The specific pathogenesis of MS remains unknown.

Still further, disorders and diseases that do include demyelination that may be associated with the toxic demyelination models, such as the Cuprizone Animal Model, include Progressive Supranuclear Palsy, Alexander's Disease, Krabbe Disease, Metachromatic Leukodystrophy, Canavan Disease, Leukodistrophies, Encephalomyelitis, Central Pontine Myelolysis (CPM), Anti Myelin-Associated Glycoprotein (MAG) Disease, Pelizaeus-Merzbacher Disease, Refsum Disease, Cockayne Syndrome, Zellweger Syndrome, Guillain-Barre Syndrome (GBS), Van der Knapp Syndrome, chronic inflammatory demyelinating polyneuropathy (CIDP), multifocal motor neuropathy (MMN), Neuromyelitis Optica (NMO), Progressive Multifocal Leukoencephalopathy (PML), Wallerian Degeneration and some inherited diseases such as Adrenoleukodystrophy, Alexander's Disease, Mild Cognitive Impairment (MCI) also known as Age Related Cognitive Decline and Pelizaeus Merzbacher Disease (PMZ). For many of these aforementioned disorders, there are few to no cures and very few effective therapies, if any.

Neuromyelitis Optica (NMO), is also sometimes referred to as Devic's disease. NMO is a disorder of the central nervous system (CNS) that predominantly affects the optic nerve and spinal cord of patients. NMO is one of the major neuroimmunological diseases in Asia.

An NMO-immunoglobulin G (IgG) has been discovered in the sera of NMO patients, which binds at or near the blood–brain barrier in the mouse brain. The epitope of NMO-IgG was identified as aquaporin-4 (AQP4), a water channel densely expressed in astrocytic foot processes at the blood–brain barrier.

NMO is characterized by the occurrence of severe optic neuritis and myelitis, mostly observed as longitudinally extensive transverse myelitis (LETM), sometimes both occurring simultaneously and sometimes occurring sequentially. Most NMO patients have autoantibodies against AQP4 in their serum. Therefore, the NMO diagnostic criteria requires the presence of both optic neuritis and myelitis and fulfilment of at least two of the three supportive criteria: MRI evidence of a contiguous spinal cord lesion extending over three or more vertebral segments; negative results for the diagnostic criteria for MS on brain MRI34 conducted at onset; and NMO-IgG (or anti-AQP4 antibody) seropositivity.

Thus, NMO is now considered as an anti-AQP4 antibody-mediated astrocytopathy, and different from a demyelinating disorder such as MS. However, mammals having NMO clearly show the pathologic results of demyelination or dysmyelination.

Other embodiments of the invention include methods for promoting survival of CNS neurons and/or PNS neurons in a mammal in need thereof comprising administering an effective amount of a gold crystal nanosuspension. In a preferred embodiment, the CNM-Au8 nanocrystalline suspensions of Example 1 are used with such methods.

Further embodiments of the invention include methods for promoting oligodendrocyte differentiation in a mammal, comprising administering to a mammal in need thereof an effective amount of a composition comprising a gold crystal nanosuspension. In a preferred embodiment, the CNM-Au8 nanocrystalline suspensions of Example 1 are used with such methods.

Additional embodiments of the invention include methods for decreasing or inhibiting expression of damaged myelin, demyelination or dysmyelination relative to the absence of providing an effective amount of a gold nanocrystalline suspension, comprising modifying the myelination of neurons (CNS and/or PNS) with a composition comprising an effective amount (both prophylactic and therapeutic) of a gold nanocrystalline suspension. In a preferred embodiment, the CNM-Au8 nanocrystalline suspensions of Example 1 are used with such methods.

Additional embodiments of the invention include methods for inhibiting or decreasing undesirable pathological events associated with myelin damage in the absence of an effective amount of the CNM-Au8 nanocrystalline suspension of Example 1 being provided, comprising providing a subject in need thereof a composition comprising a CNM-Au8 nanosuspension.

In the treatment methods of the present invention nanocrystalline suspensions, preferably CNM-Au8 nanocrystalline suspensions, can be administered via oral administration, injections and/or nasally.

In some embodiments, a CNM-Au8 nanosuspension may administered by bolus injection or chronic infusion. In some embodiments, a CNM-Au8 nanosuspension may be administered directly into the central nervous system by, for example, intrathecal or epidural placement. In some embodiments, a CNM-Au8 nanosuspension may be administered directly into a chronic lesion where myelin damage is expressed. In some embodiments, a CNM-Au8 nanosuspension may be administered directly into the bloodstream of a mammal.

