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 and Stella and, optionally, a stage-specific embryonic antigen,

wherein the CD38 inhibitor is a compound selected from the group consisting of 1-[(2-Acetoxyethoxy)methyl]-3-(aminocarbonyl)-pyridinium chloride, 1-[(2-Benzyloxyethoxy)methyl]-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Methoxy-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Phenoxy-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Nitro-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(3-Trifluoromethyl-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridiniumchloride, 1-{[2-(8'-Quinolyloxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1,2-Dimethoxy-ethylene-bis-N,N'-3-(aminocarbonyl)-pyridinium dichloride, 1,4-Dimethoxy-butylene-bis-N,N'-3-(aminocarbonyl)-pyridinium dichloride, 1,4-Dimethoxy-butyne-bis-N,N'-3-(aminocarbonyl)-pyridinium dichloride, 1,4-Dimethoxy-hexamethylene-bis-N,N'-3-(aminocarbonyl)- pyridinium dichloride, (*E*)-1-{[4-(8'-Quinolyloxy)but-2-enyloxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Phenoxy-phenoxy)ethoxy]methyl}-6-(aminocarbonyl)-quinolinium chloride, 1-{[2-(4-Phenoxy-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-4-amino-pyridinium chloride, luteolinidin, kuromanin, luteolin, delphinidin, pelargonidin, malvidin, quercetagetinidin, peonidin, myricetin, cyanidin, diosmetinidin, quercetin, robinetin, petunidin, fisetin, fisetinidin, quercetagetin, *rac*-taxifolin, *rac*-catechin, piceatannol, resveratrol, apigenin, tyrphostin-8, berberine and SRT-1720,

wherein the CD38 inhibitor is present in said medium at a concentration ≥ 25μM and the NAD precursor is present in said medium at a concentration ≥ 100μM, and

wherein said concentrations of the CD38 inhibitor and the NAD precursor are 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, tyrphostin-8, berberine and SRT-1720; 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 said concentrations of the CD38 inhibitor and NAD precursor present in said medium are effective to increase at least one selected from the group consisting of the number of functional mitochondria in, the mitochondrial energy of, and the cellular energy of the oocyte or the OSC cultured in said medium.

4. The cell culture medium of claim 1, wherein the medium further comprises ovarian tissue, ovarian follicles, bone marrow, umbilical cord blood or peripheral blood.

5. The cell culture medium of claim 1, further comprising 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 is a compound selected from the group consisting of 1-[(2-Acetoxyethoxy)methyl]-3-(aminocarbonyl)-pyridinium chloride, 1-[(2-Benzyloxyethoxy)methyl]-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Methoxy-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Phenoxy-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Nitro-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(3-

Trifluoromethyl-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridiniumchloride, 1-{[2-(8'-Quinolyloxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1,2-Dimethoxy-ethylene-bis-N,N'-3-(aminocarbonyl)-pyridinium dichloride, 1,4-Dimethoxy-butylene-bis-N,N'-3-(aminocarbonyl)-pyridinium dichloride, 1,4-Dimethoxy-butyne-bis-N,N'-3-(aminocarbonyl)-pyridinium dichloride, 1,4-Dimethoxy-hexamethylene-bis-N,N'-3-(aminocarbonyl)- pyridinium dichloride, (*E*)-1-{[4-(8'-Quinolyloxy)but-2-enyloxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Phenoxy-phenoxy)ethoxy]methyl}-6-(aminocarbonyl)-quinolinium chloride, 1-{[2-(4-Phenoxy-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-4-amino-pyridinium chloride, luteolinidin, kuromanin, luteolin, delphinidin, pelargonidin, malvidin, quercetagetinidin, peonidin, myricetin, cyanidin, diosmetinidin, quercetin, robinetin, petunidin, fisetin, fisetinidin, quercetagetin, *rac*-taxifolin, *rac*-catechin, piceatannol, resveratrol, apigenin, tyrphostin-8, berberine and SRT-1720,

wherein the CD38 inhibitor is present in said composition at a concentration ≥ 25µM and the NAD precursor is present in said composition at a concentration ≥ 100µM, and

wherein said concentrations of the CD38 inhibitor and the NAD precursor are effective to enhance the bioenergetic status of the oocyte or the OSC.

7. The composition of claim 6,

wherein the CD38 inhibitor is selected from the group consisting of apigenin, luteolin, fisetin, tyrphostin-8, berberine and SRT-1720; 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 composition further comprises ovarian tissue, ovarian follicles, bone marrow, umbilical cord blood or peripheral blood.

9. 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 an oocyte or an oogonial stem cell (OSC) according to claim 1,

wherein the CD38 inhibitor is is a compound selected from the group consisting of 1-[(2-Acetoxyethoxy)methyl]-3-(aminocarbonyl)-pyridinium chloride, 1-[(2-Benzyloxyethoxy)methyl]-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Methoxy-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Phenoxy-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Nitro-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(3-Trifluoromethyl-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridiniumchloride, 1-{[2-(8'-Quinolyloxy)ethoxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1,2-Dimethoxy-ethylene-bis-N,N'-3-(aminocarbonyl)-pyridinium dichloride, 1,4-Dimethoxy-butylene-bis-N,N'-3-(aminocarbonyl)-pyridinium dichloride, 1,4-Dimethoxy-butyne-bis-N,N'-3-(aminocarbonyl)-pyridinium dichloride, 1,4-Dimethoxy-hexamethylene-bis-N,N'-3-(aminocarbonyl)- pyridinium dichloride, (*E*)-1-{[4-(8'-Quinolyloxy)but-2-enyloxy]methyl}-3-(aminocarbonyl)-pyridinium chloride, 1-{[2-(4-Phenoxy-phenoxy)ethoxy]methyl}-6-(aminocarbonyl)-quinolinium chloride, 1-{[2-(4-Phenoxy-phenoxy)ethoxy]methyl}-3-(aminocarbonyl)-4-amino-pyridinium chloride, luteolinidin, kuromanin, luteolin, delphinidin, pelargonidin, malvidin, quercetagetinidin, peonidin, myricetin, cyanidin, diosmetinidin, quercetin, robinetin, petunidin, fisetin, fisetinidin, quercetagetin, *rac*-taxifolin, *rac*-catechin, piceatannol, resveratrol, apigenin, tyrphostin-8, berberine and SRT-1720,

wherein the CD38 inhibitor is present in said composition at a concentration ≥ 25µM and the NAD precursor is present in said composition at a concentration ≥ 25µM, and

wherein said concentrations of the CD38 inhibitor and the NAD precursor are effective to enhance the bioenergetic status of the mitochondrial preparation.

10. The composition of claim 10,

wherein the CD38 inhibitor is selected from the group consisting of apigenin, luteolin, fisetin, tyrphostin-8, berberine and SRT-1720; and

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