WHAT IS CLAIMED:

1. A method for cloning a donor genome comprising:

obtaining a donor genome from a donor cell or synthesizing a donor genome as one or more fragments; and

introducing the donor genome and a host vector into a heterologous host cell, wherein the donor genome and the host vector are optionally joined prior to introduction into the host cell, thereby generating a host cell comprising the donor genome comprising the host vector, and further wherein the donor genome is an essentially intact cellular, viral, or organelle genome that is at least a minimal genome, and is greater than about 300 kb in length.

2. The method of claim 1, wherein the donor genome is an essentially whole cellular, viral or organelle genome.

3. The method of claim 1, wherein the donor genome and the host vector are introduced into the host cell simultaneously or sequentially.

4. The method of claim 1, wherein the host vector is joined with the donor genome prior to introduction into the host cell by transforming the host vector into a donor cell containing the donor genome.

5. The method of claim 1, wherein the host cell is a bacterial cell, a fungal cell, an insect cell, a plant cell, or an algal cell.

6. The method of claim 1, wherein the host cell is a yeast cell.

7. The method of claim 4, wherein the host vector is a centromeric plasmid.

8. The method of claim 7, wherein the host vector is a yeast centromeric plasmid and the host cell is a yeast cell.

9. The method of claim 1, wherein the host vector is a vector useful for homologous recombination.

10. The method of claim 1, wherein the donor genome is linearized or fragmented prior to introduction into the host cell.

11. The method of claim 1, wherein donor genome is a bacterial genome, a fungal genome, a yeast genome, an archeal genome, a cyanobacterial genome, an algal genome, a bacteriophage genome, a mitochondrial genome, a chloroplast genome, viral genome, an organelle genome, or a synthetic genome.

12. The method of claim 1, wherein host cell is a eukaryotic cell or a prokaryotic cell.

13. The method of any of claims 1-12, further comprising modifying the donor genome within the host cell.

14. The method of any of claims 1-13, further comprising recovering the donor genome comprising the host vector from the host cell.

15. The method of claim 14, further comprising introducing the recovered donor genome into a recipient cell.

16. The method of claim 15, further comprising degrading or removing the endogenous genome of the recipient cell.

17. The method of claim 15, wherein the recovered donor genome is methylated prior to introduction into the recipient cell.

18. The method of claim 15, wherein the recipient cell's restriction endonulease function is absent, removed or inactivated.

19. The method of claim 15, wherein the recipient cell is a bacterial cell, a yeast cell, a fungal cell, an insect cell, a plant cell, or an algal cell.

20. The method of claim 1, further comprising introducing a second donor genome into the host cell, wherein the second donor genome is different from the first donor genome, thereby producing a host cell containing two different donor genomes.

21. The method of claim 20, wherein introducing the second donor genome comprises mating the host cell containing the first donor genome with a second host cell containing the second donor genome.

22. The method of any of claims 15-19, wherein introducing the recovered donor genome into the recipient cell phenotypically transforms the recipient cell to a phenotype corresponding to the donor genome incorporating any modifications thereto.

23. A cell produced by the method of any of claims 1-22.

24. A method for seamlessly introducing a modification in a target nucleic acid molecule, comprising:

(a) introducing a mutagenesis construct and a host vector into a host cell whereby the host vector recombines with the mutagenesis construct in the host cell,

wherein the mutagenesis construct contains a first portion of homology to a 5′ portion of the target nucleic acid molecule upstream of the modification; an endonuclease recognition site, a promoter, a gene encoding the endonuclease, and a selectable marker; a second repeat portion of homology that is homologous to the sequence of the genome upstream of a target locus; and a third portion of homology that is homologous to a 3′ portion of the target region downstream of the modification; and

(b) incubating the cells under conditions (1) whereby recombination occurs between the first portion of homology and the upstream or downstream portion, thereby seamlessly removing a portion of the construct, and (2) that promote one or more double-strand break cleavages in the nucleic acid molecule near the target site containing the construct,

whereby a modification is seamlessly introduced into the target nucleic acid molecule.

25. A process for making a cell which exhibits a phenotype encoded by a donor genome, said process comprising:

(a) introducing into a host cell, the donor genome and a host vector suitable for cloning the donor genome in the host cell such that a product comprising the donor genome comprising the host vector is obtained;

(b) recovering the product comprising the donor genome comprising the host vector obtained in step (a) from the host cell;

(c) introducing the product of (b) into a recipient cell under conditions such that the recipient cell exhibits a phenotype encoded by the product; and

(d) recovering the cell resulting from step (c);

wherein the donor genome is an essentially intact cellular, viral, or organelle genome that is at least a minimal genome, and is greater than about 300 kb in length and comprises the minimal components of nucleic acid material necessary for the recipient cell to exhibit the phenotype encoded by the donor genome.

