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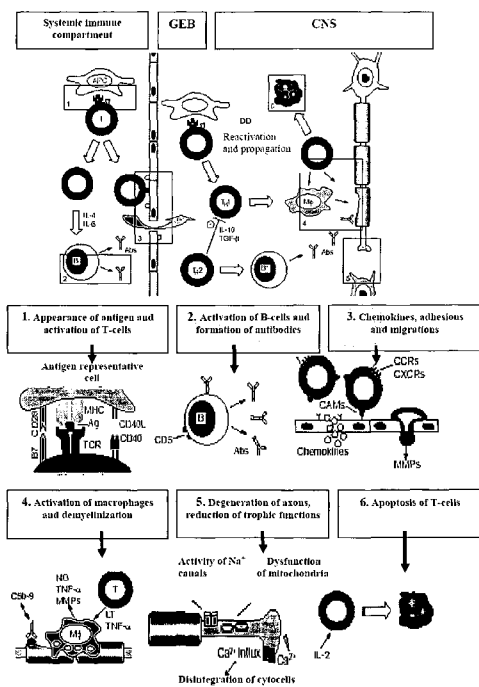
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(54) Title: COMBINATION PHARMACEUTICAL COMPOSITION AND METHODS OF TREATING DISEASES OR CONDITIONS ASSOCIATED WITH NEURODEGENERATIVE DISEASES



(57) Abstract: The present invention relates to combination pharmaceutical composition comprising an activated-potentiated form of an antibody to gamma interferon, and an activated- potentiated form of an antibody to S-100 protein and method of treating multiple sclerosis and other neurodegenerative diseases, as well as the diseases and conditions associated with neuroinfections.

WO 2012/017324 A2

**COMBINATION PHARMACEUTICAL COMPOSITION AND
METHODS OF TREATING DISEASES OR CONDITIONS
ASSOCIATED WITH NEURODEGENERATIVE DISEASES**

5

FIELD

The present invention relates to a combination pharmaceutical compositions and method of treating multiple sclerosis and other neurodegenerative diseases, as well as the diseases and conditions associated with neuroinfections.

10

BACKGROUND

Multiple sclerosis or MS is a chronic disease that affects the brain and spinal cord resulting in loss of muscle control, balance, and sensation (such as numbness). Currently, the exact cause of MS remains unknown, but researchers believe that a combination of several factors may be involved. It is believed that MS appears in genetically predisposed individuals possibly in the presence of specific external factors which lead to the development of MS. It is now generally accepted that MS involves an autoimmune process—an abnormal response of the body's immune system that is directed against the myelin (the fatty sheath that surrounds and insulates the nerve fibers) in the central nervous system (CNS—the brain, spinal cord and optic nerves). MS results in a thinning or complete loss of myelin and, as the disease advances, the cutting (transection) of the neuron's extensions or axons. When the myelin is lost, a neuron can no longer effectively conduct electrical signals. A repair process, called remyelination, takes place in early phases of the disease, but the cell's myelin sheath cannot be completely rebuilt. Repeated attacks lead to successively fewer effective remyelinations, until a scar-like plaque is built up around the damaged axons.

25

Apart from demyelination, the other pathologic trait of the disease is inflammation. According to a strictly immunological explanation, the inflammatory process is caused by T cells, a kind of lymphocyte. Lymphocytes are cells that play an important role in the body's defenses. In MS, T cells gain entry into the brain via the blood-brain barrier. It is believed that the T cells recognize myelin as foreign and attack it which triggers inflammatory processes, stimulating other immune cells and soluble factors like cytokines and antibodies.

30

In addition to autoimmune disorder, some researchers believe that infections may somehow trigger the immune system to attack nerve cells. Basically, it is believed that the virus (or a bacterium) that causes an initial infection “looks” like a nerve cell. The immune system develops T-cells to fight off the virus. Those T-cells remain in the body after the infection is gone and become confused when they “see” a nerve cell, mistaking it for an invader. The result is that your immune system attacks the nervous system.

There are four main varieties of MS. 1. Relapsing/Remitting (RRMS): characterised by relapses during which time new symptoms can appear and old ones resurface or worsen. 2. Secondary Progressive (SPMS): characterized by a gradual worsening of the disease between relapses. 3. Progressive Relapsing Multiple Sclerosis (PRMS): This form of MS follows a progressive course from onset, punctuated by relapses. 4. Primary Progressive (PPMS): This type of MS is characterized by a gradual progression of the disease from its onset with no remissions at all.

There is no known cure for MS at this time. However, there are therapies that may slow the disease. The goal of treatment is to control symptoms. Medications that alter the immune system, for example interferons, have been used to manage multiple sclerosis. Interferons are protein messengers that cells of the immune system manufacture and use to communicate with one another. There are different types of interferons, such as alpha, beta, and gamma. All interferons have the ability to regulate the immune system and play an important role in protecting against intruders including viruses. Each interferon functions differently, but the functions overlap. The beta interferons have been found useful in managing multiple sclerosis.

There is a continuing need for new drug products with desired therapeutic efficacy for treatment of MS and related symptoms.

The therapeutic effect of an extremely diluted form (or ultra-low form) of antibodies potentized by homeopathic technology (activated potentiated form) has been discovered by the inventor of the present patent application, Dr. Oleg I. Epshtein. U.S. Patent No. 7,582,294 discloses a medicament for treating Benign Prostatic Hyperplasia

or prostatitis by administration of a homeopathically activated form of antibodies to prostate specific antigen (PSA).

The S-100 protein is a cytoplasmic acidic calcium binding protein found predominantly in the gray matter of the brain, primarily in glia and Schwann cells. The protein exists in several homo-or heterodimeric isoforms consisting of two immunologically distinct subunits, alpha and beta. The S-100 protein has been suggested for use as an aid in the diagnosis and assessment of brain lesions and neurological damage due to brain injury, as in stroke. Yordan et al., Usefulness of S100B Protein in Neurological Disorders, J Pak Med Assoc Vol. 61, No. 3, March 2011, which is incorporated herein by reference.

