CLAIMS

1. A cell culture medium for culturing an oocyte or an oogonial stem cell (OSC) comprising a CD38 inhibitor and a nicotinamide adenine dinucleotide (NAD) precursor, wherein the OSC is obtained from ovarian tissue or is the progeny of an OSC obtained from ovarian tissue, is an isolated non-embryonic stem cell, is mitotically competent and expresses Vasa, Oct-4, Dazl, Stella, and optionally, a stage-specific embryonic antigen, wherein the CD38 inhibitor and NAD precursor are present in said medium in an amount effective to enhance the bioenergetic status of the oocyte or the OSC cultured in said medium.

2. The cell culture medium of claim 1,

wherein the CD38 inhibitor is selected from the group consisting of apigenin, luteolin, fisetin and tryphostin 8; and

wherein the NAD precursor is selected from the group consisting of nicotinamide mononucleotide, nicotinamide riboside and nicotinic acid.

3. The cell culture medium of claim 1 wherein the CD38 inhibitor and NAD precursor are present in said medium in an amount effective to increase at least one selected from the group consisting of the number of mitochondria in, the mitochondrial energy of, and the oocyte or the OSC cultured in said medium.

4. The cell culture medium of claim 1 wherein the CD38 inhibitor is present at a concentration ≥ 25μM, and is selected from the group consisting of apigenin, luteolin, fisetin and tryphostin 8; and wherein the NAD precursor is present at a concentration ≥ 100μM, and is selected from the group consisting of nicotinamide mononucleotide, nicotinamide riboside, and nicotinic acid.

5. The cell culture medium of claim 1, further comprising cell culture medium, oocyte retrieval solution, oocyte washing solution, oocyte in vitro maturation medium, ovarian follicle in vitro maturation medium, oocyte in vitro fertilization medium, vitrification solution or cryopreservation solution.

6. A composition comprising an isolated oocyte or oogonial stem cell (OSC) according to claim 1, and a CD38 inhibitor and an NAD precursor, wherein the CD38 inhibitor and NAD

precursor are present in said medium in an amount effective to enhance the bioenergetic status of oocyte or the OSC.

7. The composition of claim 6, wherein the CD38 inhibitor is selected from the group consisting of apigenin, luteolin, fisetin and tryphostin 8; and wherein the NAD precursor is selected from the group consisting of nicotinamide mononucleotide, nicotinamide riboside and nicotinic acid.

8. The composition of claim 6 wherein the CD38 inhibitor is present at a concentration ≥ 25μM, and is selected from the group consisting of apigenin, luteolin, fisetin and tryphostin 8; and the NAD precursor is present at a concentration ≥ 100μM, and is selected from the group consisting of nicotinamide mononucleotide, nicotinamide riboside and nicotinic acid.

9. The composition of claim 6, wherein the composition further comprises ovarian tissue, ovarian follicles, bone marrow, umbilical cord blood or peripheral blood.

10. A composition comprising a mitochondrial preparation selected from the group consisting of a purified preparation of oocyte mitochondria and a nucleus-free preparation of oocyte cytoplasm and a CD38 inhibitor and an NAD precursor, wherein the mitochondria are isolated from the oocyte or the oogonial stem cell (OSC) according to claim 1 and the CD38 inhibitor and NAD precursor are present in an amount effective to enhance the bioenergetic status of the mitochondrial preparation.

11. The composition of claim 10, wherein the CD38 inhibitor is selected from the group consisting of apigenin, luteolin, fisetin and tryphostin 8; and wherein the NAD precursor is selected from the group consisting of nicotinamide mononucleotide, nicotinamide riboside and nicotinic acid.

12. The composition of claim 11 wherein the CD38 inhibitor is present at a concentration ≥ 25μM, and is selected from the group consisting of apigenin, luteolin, fisetin and tryphostin 8; and wherein the NAD precursor is present at a concentration ≥ 100μM, and is selected from the group consisting of nicotinamide mononucleotide, nicotinamide riboside and nicotinic acid.

13. A method of preparing an oocyte or oogonial stem cell for use *in vitro* fertilization comprising:

culturing the oocyte or oogonial stem cell (OSC) according to claim 1 in a medium comprising a CD38 inhibitor and an NAD precursor, wherein the CD38 inhibitor and NAD precursor are present in an amount effective to enhance the bioenergetic status of the oocyte or oogonial stem cell.

14. The method of claim 13 wherein the CD38 inhibitor is selected from the group consisting of apigenin, luteolin, fisetin and tryphostin 8; and wherein the NAD precursor is selected from the group consisting of nicotinamide mononucleotide, nicotinamide riboside and nicotinic acid.

15. A method of preparing a preimplantation zygote for use *in vitro* fertilization comprising:

culturing said preimplantation zygote in a medium comprising a CD38 inhibitor and an NAD precursor, wherein the CD38 inhibitor and NAD precursor are present in an amount effective to enhance the bioenergetic status of the preimplantation zygote.