In certain embodiments of the invention, the gold nanosuspensions, and preferably the CNM-Au8 nonocrystalline suspensions, is/are administered as a treatment for a disease that includes Progressive Supranuclear Palsy, Alexander's Disease, Krabbe Disease, Metachromatic Leukodystrophy, Canavan Disease, Leukodistrophies, Encephalomyelitis, Central Pontine

agent that stops, reduces, prevents, or inhibits the ability of pathological events that negatively regulate myelination of neurons by oligodendrocytes. Additionally, a gold nanosuspension, and preferably a CNM-Au8 nanosuspension, to be used in treatment methods disclosed herein, can be prepared and used as a therapeutic agent that stops, reduces, prevents, or inhibits the ability of pathologic events to negatively regulate oligodendrocyte differentiation, proliferation and survival.

Further embodiments of the invention include a method of inducing oligodendrocyte proliferation or survival to treat a disease, disorder or injury involving the destruction of oligodendrocytes or myelin comprising delivering to a mammal, at or near the site of the disease, disorder or injury, gold nanocrystals from a CNM-Au8 nanosuspension in an amount sufficient to reduce inhibition of axonal extension and/or promote myelination and/or ameliorate demyelination.

In the treatment methods of the present invention, the gold nanosuspensions can be administered via oral administration, injections and/or nasally.

In some embodiments, a gold nanosuspension, and preferably a CNM-Au8 nanosuspension, may administered by bolus injection or chronic infusion. In some embodiments, a CNM-Au8 nanosuspension may be administered directly into the central nervous system by, for example, intrathecal or epidural placement. In some embodiments, a CNM-Au8 nanosuspension may be administered directly into a chronic lesion where myelin damage is expressed. In some embodiments, a CNM-Au8 nanosuspension may be administered directly into the bloodstream of a mammal.

Diseases or disorders which may be treated or ameliorated by the methods of the present invention include diseases, disorders or injuries which relate to dysmyelination or demyelination of mammalian neurons. Specifically, such diseases and disorders include those in which the myelin which surrounds the neuron is either absent, incomplete, not formed properly or is deteriorating. Such diseases include, but are not limited to, Progressive Supranuclear Palsy, Alexander's Disease, Krabbe Disease, Metachromatic Leukodystrophy, Canavan Disease, Leukodistrophies, Encephalomyelitis, Central Pontine Myelolysis (CPM), Anti-MAG Disease, Pelizaeus-Merzbacher Disease, Refsum Disease, Cockayne Syndrome, Zellweger Syndrome, Guillain-Barre Syndrome (GBS), Van der Knapp Syndrome, chronic inflammatory demyelinating polyneuropathy (CIDP), multifocal motor neuropathy (MMN), Neuromyelitis Optica (NMO), Progressive Multifocal Leukoencephalopathy (PML), Mild Cognitive Impairment (MCI) also known as Age Related Cognitive Decline, Wallerian

Degeneration and some inherited diseases such as Adrenoleukodystrophy, Alexander's Disease, and Pelizaeus Merzbacher Disease (PMZ).

Diseases or disorders which may be treated or ameliorated by the methods of the present invention include diseases, disorders or injuries which relate to the death or lack of proliferation or differentiation of oligodendrocytes. Such disease include, but are not limited to, Progressive Supranuclear Palsy, Alexander's Disease, Krabbe Disease, Metachromatic Leukodystrophy, Canavan Disease, Leukodistrophies, Encephalomyelitis, Central Pontine Myelolysis (CPM), Anti-MAG Disease, Pelizaeus-Merzbacher Disease, Refsum Disease, Cockayne Syndrome, Zellweger Syndrome, Guillain-Barre Syndrome (GBS), Van der Knapp Syndrome, chronic inflammatory demyelinating polyneuropathy (CIDP), multifocal motor neuropathy (MMN), Neuromyelitis Optica (NMO), Progressive Multifocal Leukoencephalopathy (PML), Mild Cognitive Impairment (MCI) also known as Age Related Cognitive Decline, Wallerian Degeneration and some inherited diseases such as Adrenoleukodystrophy, Alexander's Disease, and Pelizaeus Merzbacher Disease (PMZ).