Ultra low doses of antibodies to S-100 protein have been shown to have anxiolytic, anti-asthenic, anti-aggressive, stress-protective, anti-hypoxic, anti-ischemic, neuroprotective and nootropic activity. See Castagne V. et al., *Antibodies to S100 proteins have anxiolytic-like activity at ultra-low doses in the adult rat*, J Pharm Pharmacol. 2008, 60(3):309-16; Epstein O. I., *Antibodies to calcium-binding S100B protein block the conditioning of long-term sensitization in the terrestrial snail*, Pharmacol Biochem Behav., 2009, 94(1):37-42; Voronina T.A. et al., Chapter 8. *Antibodies to S-100 protein in anxiety-depressive disorders in experimental and clinical conditions. In "Animal models in biological psychiatry"*, Ed. Kalueff A.V. N-Y, "Nova Science Publishers, Inc.", 2006, pp. 137-152, all of which are incorporated herein by reference.

Ultra low doses of antibodies to gamma interferon have been shown to be useful in the treatment and prophylaxis of treating a disease of viral origination. See U.S. Patent No. 7,572,441, which is incorporated herein by reference in its entirety.

SUMMARY

In one aspect, the invention provides a combination pharmaceutical composition comprising a) an activated-potentiated form of an antibody to gamma interferon, and b) an activated-potentiated form of an antibody to S-100 protein.

In one variant, the present invention provides a combination pharmaceutical composition comprising a) an activated-potentiated form of an antibody to gamma interferon, and b) an activated-potentiated form of an antibody to S-100 protein, wherein the antibody is to the entire gamma interferon or fragments thereof.

5 In one variant, the invention provides a combination pharmaceutical composition comprising a) an activated-potentiated form of an antibody to gamma interferon, and b) an activated-potentiated form of an antibody to S-100 protein, wherein the antibody to the S-100 protein is an antibody to the entire S-100 protein or fragments thereof.

10 In one variant, the combination pharmaceutical composition of this aspect of the invention includes activated-potentiated form of an antibody to gamma interferon is in the form of a mixture of (C12, C30, and C50) or (C12, C30 and C200) homeopathic dilutions impregnated onto a solid carrier. The activated-potentiated form of an antibody to S-100 protein is in the form of mixture of (C12, C30, and C50) or (C12, C30 and C200) homeopathic dilutions may be subsequently impregnated onto the solid carrier.

15 In another variant, the combination pharmaceutical composition of this aspect of the invention includes the activated-potentiated form of an antibody to S-100 protein is in the form of mixture of (C12, C30, and C50) or (C12, C30 and C200) homeopathic dilutions impregnated onto a solid carrier. The activated-potentiated form of an antibody to gamma interferon is in the form of mixture of (C12, C30, and C50) or (C12, C30 and C200)
20 homeopathic dilutions may be subsequently impregnated onto the solid carrier.

25 Preferably, the activated-potentiated form of an antibody to gamma interferon is a monoclonal, polyclonal or natural antibody, more preferably, a polyclonal antibody. In one variant of this aspect of the invention, the activated-potentiated form of an antibody to gamma interferon is prepared by successive centesimal dilutions coupled with shaking of every dilution.

30 Preferably, the activated-potentiated form of an antibody to S-100 protein is a monoclonal, polyclonal or natural antibody, more preferably, a polyclonal antibody. In one variant of this aspect of the invention, the activated-potentiated form of an antibody to S-100 protein is prepared by successive centesimal dilutions coupled with shaking of every dilution. Vertical shaking is specifically contemplated.

In another aspect, the invention provides a method of treating a patient suffering from multiple sclerosis by administration of a) an activated-potentiated form of an antibody to gamma interferon, and b) an activated-potentiated form of an antibody to S-100 protein. Preferably, the activated-potentiated form of an antibody to gamma interferon and the activated-potentiated form of an antibody to S-100 protein are administered in the form of combined pharmaceutical composition.

In another aspect, the invention provides a method of significantly delaying the onset of symptoms in a patient suffering from multiple sclerosis by administration of a combination pharmaceutical composition wherein the composition comprises a) an activated-potentiated form of an antibody to gamma interferon, and b) an activated-potentiated form of an antibody to S-100 protein.

In another aspect, the present invention further provides a method of reducing the frequency of appearance of relapse in a patient suffering from multiple sclerosis by administration of a combination pharmaceutical composition wherein the composition comprises a) an activated-potentiated form of an antibody to gamma interferon, and b) an activated-potentiated form of an antibody to S-100 protein.

In one variant of the invention, there is provided administration of from one to two unit dosage forms of the activated-potentiated form of an antibody to gamma interferon, and from one to two unit dosage forms of the activated-potentiated form of an antibody to S-100 protein each of the dosage form being administered from once daily to four times daily. Preferably, the one to two unit dosage forms of each of the activated-potentiated forms of antibodies is administered twice daily.

In a preferred variant of this aspect of the invention, there is provided administration of from one to two unit dosage forms, of the combination composition comprising a) the activated-potentiated form of an antibody to gamma interferon, and b) the activated-potentiated form of an antibody to S-100 protein, each of the dosage form being administered from once daily to four times daily. Preferably, one to two unit dosage forms are administered twice daily.

In another variant of this aspect of the invention, which is preferred, the combination is administered in the form of one unit dosage form comprising a) the

activated-potentiated form of an antibody to gamma interferon, and b) the activated-potentiated form of an antibody to S-100 protein, preferably twice daily.

BRIEF DESCRIPTION OF THE DRAWINGS

- 5 FIG. 1 – Illustrates the immune response in pathogenesis of multiple sclerosis
 FIG. 2 – Shows the mean day of clinical symptoms onset
 FIG. 3 – Shows the severity of disease (points)
 FIG. 4 – Shows the severity of disease at different stages (points)
 FIG. 5 – Shows the frequency of appearance of relapse

10

DETAILED DESCRIPTION

The invention is defined with reference to the appended claims. With respect to the claims, the glossary that follows provides the relevant definitions.

15 The term “antibody” as used herein shall mean an immunoglobulin that specifically binds to, and is thereby defined as complementary with, a particular spatial and polar organization of another molecule. Antibodies as recited in the claims may include a complete immunoglobulin or fragment thereof, may be natural, polyclonal or monoclonal, and may include various classes and isotypes, such as IgA, IgD, IgE, IgG1, IgG2a, IgG2b and IgG3, IgM, etc. Fragments thereof may include Fab, Fv and F(ab')₂, Fab', and the like. The singular “antibody” includes plural “antibodies”.

