CLAIMS

1. A method for creating a self-replicating synthetic cell, said method comprising:

(i) assembling a synthetic bacterial, cyanobacterial, or microalgal donor genome as one or more fragments and introducing the donor genome as one or more fragments and a host vector into a yeast host cell, wherein the donor genome and the host vector are joined prior to or after introduction into the yeast host cell;

(ii) recovering the assembled donor genome from the yeast host cell;

(iii) 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;

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

(iv) introducing the recovered donor genome into the recipient cell,

thereby generating a self-replicating synthetic cell comprising the donor genome and controlled only by the donor genome, wherein the donor genome is sufficient to sustain viability and continuous self-replication of the recipient cell; and

wherein the synthetic cell supports gene expression from the donor genome and has a phenotype of the donor genome,

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.

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

3. The method of claim **1**, wherein the donor genome and host vector are joined 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 host vector is a centromeric plasmid.

5. The method of claim **1**, wherein the donor genome is modified within the yeast host cell.

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

7. The method of claim **1**, wherein the recovered donor genome is methylated prior to introduction into the recipient cell.

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

9. 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.

10. The method of claim **9**, 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.

11. The method of claim **1**, wherein the synthetic cell exhibits a phenotype corresponding to the donor genome incorporating any modifications thereto.

12. The method of claim **1** wherein the synthetic donor genome is assembled in vitro prior to introducing the donor genome into the host cell.

13. The method of claim **5** wherein the modification of the donor genome is selected from the group consisting of a substitution, a deletion, an insertion, a rearrangement, and a recombination.

14. The method of claim **13** wherein the modification is selected from the group consisting of: an insertion, a deletion, and a substitution.

15. The method of claim **5** wherein the modification is a homologous recombination.

16. The method of claim **1** wherein the donor genome is a bacterial genome and the recipient cell is a bacterial cell.

17. The method of claim **1** wherein the donor genome is a cyanobacterial genome and the recipient cell is a cyanobacterial cell.

18. The method of claim **1** wherein the donor genome is a microalgal genome and the recipient cell is a microalgal cell.

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

20. The method of claim **16**, wherein the donor genome is a *Mycoplasma* genome and the recipient cell is a *Mycoplasma* cell.

21. The method of claim **19**, wherein the recipient cell is a *Mycoplasma capricolum.*

22. The method of claim **20**, wherein the recipient cell is a *Mycoplasma capricolum.*