Diseases or disorders which may be treated or ameliorated by the methods of the present invention include neurodegenerate disease or disorders. Such diseases include, but are not limited to, Progressive Supranuclear Palsy, Alexander's Disease, Krabbe Disease, Metachromatic Leukodystrophy, Canavan Disease, Leukodistrophies, Encephalomyelitis, Central Pontine Myelolysis (CPM), Anti-MAG Disease, Pelizaeus-Merzbacher Disease, Refsum Disease, Cockayne Syndrome, Zellweger Syndrome, Guillain-Barre Syndrome (GBS), Van der Knapp Syndrome, Mild Cognitive Impairment (MCI) also known as Age Related Cognitive Decline, chronic inflammatory demyelinating polyneuropathy (CIDP), multifocal motor neuropathy (MMN), Neuromyelitis Optica (NMO), Progressive Multifocal Leukoencephalopathy (PML), Wallerian Degeneration and some inherited diseases such as Adrenoleukodystrophy, Alexander's Disease, and Pelizaeus Merzbacher Disease (PMZ).

Examples of additional diseases, disorders or injuries which may be treated or ameliorated by the methods of the present invention include, but are not limited, to spinal cord injuries, chronic myelopathy or rediculopathy, traumatic brain injury, motor neuron disease, axonal shearing, contusions, paralysis, post radiation damage or other neurological complications of chemotherapy, stroke, large lacunes, medium to large vessel occlusions, leukoariaosis, acute ischemic optic neuropathy, vitamin E deficiency (isolated deficiency syndrome, AR, Bassen-Komzweig syndrome), B12, B6 (pyridoxine-pellagra), thiamine, folate, nicotinic acid deficiency, Marchiafava-Bignami syndrome, Metachromatic Leukodystrophy,

CLAIMS

1.) Use of a composition in the manufacture of a medicament for the therapeutic and/or prophylactic treatment of dysmyelination, wherein the composition is to be administered in a therapeutically effective amount, to a mammal in need thereof, the composition comprising:

a.) pharmaceutical grade water;

b.) gold nanocrystals suspended in said water forming a suspension, wherein said gold nanocrystals:

i.) have surfaces that include at least one characteristic selected from the group of characteristics consisting of: (1) no organic chemical constituents adhered or attached to said surfaces and/or (2) are substantially clean and do not have chemical constituents adhered or attached to surfaces, other than water or said processing enhancer, which alter the functioning of said nanocrystals;

ii.) have a mode particle size of less than 50nm;

iii.) are present in said suspension at a concentration of 2-5,000 ppm; and

c.) said suspension having a pH of between 5 to 9.5 and a zeta potential of at least -30mv.

2.) The use of claim 1, wherein said suspension has a zeta potential of at least -40 mV.

3.) The use of claim 1, wherein said gold nanocrystals are present in a concentration amount of 2-2000ppm.

4.) Use of a composition in the manufacture of a medicament for the therapeutic and/or prophylactic treatment of dysmyelination, wherein the composition comprises a nanosuspension wherein the nanosuspension is to be administered in a therapeutically effective amount to a mammal in need thereof, the nanosuspension comprising:

a.) pharmaceutical grade water;

b.) at least one processing enhancer comprising sodium bicarbonate; and

c.) gold nanocrystals suspended in said water forming said nanosuspension, wherein said gold nanocrystals:

i.) have surfaces that include at least one characteristic selected from the group of characteristics consisting of: (1) no organic chemical constituents adhered or attached to said surfaces and/or (2) are substantially clean and do not have chemical

constituents adhered or attached to surfaces, other than water or said processing enhancer, which alter the functioning of said nanocrystals;

ii.) have a mode particle size of less than 50nm;

iii.) are present in said nanosuspension at a concentration of 2-3,000 ppm;

d.) said nanosuspension having a pH of between 5 to 9.5 and a zeta potential of at least -20mv.