20 The term “activated-potentiated form” or “potentiated form” respectively, with respect to antibodies recited herein is used to denote a product of homeopathic potentization of any initial solution of antibodies. “Homeopathic potentization” denotes the use of methods of homeopathy to impart homeopathic potency to an initial solution
25 of relevant substance. Although not so limited, ‘homeopathic potentization’ may involve, for example, repeated consecutive dilutions combined with external treatment, particularly (mechanical) shaking. In other words, an initial solution of antibody is subjected to consecutive repeated dilution and multiple vertical shaking of each obtained solution in accordance with homeopathic technology. The preferred
30 concentration of the initial solution of antibody in the solvent, preferably water or a

water-ethyl alcohol mixture, ranges from about 0.5 to about 5.0 mg/ml. The preferred procedure for preparing each component, i.e. antibody solution, is the use of the mixture of three aqueous or aqueous-alcohol dilutions of the primary matrix solution (mother tincture) of antibodies diluted 100^{12} , 100^{30} and 100^{200} times, respectively, which is equivalent to centesimal homeopathic dilutions (C12, C30, and C200) or the use of the mixture of three aqueous or aqueous-alcohol dilutions of the primary matrix solution of antibodies diluted 100^{12} , 100^{30} and 100^{50} times, respectively, which is equivalent to centesimal homeopathic dilutions (C12, C30 and C50). Examples of homeopathic potentization are described in U.S. Patent. Nos. 7,572,441 and 7,582,294, which are incorporated herein by reference in their entirety and for the purpose stated. . While the term "activated-potentiated form" is used in the claims, the term "ultra-low doses" is used in the examples. The term "ultra-low doses" became a term of art in the field of art created by study and use of homeopathically diluted and potentized form of substance. The term "ultra-low dose" or "ultra-low doses" is meant as fully supportive and primarily synonymous with the term 'activated-potentiated" form used in the claims.

In other words, an antibody is in the "activated-potentiated" or "potentiated" form when three factors are present. First, the "activated-potentiated" form of the antibody is a product of a preparation process well accepted in the homeopathic art. Second, the "activated-potentiated" form of antibody must have biological activity determined by methods well accepted in modern pharmacology. And third, the biological activity exhibited by the "activated potentiated" form of the antibody cannot be explained by the presence of the molecular form of the antibody in the final product of the homeopathic process.

For example, the activated potentiated form of antibodies may be prepared by subjecting an initial, isolated antibody in a molecular form to consecutive multiple dilutions coupled with an external impact, such as mechanical shaking. The external treatment in the course of concentration reduction may also be accomplished, for example, by exposure to ultrasonic, electromagnetic, or other physical factors. V. Schwabe "Homeopathic medicines", M., 1967, U.S. Patents Nos. 7,229,648 and 4,311,897, which are incorporated by reference in their entirety and for the purpose stated, describe such processes that are well accepted

methods of homeopathic potentiation in the homeopathic art. This procedure gives rise to a uniform decrease in molecular concentration of the initial molecular form of the antibody. This procedure is repeated until the desired homeopathic potency is obtained. For the individual antibody, the required homeopathic potency can be determined by subjecting the intermediate dilutions to biological testing in the desired pharmacological model. Although not so limited, "homeopathic potentization" may involve, for example, repeated consecutive dilutions combined with external treatment, particularly vertical (mechanical) shaking. In other words, an initial solution of antibody is subjected to consecutive repeated dilution and multiple vertical shaking of each obtained solution in accordance with homeopathic technology. The preferred concentration of the initial solution of antibody in the solvent, preferably, water or a water-ethyl alcohol mixture, ranges from about 0.5 to about 5.0 mg/ml. The preferred procedure for preparing each component, i.e. antibody solution, is the use of the mixture of three aqueous or aqueous-alcohol dilutions of the primary matrix solution (mother tincture) of antibodies diluted 100^{12} , 100^{30} and 100^{200} times, respectively, which is equivalent to centesimal homeopathic dilutions C12, C30 and C200 or the mixture of three aqueous or aqueous-alcohol dilutions of the primary matrix solution (mother tincture) of antibodies diluted 100^{12} , 100^{30} and 100^{50} times, respectively, which is equivalent to centesimal homeopathic dilutions C12, C30 and C50. Examples of how to obtain the desired potency are also provided, for example, in U.S. Patent Nos. 7,229,648 and 4,311,897, which are incorporated by reference for the purpose stated. The procedure applicable to the "activated potentiated" form of the antibodies described herein is described in more detail below.

There has been a considerable amount of controversy regarding homeopathic treatment of human subjects. While the present invention relies on accepted homeopathic processes to obtain the "activated-potentiated" form of antibodies, it does not rely solely on homeopathy in human subjects for evidence of activity. It has been surprisingly discovered by the inventor of the present application and amply demonstrated in the accepted pharmacological models that the solvent ultimately obtained from consecutive multiple dilution of a starting molecular form of an antibody has definitive activity unrelated to the presence of the traces of the molecular form of

the antibody in the target dilution. The "activated-potentiated" form of the antibody provided herein are tested for biological activity in well accepted pharmacological models of activity, either in appropriate *in vitro* experiments, or *in vivo* in suitable animal models. The experiments provided further below provide evidence of biological activity in such models. Human clinical studies also provide evidence that the activity observed in the animal model is well translated to human therapy. Human studies have also provided evidence of availability of the "activated potentiated" forms described herein to treat specified human diseases or disorders well accepted as pathological conditions in the medical science.

Also, the claimed "activated-potentiated" form of antibody encompasses only solutions or solid preparations the biological activity of which cannot be explained by the presence of the molecular form of the antibody remaining from the initial, starting solution. In other words, while it is contemplated that the "activated-potentiated" form of the antibody may contain traces of the initial molecular form of the antibody, one skilled in the art could not attribute the observed biological activity in the accepted pharmacological models to the remaining molecular form of the antibody with any degree of plausibility due to the extremely low concentrations of the molecular form of the antibody remaining after the consecutive dilutions. While the invention is not limited by any specific theory, the biological activity of the "activated-potentiated" form of the antibodies of the present invention is not attributable to the initial molecular form of the antibody. Preferred is the "activated-potentiated" form of antibody in liquid or solid form in which the concentration of the initial molecular form of the antibody is below the limit of detection of the accepted analytical techniques, such as capillary electrophoresis and High Performance Liquid Chromatography. Particularly preferred is the "activated-potentiated" form of antibody in liquid or solid form in which the concentration of the initial molecular form of the antibody is below the Avogadro number. In the pharmacology of molecular forms of therapeutic substances, it is common practice to create a dose-response curve in which the level of pharmacological response is plotted against the concentration of the active drug administered to the subject or tested *in vitro*. The minimal level of the drug which produces any detectable response is known

as a threshold dose. It is specifically contemplated and preferred that the “activated-potentiated” form of the antibodies contains molecular antibody, if any, at a concentration below the threshold dose for the molecular form of the antibody in the given biological model.