16. The method of claim 15 wherein the CD38 inhibitor is selected from the group consisting of apigenin, luteolin, fisetin and tryphostin 8; and wherein the NAD precursor is selected from the group consisting of nicotinamide mononucleotide, nicotinamide riboside and nicotinic acid.

17. The method of claim 13 or claim 15, wherein the medium is selected from cell culture medium, oocyte retrieval solution, oocyte washing solution, oocyte in vitro maturation medium, ovarian follicle in vitro maturation medium, oocyte in vitro fertilization medium, vitrification solution and cryopreservation solution.

18. The method of claim 17, wherein the oocyte or the OSC is mammalian.

19. The method of claim 18, wherein the oocyte or the OSC is from a human female.

20. The method of claim 19, wherein the human female is selected from the group consisting of selected from the group consisting of females of advanced maternal age, females suffering from oocyte-related infertility and females with low ovarian reserve.

21. The method of claim 13, wherein the oocyte is used for in vitro fertilization.

CLAIMS

What is claimed is:

1. A cell culture medium comprising an agent selected from the group consisting of a CD38 inhibitor and an NAD precursor.

2. The cell culture medium of claim 1,

wherein the CD38 inhibitor is selected from the group consisting of apigenin, luteolin, fisetin, and tyrphostin 8; and

wherein the NAD precursor is selected from the group consisting of nicotinamide mononucleotide, nicotinamideriboside, nicotinamideriboside hydride, and nicotinic acid.

3. The cell culture medium of claim 1 wherein said agent is present in said medium in an amount effective to enhance the bioenergetic status of a cell cultured in said medium.

4. The cell culture medium of claim 1 wherein said agent is present in said medium in an amount effective to increase the number of mitochondria in a cell cultured in said medium.

5. The cell culture medium of claim 1 wherein said agent is present in said medium in an amount effective to increase the mitochondrial energy of a cell cultured in said medium.

6. The cell culture medium of claim 1 wherein said agent is present in said medium in an amount effective to increase the cellular energy of a cell cultured in said medium.

7. The cell culture medium of claim 1 wherein the CD38 inhibitor is present at a concentration $\geq 25\mu M$.

8. The cell culture medium of claim 1 wherein the NAD precursor is present at a concentration $\geq 100\mu M$.

9. A composition comprising an isolated oocyte, oogonial stem cell or the progeny of an oogonial stem cell, and an agent selected from the group consisting of a CD38 inhibitor and an NAD precursor.

10. The composition of claim 9, wherein the agent is selected from the group consisting

of apigenin, luteolin, fisetin, tyrphostin 8, nicotinamide mononucleotide, nicotinamideriboside, nicotinamideriboside hydride, and nicotinic acid.

11. The composition of claim 10 wherein the agent is present at a concentration ≥25μM, and is selected from the group consisting of apigenin, luteolin, fisetin, and tyrphostin 8.

12. The composition of claim 10 wherein the agent is present at a concentration ≥100μM, and is selected from the group consisting of nicotinamide mononucleotide, nicotinamideriboside, nicotinamideriboside hydride, and nicotinic acid.

13. The composition of claim 10, wherein the composition further comprises ovarian tissue, ovarian follicles, bone marrow, umbilical cord blood or peripheral blood.

14. A composition comprising a mitochondrial preparation selected from the group consisting of a purified preparation of oocyte mitochondria and a nucleus-free preparation of oocyte cytoplasm and an agent selected from the group consisting of a CD38 inhibitor and an NAD precursor.

15. The composition of claim 14, wherein the agent is selected from the group consisting of apigenin, luteolin, fisetin, tyrphostin 8, nicotinamide mononucleotide, nicotinamideriboside, nicotinamideriboside hydride, and nicotinic acid.

16. The composition of claim 15 wherein the agent is present at a concentration ≥25μM, and is selected from the group consisting of apigenin, luteolin, fisetin, and tyrphostin 8.

17. The composition of claim 15 wherein the agent is present at a concentration ≥100μM, and is selected from the group consisting of nicotinamide mononucleotide, nicotinamideriboside, nicotinamideriboside hydride, and nicotinic acid.

18. A method of preparing an oocyte or oogonial stem cell for use *in vitro* fertilization comprising:

culturing said oocyte or oogonial stem cell in a medium comprising an agent selected from the group consisting of a CD38 inhibitor and an NAD precursor.

19. The method of claim 18 wherein the agent is selected from the group consisting of apigenin, luteolin, fisetin, tyrphostin 8, nicotinamide mononucleotide, nicotinamideriboside,

nicotinamideriboside hydride, and nicotinic acid.

20. A method of preparing a preimplantation zygote for use *in vitro* fertilization comprising: culturing said preimplantation zygote in a medium comprising an agent selected from the group consisting of a CD38 inhibitor and an NAD precursor.

21. The method of claim 20 wherein the agent is selected from the group consisting of apigenin, luteolin, fisetin, tyrphostin 8, nicotinamide mononucleotide, nicotinamideriboside, nicotinamideriboside hydride, and nicotinic acid.