5.) Use of a composition in the manufacture of a medicament for the therapeutic and/or prophylactic treatment of dysmyelination of central nervous system neurons in a mammal, wherein the composition is to be administered to the mammal in need thereof a treatment, the composition comprising:

a.) pharmaceutical grade water;

b.) gold nanocrystals suspended in said water forming a suspension, wherein said gold nanocrystals:

i.) have surfaces that include at least one characteristic selected from the group of characteristics consisting of: (1) no organic chemical constituents adhered or attached to said surfaces and/or (2) are substantially clean and do not have chemical constituents adhered or attached to surfaces, other than water or said processing enhancer, which alter the functioning of said nanocrystals;

ii.) have a mode particle size of less than 50nm;

iii.) are present in said suspension at a concentration of 2-3,000 ppm; and

c.) said suspension having a pH of between 5 to 9.5, a zeta potential of at least -20mv and the suspension does not contain chlorides.

6.) Use of a composition in the manufacture of a medicament for the therapeutic and/or prophylactic treatment of dysmyelination, wherein an effective amount of a nanosuspension is to be used, the nanosuspension comprising:

a.) pharmaceutical grade water;

b.) gold nanocrystals suspended in said water forming the nanosuspension, wherein said gold nanocrystals:

i.) have surfaces that include at least one characteristic selected from the group of characteristics consisting of: (1) no organic chemical constituents adhered or attached to said surfaces and/or (2) are substantially clean and do not have chemical constituents adhered or attached to surfaces, other than water or said processing

enhancer, which alter the functioning of said nanocrystals;

ii.) have a mode particle size of less than 50nm; and

iii.) are present in said nanosuspension at a concentration of 2-3,000 ppm; and

c.) said nanosuspension having a pH of between 5 to 9.5 and a zeta potential of at least -40mv.

7.) Use of a composition in the manufacture of a medicament for the therapeutic and/or prophylactic treatment of a disease, wherein an effective amount of a nanosuspension is to be used, the nanosuspension comprising:

a.) pharmaceutical grade water;

b.) gold nanocrystals suspended in said water forming the nanosuspension, wherein said gold nanocrystals:

i.) have surfaces that include at least one characteristic selected from the group of characteristics consisting of: (1) no organic chemical constituents adhered or attached to said surfaces and/or (2) are substantially clean and do not have chemical constituents adhered or attached to surfaces, other than water or said processing enhancer, which alter the functioning of said nanocrystals;

ii.) have a mode particle size of less than 50nm; and

iii.) are present in said nanosuspension at a concentration of 2-3,000 ppm; and

c.) said nanosuspension having a pH of between 5 to 9.5 and a zeta potential of at least -40mv,

wherein said disease comprises at least one disease selected from the group consisting of Progressive Supranuclear Palsy, Alexander's Disease, Krabbe Disease, Metachromatic Leukodystrophy, Canavan Disease, Leukodistrophies, Encephalomyelitis, Central Pontine Myelolysis (CPM), Anti Myelin-Associated Glycoprotein (MAG) Disease, Pelizaeus-Merzbacher Disease, Refsum Disease, Cockayne Syndrome, Zellweger Syndrome, Guillain-Barre Syndrome (GBS), Van der Knapp Syndrome, chronic inflammatory demyelinating polyneuropathy (CIDP), multifocal motor neuropathy (MMN), Neuromyelitis Optica (NMO) ,Progressive Multifocal Leukoencephalopathy (PML), Wallerian Degeneration and some inherited diseases such as Adrenoleukodystrophy, and Pelizaeus-Merzbacher Disease (PMZ).

8.) The use of claim 7, wherein said disease comprises Neuromyelitis Optica (NMO).

9.) Use of a therapeutically and/or prophylactically effective amount of a composition comprising an elemental gold nanosuspension in the manufacture of a medicament for the therapeutic and/or prophylactic treatment of dysmyelination, wherein the composition is to be administered to a mammal in need thereof.

10.) Use of a therapeutically and/or prophylactically effective amount of a composition comprising an elemental gold nanosuspension in the manufacture of a medicament for the therapeutic and/or prophylactic treatment of dysmyelination resulting from degeneration of supporting oligodendrocytes in a mammal, wherein the composition is to be administered to a mammal in need thereof.

11.) Use of a therapeutically and/or prophylactically effective amount of a composition comprising an elemental gold nanosuspension in the manufacture of a medicament for the therapeutic and/or prophylactic treatment of dysmyelination of central nervous system neurons in a mammal, wherein the composition is to be administered to a mammal in need thereof.

12.) The use of any of claims 1, 4-6 and 9-11 wherein said dysmyelination comprises a disturbance of cellular respiration.

13.) The use of any of claims 1, 4-6 and 9-11 wherein said dysmyelination comprises a disturbance in mitochondrial morphology.