5 Experimental animal models of multiple sclerosis are known. For example, Experimental autoimmune encephalomyelitis, sometimes Experimental Allergic Encephalomyelitis (EAE) is an animal model of inflammatory demyelinating diseases of the central nervous system. It is mostly used with rodents and knockout mice. This experimental model is widely studied as an animal model of the human central nervous
10 system demyelinating diseases, such as multiple sclerosis. It is possible to induce EAE in sensory animals by homogenate of homologous or heterologous cerebral tissue, purified myelin or proteins being introduced into the animal’s composition (Raine, et al., Ann. NY Acad. Sci., 1984, 436: 33-51; McCombe, et al., J. Neuroimmunol. 1994; 51 (2): 153-167).

15 At the present time, more than 20 myelin proteins have been described which possess immunogenic properties and most frequently are used for inducing EAE (Baumann, et al., Physiol. Rev. 2001, 81(2): 871-927). Examples include: basic myelin protein (“MBP”) (Hashim, Immunol. Rev., 1978, 39:60-107); proteolipid protein (“PLP”) (Bradl, et al., Brain Pathol., 1996, 6(3): 303-311; Tuohy, Neurochem. Res., 1994, 19(8):
20 935-944); glycoproteins: myelin associated glycoprotein (“MAG”) (Weerth et al, 1999); myelin oligodendrocyte glycoprotein (“MOG”); and oligodendrocyte specific protein (“OSP”) (Stevens, et al., J Immunol., 1999; 162 (12): 7501-7509). It is recognized that, not only whole proteins, but also specific fragments of these proteins are capable of causing EAE when introduced into animals. The most commonly used antigens in
25 rodents are spinal cord homogenate (SCH), purified myelin, myelin protein such as MBP, PLP and MOG or peptides of these proteins, all resulting in distinct models with different disease characteristics regarding both immunology and pathology.

The most adequate model MS is caused in EAE models by introducing homogenate of spinal cord (Gilerovich et al, 2010; Zhabotinskiy, Joffe, 1975; Zhitnukhin
30 et al, 2008; Sinha et al, 2009). In this model, as with the initial disease, immune

response is made to all components of myelin: inflammation is induced with subsequent demyelination, degeneration of axons and then the nerve cells themselves (Gilerovich et al, 2010; Sinha et al, 2009). A pathologic chain of events is manifested with development of pareses, paralyzes and other disease symptoms.

5 In the development of EAE, it was possible to distinguish four stages:
1. Sensitization of T-lymphocytes on the periphery under the effect of cerebral antigen with CFA and increase in the permeability of GEB. 2. Migration of activated T-cells to the CNS and activation of antigen-presenting cells (astrocytes and microglia) directly in the brain. These two stages correspond to the latent (induction) period when clinical
10 manifestations are not observed. 3. Development of autoimmune and inflammatory reactions in the brain, which leads to demyelination of nerve fibers (clinical period). 4. Suppression of pathologic processes and repair of damaged tissues (recovery phase). During this period, neurologic and motor disorders are smoothed in the majority of animals and partial or complete recovery ensues, after which animals are resistant to
15 the repeated induction of EAE. The average duration of EAE is 30 days: latent stage, clinical stage and recovery stage. The duration of each stage is usually 7-10 days.

Analogous phases of development of the pathologic process in the CNS are also observed with multiple sclerosis. See figure 1 - Immune response in pathogenesis of multiple sclerosis (Wiendl & Kieseier, 2003).

20 The present invention provides a combination pharmaceutical composition comprising a) an activated-potentiated form of an antibody to gamma interferon, and b) an activated-potentiated form of an antibody to S-100 protein. As set forth herein above, each of the individual components of the combination is generally known for its own individual medical uses. However, the inventors of the present patent application
25 surprisingly discovered that administration of the combination remarkably delays the onset of symptoms and reduces the probability of relapse in patients with multiple sclerosis.

The combination pharmaceutical composition in accordance with this aspect of
30 the invention may be in the liquid form or in solid form. Each of the activated

potentiated forms of the antibodies included in the pharmaceutical composition is prepared from an initial molecular form of the antibody via a process accepted in homeopathic art. The starting antibodies may be monoclonal, or polyclonal antibodies prepared in accordance with known processes, for example, as described in
5 Immunotechniques, G. Frimel, M., "Meditsyna", 1987, p. 9-33; "Hum. Antibodies. Monoclonal and recombinant antibodies, 30 years after" by Laffly E., Sodoyer R. – 2005 – Vol. 14. – N 1-2. P.33-55, both incorporated herein by reference.

Monoclonal antibodies may be obtained, e.g., by means of hybridoma technology. The initial stage of the process includes immunization based on the
10 principles already developed in the course of polyclonal antisera preparation. Further stages of work involve the production of hybrid cells generating clones of antibodies with identical specificity. Their separate isolation is performed using the same methods as in the case of polyclonal antisera preparation.

Polyclonal antibodies may be obtained via active immunization of animals. For
15 this purpose, for example, suitable animals (e.g. rabbits) receive a series of injections of the appropriate antigen, either S-100 protein or gamma interferon. The animals' immune system generates corresponding antibodies, which are collected from the animals in a known manner. This procedure enables preparation of a monospecific antibody-rich serum.

If desired, the serum containing antibodies may be purified, for example by using
20 affine chromatography, fractionation by salt precipitation, or ion-exchange chromatography. The resulting purified, antibody-enriched serum may be used as a starting material for the preparation of the activated-potentiated form of the antibodies. The preferred concentration of the resulting initial solution of antibody in the solvent,
25 preferably water or a water-ethyl alcohol mixture, ranges from about 0.5 to about 5.0 mg/ml.