26. The process of claim 25, further comprising modifying the donor genome of (a) within the host cell.

27. The process of claim 25, further comprising degrading or removing an endogenous genome of the recipient cell.

28. A cell which exhibits a desired phenotype encoded by a donor genome and not otherwise exhibited by the cell, wherein the cell is produced by the process of any one of claims 25-27.

29. A cell which comprises a donor genome and exhibits a desired phenotype encoded by the donor genome and not otherwise exhibited by the cell, wherein the donor genome comprises greater than 300 kb of foreign genomic nucleic acid material and the minimal components of a genome necessary for the cell to exhibit the desired phenotype.

WHAT IS CLAIMED:

1. A method for cloning a donor genome comprising:

obtaining a donor genome from a bacterial or cyanobacterial or a microalgal donor cell as one or more fragments; and

introducing the donor genome and a yeast host vector into a yeast host cell, wherein the donor genome and the yeast host vector are joined prior to or after introduction of the donor genome and yeast host vector into the yeast host cell;

thereby generating a yeast host cell comprising the donor genome comprising the yeast host vector, and further wherein the donor genome is an essentially intact genome that is at least a minimal genome, and is greater than about 300 kb in length;

propagating the donor genome in the yeast host cell;

performing step a) or b) or c) wherein a), b), and c) comprise:

a) preparing the donor genome for transplantation into a bacterial, cyanobacterial, or microalgal recipient cell by methylating the donor genome;

b) preparing a bacterial or cyanobacterial or microalgal recipient cell by removing or inactivating a restriction endonuclease function present in the recipient cell that cuts the donor genome; and

c) providing a bacterial, cyanobacterial, or microalgal recipient cell lacking a restriction endonuclease function that cuts the donor genome; and

recovering the donor genome comprising the yeast host vector from the host cell and introducing the recovered donor genome comprising the yeast host vector into the recipient cell, wherein the recipient cell supports gene expression from the donor genome,

thereby cloning the donor genome and producing a self-replicating bacterial or cyanobacterial or microalgal recipient cell controlled only by the donor genome;

wherein the donor genome is sufficient to sustain viability and continuous self-replication of the recipient cell.

2. The method of claim 1, wherein the donor genome and the yeast host vector are introduced into the yeast host cell simultaneously.

3. The method of claim 1, wherein the yeast host vector is joined with the donor genome prior to introduction into the yeast host cell by transforming the yeast host vector into a donor cell containing the donor genome.

4. The method of claim 3, wherein the yeast host vector is a centromeric plasmid.

5. The method of claim 1, wherein the yeast host vector and the donor genome are joined by homologous recombination.

6. The method of claim 1, wherein the donor genome is linearized or fragmented prior to introduction into the yeast host cell.

7. The method of claim 1, further comprising modifying the donor genome within the host cell.

8. The method of claim 1, further comprising degrading or removing the endogenous genome of the recipient cell.

9. The method of claim 1, wherein the recovered donor genome is prepared for transplantation into the recipient cell by methylating the donor genome.

10. The method of claim 1, wherein the recipient cell's restriction endonulease function is absent, removed or inactivated.

11. The method of claim 1, further comprising introducing a second donor genome into the host cell, wherein the second donor genome is different from the first donor genome, thereby producing a host cell containing two different donor genomes.

12. The method of claim 11, wherein introducing the second donor genome comprises mating the host cell containing the first donor genome with a second host cell containing the second donor genome.

13. The method of claim 1, wherein introducing the recovered donor genome into the recipient cell phenotypically transforms the recipient cell to a phenotype corresponding to the donor genome incorporating any modifications thereto.

14. The method of claim 7, further comprising recovering the donor genome comprising the host vector from the host cell.

15. The method of claim 14, further comprising introducing the recovered donor genome into a recipient cell.

16. The method of claim 7, wherein modifying the donor genome comprises one or more modifications selected from the group consisting of: a substitution, a deletion, an insertion, a rearrangement, a recombination, and any combination thereof.

17. The method of claim 16, wherein the one or more modifications is not the insertion of a selection marker.

18. The method of claim 17, further comprising recovering the modified donor genome comprising the host vector from the host cell.

19. The method of claim 16, further comprising introducing the recovered donor genome into a recipient cell.

20. The method of claim 1, wherein the recipient cell is a bacterial cell.

21. The method of claim 1 wherein the donor genome is a synthetic genome.

22. The method of claim 1, wherein the donor genome and the yeast host vector are introduced into the yeast host cell sequentially.

23. The method of claim 1 wherein the yeast host cell is Saccharomyces cerevisiae or Saccharomyces pombe.

24. The method of claim 20 wherein the donor genome is a bacterial cell.

25. The method of claim 24 wherein the donor genome is a Mycoplasma genome and the recipient cell is a Mycoplasma cell.