-3, IL-10, IL-12, IL-15, IL-21, GPC3, DLL3, ROR1, leptin, ghrelin, FGF-1, FGF-19, FGF-21, FGF-23, HGH, FcR, insulin, IGF1, TNFR1, TRAIL, EPO, or analogs, bispecifics or fragments thereof;

    iv. the antibody is an IgG1, IgG2, IgG3, or IgG4 antibody;

    v. the antibody fragment is Fab, Fab', F(ab')2, Fv fragments, single chain antibody fragments (scFv), disulfide stabilized scFv (dsFv)), diabody (Db), BiTE (bispecific T-cell Engager), DART (Dual Affinity Re-Targeting), or Tandem Diabody (TandAb);

    vi. the antibody fragment is Fab; or

    vii. the antibody fragment is anti-CD3 Fab.

13. The vector of claim 12, wherein the anti-CD3 Fab has a para-acetyl phenylalanine site-specifically incorporated at the lysine (K) residue at position 129 of the heavy-chain constant domain (CH1).

14. A recombinant cell or cell line comprising the vector of any one of claims 1-13.

15. The recombinant cell or cell line of claim 14, wherein the recombinant cell or cell line is for optimizing plasmid retention in the recombinant cell or cell line.

16. A method of producing a recombinant protein comprising a site-specifically incorporated non-naturally encoded amino acid, the method comprising expressing the recombinant protein in a bacterial cell from a vector of any one of claims 1-13.

17. The method of claim 16 for improving the yield of the recombinant protein comprising a site-specifically incorporated non-naturally encoded amino acid.

18. The method of claim 17, wherein the yield of the recombinant protein comprising a site-specifically incorporated non-naturally encoded amino acid is increased by at least 0.2-fold.

19. The method of any one of claims 16-18, wherein the non-naturally encoded amino acid is O-methyl-L-tyrosine, L-3-(2-naphthyl)alanine, 3-methyl-phenylalanine, O-4-allyl-L-tyrosine, 4-propyl-L-tyrosine, *p*-propargyloxy-L-phenylalanine, tri-O-acetyl-GlcNAcβ-serine, L-Dopa, a fluorinated phenylalanine, isopropyl-L-phenylalanine, *p*-azido-L-phenylalanine, *p*-acyl-L-phenylalanine, *p*-benzoyl-L-phenylalanine, L-phosphoserine, phosphonoserine, phosphonotyrosine, *p*-iodo-phenylalanine, *p*-bromophenylalanine, *p*-amino-L-phenylalanine, isopropyl-L-phenylalanine, para-acetyl phenylalanine, p-nitrophenylalanine, p-sulfotyrosine, p-carboxyphenylalanine, o-nitrophenylalanine, m-nitrophenylalanine, p-boronyl phenylalanine, o-boronylphenylalanine, m-boronylphenylalanine, p-aminophenylalanine, o-aminophenylalanine, m-aminophenylalanine, p-acylphenylalanine, o-acylphenylalanine, m-acylphenylalanine, p-OMe phenylalanine, o-OMe phenylalanine, m-OMe phenylalanine, p-sulfophenylalanine, o-sulfophenylalanine, m-sulfophenylalanine, 5-nitro His, 3-nitro Tyr, 2-nitro Tyr, nitro substituted Leu, nitro substituted His, nitro substituted De, nitro substituted Trp, 2-nitro Trp, 4-nitro Trp, 5-nitro Trp, 6-nitro Trp, 7-nitro Trp, 3-aminotyrosine, 2-aminotyrosine, O-sulfotyrosine, 2-sulfooxyphenylalanine, 3-

sulfooxyphenylalanine, o-carboxyphenylalanine, m-carboxyphenylalanine, p-acetyl-L-phenylalanine, p-propargyl-phenylalanine, O-methyl-L-tyrosine, L-3-(2-naphthyl)alanine, a 3-methyl-phenylalanine, O-4-allyl-L-tyrosine, 4-propyl-L-tyrosine, tri-O-acetyl-GlcNAcβ-serine, L-Dopa, fluorinated phenylalanine, isopropyl-L-phenylalanine, p-azido-L-phenylalanine, p-acyl-L-phenylalanine, p-benzoyl-L-phenylalanine, L-phosphoserine, phosphonoserine, phosphonotyrosine, p-iodo-phenylalanine, p-bromophenylalanine, p-amino-L-phenylalanine, isopropyl-L-phenylalanine or p-propargyloxy-phenylalanine.

20. The method of any one of claims 16-19, wherein the non-naturally encoded amino acid is para-acetyl phenylalanine.