The preferred procedure for preparing each component of the combination drug according to the present invention is the use of the mixture of three aqueous-alcohol
30 dilutions of the primary matrix solution of antibodies diluted 100^{12} , 100^{30} and 100^{50} times, respectively, which is equivalent to centesimal homeopathic dilutions C12, C30,

and C50 or diluted 100¹², 100³⁰ and 100²⁰⁰ times, respectively, which is equivalent to centesimal homeopathic dilutions C12, C30 and C200. To prepare a solid dosage form, a solid carrier is treated with the desired dilution obtained via the homeopathic process. To obtain a solid unit dosage form of the combination of the invention, the carrier mass is impregnated with each of the dilutions. Both orders of impregnation are suitable to prepare the desired combination dosage form.

In a preferred embodiment, the starting material for the preparation of the activated potentiated form that comprise the combination of the invention is polyclonal, animal-raised antibody to the corresponding antigen, namely, gamma interferon or S-100 protein. To obtain the activated-potentiated form of polyclonal antibodies to gamma interferon, the desired antigen may be injected as immunogen into a laboratory animal, preferably, rabbits. Polyclonal antibodies to gamma interferon may be obtained using the whole molecule of gamma interferon of the following sequence:

SEQ. ID. NO. 1.

15	Met	Lys	Tyr	Thr	Ser	Tyr	Ile	Leu	Ala	Phe	Gln	Leu	Cys	Ile	Val
	1				5					10					15
	Leu	Gly	Ser	Leu	Gly	Cys	Tyr	Cys	Gln	Asp	Pro	Tyr	Val	Lys	Glu
	16				20					25					30
	Ala	Glu	Asn	Leu	Lys	Lys	Tyr	Phe	Asn	Ala	Gly	His	Ser	Asp	Val
20	31				35					40					45
	Ala	Asp	Asn	Gly	Thr	Leu	Phe	Leu	Gly	Ile	Leu	Lys	Asn	Trp	Lys
	46				50					55					60
	Glu	Glu	Ser	Asp	Arg	Lys	Ile	Met	Gln	Ser	Gln	Ile	Val	Ser	Phe
	61				65					70					75
25	Tyr	Phe	Lys	Leu	Phe	Lys	Asn	Phe	Lys	Asp	Asp	Gln	Ser	Ile	Gln
	76				80					85					90
	Lys	Ser	Val	Glu	Thr	Ile	Lys	Glu	Asp	Met	Asn	Val	Lys	Phe	Phe
	91				95					100					105
	Asn	Ser	Asn	Lys	Lys	Lys	Arg	Asp	Asp	Phe	Glu	Lys	Leu	Thr	Asn
30	106				110					115					120
	Tyr	Ser	Val	Thr	Asp	Leu	Asn	Val	Gln	Arg	Lys	Ala	Ile	His	Glu

	121		125		130		135								
	Leu	Ile	Gln	Val	Met	Ala	Glu	Leu	Ser	Pro	Ala	Ala	Lys	Thr	Gly
	136		140		145		150								
	Lys	Arg	Lys	Arg	Ser	Gln	Met	Leu	Phe	Arg	Gly	Arg	Arg	Ala	Ser
5	151		155		160		165								
	Gln														
	166														

Polyclonal antibodies to gamma interferon may be obtained using the whole molecule of
 10 gamma interferon of the following sequence:

SEQ. ID. NO. 2

	Met	Lys	Tyr	Thr	Ser	Tyr	Ile	Leu	Ala	Phe	Gln	Leu	Cys	Ile	Val
	1				5					10				15	
	Leu	Gly	Ser	Leu	Gly	Cys	Tyr	Cys	Gln	Asp	Pro	Tyr	Val	Lys	Glu
15	16				20					25				30	
	Ala	Glu	Asn	Leu	Lys	Lys	Tyr	Phe	Asn	Ala	Gly	His	Ser	Asp	Val
	31				35					40				45	
	Ala	Asp	Asn	Gly	Thr	Leu	Phe	Leu	Gly	Ile	Leu	Lys	Asn	Trp	Lys
	46				50					55				60	
20	Glu	Glu	Ser	Asp	Arg	Lys	Ile	Met	Gln	Ser	Gln	Ile	Val	Ser	Phe
	61				65					70				75	
	Tyr	Phe	Lys	Leu	Phe	Lys	Asn	Phe	Lys	Asp	Asp	Gln	Ser	Ile	Gln
	76				80					85				90	
	Lys	Ser	Val	Glu	Thr	Ile	Lys	Glu	Asp	Met	Asn	Val	Lys	Phe	Phe
25	91				95					100				105	
	Asn	Ser	Asn	Lys	Lys	Lys	Arg	Asp	Asp	Phe	Glu	Lys	Leu	Thr	Asn
	106				110					115				120	
	Tyr	Ser	Val	Thr	Asp	Leu	Asn	Val	Gln	Arg	Lys	Ala	Ile	His	Glu
30	121				125					130				135	
	Leu	Ile	Gln	Val	Met	Ala	Glu	Leu	Ser	Pro	Ala	Ala	Lys	Thr	Gly
	136				140					145				150	

Lys Ser Val Glu Thr Ile Lys Glu Asp Met Asn Val Lys Phe Phe
 91 95 100 105
 Asn Ser Asn Lys Lys Lys Arg Asp Asp Phe Glu Lys Leu Thr Asn
 106 110 115 120
 5 Tyr Ser Val Thr Asp Leu Asn Val Gln Arg Lys Ala Ile His Glu
 121 125 130 135
 Leu Ile Gln Val Met Ala Glu Leu Ser Pro Ala Ala Lys Thr Gly
 136 140 145 150
 Lys Arg Lys Arg Ser Gln Met Leu Phe Arg Gly Arg Arg Ala Ser
 10 151 155 160 165
 Gln
 166

