CLAIMS

1. A method for preparing a viable human oocyte in vitro, the method comprising the steps of:

a) gaining access through the zona pellucida of a first oocyte containing a polar body using laser drilling; and removing the polar body from the first oocyte in a medium comprising HEPES buffer, at least 10% human tubal fluid, and cytochalasin B; and
b) removing the chromosomes and spindle from a second oocyte in another medium comprising HEPES buffer, at least 10% human tubal fluid, and cytochalasin B using a Polarized Microscope Imaging System and the laser drilling to create an enucleated cytoplast; and fusing the polar body removed from the first oocyte with the enucleated cytoplast in a medium using a hemagglutinating virus of Japan envelope (HVJ-E), thereby preparing the viable human oocyte.

2. The method of Claim 1 further comprising fertilizing the viable human oocyte via in vitro fertilization, thereby creating an embryo.

3. The method of Claim 2, in which the embryo is cultured to the blastocyst stage.

4. A method of producing a human oocyte in vitro, the method comprising:

a) determining a mitochondrial DNA sequence of the conserved sequence box II of a donor oocyte;
b) enucleating the donor oocyte while the donor oocyte is arrested at metaphase II in a medium comprising HEPES buffer, at least 10% human tubal fluid, and

cytochalasin B using a Polarized Microscope Imaging System and laser drilling, thereby isolating donor nuclear genetic material;

c) selecting an enucleated recipient oocyte, wherein the mitochondrial DNA of the donor oocyte has the same conserved sequence box II genotype as the recipient oocyte;

d) introducing the donor nuclear genetic material into the enucleated recipient oocyte in another medium comprising HEPES buffer, at least 10% human tubal fluid, and cytochalasin B, thereby producing a human oocyte.

5. The method of claim 4 further comprising fertilizing the viable human oocyte via in vitro fertilization, thereby creating an embryo.

6. The method of Claim 4 or Claim 5 where enucleating the donor oocyte is performed in a medium comprising at least 10% human tubal fluid, HEPES buffer, and cytochalasin B using a Polarized Microscope Imaging System.

7. The method of Claim 5, in which the embryo is cultured to the blastocyst stage.

8. The method of any one of Claims 4, 5, 6, or 7 where the donor oocyte and the recipient oocyte both have the G5A8 genotype or both have the G6A8 genotype.

9. The method of any one of Claims 4, 5, 6, or 7 where the mitochondrial DNA from the donor oocyte comprises a mutation.

10. The method of Claim 9 where the donor oocyte is from a subject that has Leigh Syndrome, Mitochondrial Encephalomyopathy Lactic Acidosis, or Stroke-like Episodes.

11. A method of producing a human oocyte in vitro, the produced human oocyte comprising minimal maternal mitochondrial DNA, the method comprising:

determining the sequence of the major non-coding region of the mitochondrial DNA of a donor oocyte, where the major non-coding region sequence includes a D loop region;

enucleating the donor oocyte in a medium comprising HEPES buffer, at least 10% human tubal fluid, and cytochalasin B while the donor oocyte is arrested at metaphase II, thereby isolating donor nuclear genetic material;

selecting an enucleated recipient oocyte, wherein the enucleated recipient oocyte has the same major non-coding region sequence that includes a D loop region as the donor oocyte; and

introducing the donor nuclear genetic material into the enucleated recipient oocyte in another medium comprising HEPES buffer, at least 10% human tubal fluid, and cytochalasin B.

12. The method of Claim 11 where the donor oocyte and the recipient oocyte both have an identical H56, H1b, U5a, F1a, X2c, D4a, H49, or B2k mtDNA haplotype.

13. The method of Claim 11 where the mitochondrial DNA from the donor oocyte comprises a mutation.

14. The method of Claim 13 where the donor oocyte is from a subject that has Leigh Syndrome, Mitochondrial Encephalomyopathy Lactic Acidosis or Stroke-like Episodes.