SEQ. ID. NO 5

15 Gln Asp Pro Tyr Val Lys Glu
 24 30
 Ala Glu Asn Leu Lys Lys Tyr Phe Asn Ala Gly His Ser Asp Val
 31 35 40 45
 Ala Asp Asn Gly Thr Leu Phe Leu Gly Ile Leu Lys Asn Trp Lys
 20 46 50 55 60
 Glu Glu Ser Asp Arg Lys Ile Met Gln Ser Gln Ile Val Ser Phe
 61 65 70 75
 Tyr Phe Lys Leu Phe Lys Asn Phe Lys Asp Asp Gln Ser Ile Gln
 76 80 85 90
 25 Lys Ser Val Glu Thr Ile Lys Glu Asp Met Asn Val Lys Phe Phe
 91 95 100 105
 Asn Ser Asn Lys Lys Lys Arg Asp Asp Phe Glu Lys Leu Thr Asn
 106 110 115 120
 Tyr Ser Val Thr Asp Leu Asn Val Gln Arg Lys Ala Ile His Glu
 30 121 125 130 135

Leu Ile Gln Val Met Ala Glu Leu Ser Pro Ala Ala Lys Thr Gly
 136 140 145 150
 Lys Arg Lys Arg Ser Gln Met Leu Phe Gln Gly Arg Arg Ala Ser
 151 155 160 165
 5 Gln
 166

SEQ. ID. NO 6

Gln Ser Gln Ile Val Ser Phe
 10 69 75
 Tyr Phe Lys Leu Phe Lys Asn Phe Lys Asp Asp Gln Ser Ile Gln
 76 80 85 90
 Lys Ser Val Glu Thr Ile Lys Glu Asp Met Asn Val Lys Phe Phe
 91 95 100 105
 15 Asn Ser Asn Lys Lys Lys Arg Asp Asp Phe Glu Lys Leu Thr Asn
 106 110 115 120
 Tyr Ser Val
 121 123

20 SEQ. ID. NO 7

Met Asn Val Lys Phe Phe
 100 105
 Asn Ser Asn Lys Lys Lys Arg Asp Asp Phe Glu Lys Leu Thr Asn
 106 110 115 120
 25 Tyr Ser Val Thr Asp Leu Asn Val Gln Arg Lys Ala Ile His Glu
 121 125 130 135
 Leu Ile Gln Val Met Ala Glu Leu Ser Pro
 136 140 145

SEQ. ID. NO 8

Ser Val Glu Thr Ile Lys Glu Asp Met Asn Val Lys Phe Phe
 92 95 100 105
 Asn Ser Asn Lys Lys Lys Arg Asp Asp Phe Glu Lys Leu Thr Asn
 5 106 110 115 120
 Tyr Ser Val Thr Asp Leu Asn Val Gln Arg
 121 125 130

SEQ. ID. NO 9

10 Val Thr Asp Leu Asn Val Gln Arg Lys Ala Ile His Glu
 123 125 130 135
 Leu Ile Gln Val Met Ala Glu Leu Ser Pro Ala Ala
 136 140 145 147

15 SEQ. ID. NO 10

Ser Tyr Ile Leu Ala Phe Gln Leu Cys Ile Val
 5 10
 15
 Leu Gly Ser Leu Gly Cys Tyr Cys Gln Asp Pro Tyr Val Lys Glu
 20 16 20 25 30
 Ala Glu Asn Leu Lys Lys Tyr Phe Asn Ala Gly His Ser Asp Val
 31 35 40 45

SEQ. ID. NO 11

25 Glu Thr Ile Lys Glu Asp Met Asn Val Lys Phe Phe
 94 100
 105
 Asn Ser Asn Lys Lys Lys Arg Asp Asp
 106 110 114

SEQ. ID. NO 13

									Met	Gln	Asp	Pro	Tyr	Val	Lys	Glu
										24						30
	Ala	Glu	Asn	Leu	Lys	Lys	Tyr	Phe	Asn	Ala	Gly	His	Ser	Asp	Val	
5	31				35					40						45
	Ala	Asp	Asn	Gly	Thr	Leu	Phe	Leu	Gly	Ile	Leu	Lys	Asn	Trp	Lys	
	46				50					55						60
	Glu	Glu	Ser	Asp	Arg	Lys	Ile	Met	Gln	Ser	Gln	Ile	Val	Ser	Phe	
10	61				65					70						75
	Tyr	Phe	Lys	Leu	Phe	Lys	Asn	Phe	Lys	Asp	Asp	Gln	Ser	Ile	Gln	
	76				80					85						90
	Lys	Ser	Val	Glu	Thr	Ile	Lys	Glu	Asp	Met	Asn	Val	Lys	Phe	Phe	
	91				95					100						105
	Asn	Ser	Asn	Lys	Lys	Lys	Arg	Asp	Asp	Phe	Glu	Lys	Leu	Thr	Asn	
15	106				110					115						120
	Tyr	Ser	Val	Thr	Asp	Leu	Asn	Val	Gln	Arg	Lys	Ala	Ile	His	Glu	
	121				125					130						135
	Leu	Ile	Gln	Val	Met	Ala	Glu	Leu	Ser	Pro	Ala	Ala	Lys	Thr	Gly	
20	136				140					145						150
	Lys	Arg	Lys	Arg	Ser	Gln	Met	Leu	Phe	Arg	Gly	Arg	Arg	Ala	Ser	
	151				155					160						165
	Gln															
	166															

25 The exemplary procedure for preparation of the starting polyclonal antibodies to human gamma interferon may be described as follows. In 7-9 days before blood sampling, 1-3 intravenous injections of the desired antigen are made to the rabbits to increase the level of polyclonal antibodies in the rabbit blood stream. Upon immunization, blood samples are taken to test the antibody level. Typically, the maximum level of immune reaction of the soluble antigen is achieved within 40 to 60 days after the first injection of the antigen. Upon completion of the first immunization

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cycle, rabbits have a 30-day rehabilitation period, after which re-immunization is performed with another 1-3 intravenous injections.

To obtain antiserum containing the desired antibodies, the immunized rabbits' blood is collected from rabbits and placed in a 50ml centrifuge tube. Product clots formed on the tube sides are removed with a wooden spatula, and a rod is placed into the clot in the tube center. The blood is then placed in a refrigerator for one night at the temperature of about 4°C. On the following day, the clot on the spatula is removed, and the remaining liquid is centrifuged for 10 min at 13,000 rotations per minute. Supernatant fluid is the target antiserum. The obtained antiserum is typically yellow. 20% of NaN_3 (weight concentration) is added in the antiserum to a final concentration of 0.02% and stored before use in frozen state at the temperature of -20°C or without NaN_3 at the temperature of -70°C. To separate the target antibodies to gamma interferon from the antiserum, the following solid phase absorption sequence is suitable:

10 ml of the antiserum of rabbits is diluted twofold with 0.15 M NaCl, after which 6.26g Na_2SO_4 is added, mixed and incubated for 12-16 hours at 4°C. The sediment is removed by centrifugation, diluted in 10ml of phosphate buffer and dialyzed against the same buffer during one night at ambient temperature. After the sediment is removed, the solution is applied to a DEAE-cellulose column balanced by phosphate buffer. The antibody fraction is determined by measuring the optical density of the eluate at 280 nm.

The isolated crude antibodies are purified using affine chromatography method by attaching the obtained antibodies to gamma interferon located on the insoluble matrix of the chromatography media, with subsequent elution by concentrated aqueous salt solutions.

The resulting buffer solution is used as the initial solution for the homeopathic dilution process used to prepare the activated potentiated form of the antibodies. The preferred concentration of the initial matrix solution of the antigen-purified polyclonal rabbit antibodies to gamma interferon is 0.5 to 5.0 mg/ml, preferably, 2.0 to 3.0 mg/ml.

The brain-specific S100 protein, expressed by neurons and glial cells (astrocytes and oligodendrocytes), directly or through interactions with other proteins executes in

the CNS a number of functions directed at maintaining normal brain functioning, including affecting learning and memory processes, growth and viability of neurons, regulation of metabolic processes in neuronal tissues and others. To prepare the activated-potentiated form of antibodies, an antiserum to brain-specific S-100 protein
5 may be removed from the brain tissue of a bull and processed as follows:

- the bull brain tissue frozen in liquid nitrogen is converted into powder using a specialized mill;

- proteins are extracted in the ratio of 1:3 (weight/volume) using an extracting buffer with homogenization;

10 - the homogenate is heated for 10 min at 60°C and then cooled to 4°C in an ice bath;

- thermolabile proteins are removed by centrifugation;

- ammonium sulfate fractionation is carried out in stages, with subsequent removal of precipitated proteins;

15 - the fraction containing S-100 protein is precipitated using 100% saturated ammonium sulfate accomplished by pH drop to 4.0; the desired fraction is collected by centrifugation;

- the precipitate is dissolved in a minimum buffer volume containing EDTA and mercaptoethanol, the precipitate is dialyzed with deionized water and lyophilized;

20 - fractionation of acidic proteins is followed by chromatography in ion-exchanging media, DEAE-cellulose DE-52 and then DEAE-sephadex A-50;

- the collected and dialyzed fractions, which contain S-100 protein, are divided according to molecular weight by gel filtration on sephadex G-100;

- purified S-100 protein is dialyzed and lyophilized.

25 The molecular weight of the purified brain-specific S-100 protein is 21000 D.

The polyclonal antibodies to S-100 protein may also be obtained by a similar methodology to the methodology described for gamma interferon antibodies using an adjuvant. The entire molecule of S-100 protein may be used as immunogen (antigen) for rabbits' immunization.

Bovine S100B (SEQ. ID. NO. 14)

	Met	Ser	Glu	Leu	Glu	Lys	Ala	Val	Val	Ala	Leu	Ile	Asp	Val	Phe
	1				5					10					15
5	His	Gln	Tyr	Ser	Gly	Arg	Glu	Gly	Asp	Lys	His	Lys	Leu	Lys	Lys
	16				20					25					30
	Ser	Glu	Leu	Lys	Glu	Leu	Ile	Asn	Asn	Glu	Leu	Ser	His	Phe	Leu
	31				35					40					45
	Glu	Glu	Ile	Lys	Glu	Gln	Glu	Val	Val	Asp	Lys	Val	Met	Glu	Thr
	46				50					55					60
10	Leu	Asp	Ser	Asp	Gly	Asp	Gly	Glu	Cys	Asp	Phe	Gln	Glu	Phe	Met
	61				65					70					75
	Ala	Phe	Val	Ala	Met	Ile	Thr	Thr	Ala	Cys	His	Glu	Phe	Phe	Glu
	76				80					85					90
15	His	Glu													
	91	92													

Human S100B (SEQ. ID. 15)

	Met	Ser	Glu	Leu	Glu	Lys	Ala	Met	Val	Ala	Leu	Ile	Asp	Val	Phe
	1				5					10					15
20	His	Gln	Tyr	Ser	Gly	Arg	Glu	Gly	Asp	Lys	His	Lys	Leu	Lys	Lys
	16				20					25					30
	Ser	Glu	Leu	Lys	Glu	Leu	Ile	Asn	Asn	Glu	Leu	Ser	His	Phe	Leu
	31				35					40					45
25	Glu	Glu	Ile	Lys	Glu	Gln	Glu	Val	Val	Asp	Lys	Val	Met	Glu	Thr
	46				50					55					60
	Leu	Asp	Asn	Asp	Gly	Asp	Gly	Glu	Cys	Asp	Phe	Gln	Glu	Phe	Met
	61				65					70					75
	Ala	Phe	Val	Ala	Met	Val	Thr	Thr	Ala	Cys	His	Glu	Phe	Phe	Glu
	76				80					85					90
30	His	Glu													
	91	92													

Human S100A1 (SEQ. ID. No. 16)

	Met	Gly	Ser	Glu	Leu	Glu	Thr	Ala	Met	Glu	Thr	Leu	Ile	Asn	Val
35	1				5					10					15
	Phe	His	Ala	His	Ser	Gly	Lys	Glu	Gly	Asp	Lys	Tyr	Lys	Leu	Ser
	16				20					25					30
	Lys	Lys	Glu	Leu	Lys	Glu	Leu	Leu	Gln	Thr	Glu	Leu	Ser	Gly	Phe
	31				35					40					45
40	Leu	Asp	Ala	Gln	Lys	Asp	Val	Asp	Ala	Val	Asp	Lys	Val	Met	Lys
	46				50					55					60
	Glu	Leu	Asp	Glu	Asn	Gly	Asp	Gly	Glu	Val	Asp	Phe	Gln	Glu	Tyr
	61				65					70					75

Val Val Leu Val Ala Ala Leu Thr Val Ala Cys Asn Asn Phe Phe
 76 80 85 90
 Trp Glu Asn Ser
 91 94

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Bovine S100A1 (SEQ. ID. NO. 17)

Met Gly Ser Glu Leu Glu Thr Ala Met Glu Thr Leu Ile Asn Val
 1 5 10 15
 Phe His Ala His Ser Gly Lys Glu Gly Asp Lys Tyr Lys Leu Ser
 10 16 20 25 30
 Lys Lys Glu Leu Lys Glu Leu Leu Gln Thr Glu Leu Ser Gly Phe
 31 35 40 45
 Leu Asp Ala Gln Lys Asp Ala Asp Ala Val Asp Lys Val Met Lys
 46 50 55 60
 Glu Leu Asp Glu Asn Gly Asp Gly Glu Val Asp Phe Gln Glu Tyr
 15 61 65 70 75
 Val Val Leu Val Ala Ala Leu Thr Val Ala Cys Asn Asn Phe Phe
 76 80 85 90
 Trp Glu Asn Ser
 20 91 94

To obtain brain-specific antiserum to separated brain-specific S-100 protein, a mixture of purified S-100 protein (antigen) may be prepared in complex by methylated bull serum albumin as the medium with complete Freund's adjuvant, which is subcutaneously injected in the laboratory animal, rabbit, in the area of the spine in the quantity of 1-2 ml. The antiserum may have a titer of 1:500 - 1:1000.

The activated potentiated form of each component of the combination may be prepared from an initial solution by homeopathic potentization, preferably using the method of proportional concentration decrease by serial dilution of 1 part of each preceding solution (beginning with the initial solution) in 9 parts (for decimal dilution), or in 99 parts (for centesimal dilution), or in 999 parts (for millesimal dilution) of a neutral solvent, starting with a concentration of the initial solution of antibody in the solvent, preferably, water or a water-ethyl alcohol mixture, in the range from about 0.5 to about 5.0 mg/ml, coupled with external impact. Preferably, the external impact involves multiple vertical shaking (dynamization) of each dilution. Preferably, separate containers are used for each subsequent dilution up to the required potency level, or the dilution factor. This method is well-accepted in the homeopathic art. See, e.g. V.

Schwabe "*Homeopathic medicines*", M., 1967, p. 14-29, incorporated herein by reference for the purpose stated.

For example, to prepare a 12-centesimal dilution (denoted C12), one part of the initial matrix solution of antibodies to gamma interferon with the concentration of 3.0 mg/ml is diluted in 99 parts of neutral aqueous or aqueous-alcohol solvent (preferably, 15%-ethyl alcohol) and then vertically shaken many times (10 and more) to create the 1st centesimal dilution (denoted as C1). The 2nd centesimal dilution (C2) is prepared from the 1st centesimal dilution C1. This procedure is repeated 11 times to prepare the 12th centesimal dilution C12. Thus, the 12th centesimal dilution C12 represents a solution obtained by 12 serial dilutions of one part of the initial matrix solution of antibodies to gamma interferon with the concentration of 3.0 mg/ml in 99 parts of a neutral solvent in different containers, which is equivalent to the centesimal homeopathic dilution C12. Similar procedures with the relevant dilution factor are performed to obtain dilutions C30, C50 and C 200. The intermediate dilutions may be tested in a desired biological model to check activity. The preferred activated potentiated forms for both antibodies comprising the combination of the invention are a mixture of C12, C30, and C50 dilutions or C12, C30 and C200 dilutions. When using the mixture of various homeopathic dilutions (primarily centesimal) of the active substance as biologically active liquid component, each component of the composition (e.g., C12, C30, C50, C200) is prepared separately according to the above-described procedure until the next-to-last dilution is obtained (e.g., until C11, C29, and C199 respectively), and then one part of each component is added in one container according to the mixture composition and mixed with the required quantity of the solvent (e.g. with 97 parts for centesimal dilution).

It is possible to use the active substance as mixture of various homeopathic dilutions, e.g. decimal and/or centesimal (D20, C30, C100 or C12, C30, C50 or C12, C30, C200, etc.), the efficiency of which is determined experimentally by testing the dilution in a suitable biological model, for example, in models described in the examples herein.

In the course of potentiation and concentration decrease, the vertical shaking may be substituted for external exposure to ultrasound, electromagnetic field or any similar external impact procedure accepted in the homeopathic art.

5 Preferably, the pharmaceutical composition of the invention may be in the form of a liquid or in the solid unit dosage form. The preferred liquid form of the pharmaceutical composition is a mixture, preferably, at a 1:1 ratio of the activated potentiated form of antibodies to gamma interferon and the activated potentiated form of antibodies to S-100 protein. The preferred liquid carrier is water or water-ethyl alcohol mixture.

10 The solid unit dosage form of the pharmaceutical composition of the invention may be prepared by impregnating a solid, pharmaceutically acceptable carrier with the mixture of the activated potentiated form aqueous or aqueous-alcohol solutions of active components that are mixed, preferably in 1:1 ratio. Alternatively, the carrier may be impregnated consecutively with each requisite dilution. Both orders of impregnation are acceptable.

15 Preferably, the pharmaceutical composition in the solid unit dosage form is prepared from granules of the pharmaceutically acceptable carrier which was previously saturated with the aqueous or aqueous-alcoholic dilutions of the activated potentiated form of antibodies to gamma interferon and the activated potentiated form of antibodies to S-100 protein. The solid dosage form may be in any form known in the
20 pharmaceutical art, including a tablet, a capsule, a lozenge, and others. As an inactive pharmaceutical ingredients one can use glucose, sucrose, maltose, amylum, isomaltose, isomalt and other mono- olygo- and polysaccharides used in manufacturing of pharmaceuticals as well as technological mixtures of the above mentioned inactive pharmaceutical ingredients with other pharmaceutically acceptable excipients, for
25 example isomalt, crospovidone, sodium cyclamate, sodium saccharine, anhydrous citric acid etc), including lubricants, disintegrants, binders and coloring agents. The preferred carriers are lactose and isomalt. The pharmaceutical dosage form may further include standard pharmaceutical excipients, for example, microcrystalline cellulose and magnesium stearate.

To prepare the solid oral form, 100-300 μm granules of lactose are impregnated with aqueous or aqueous-alcoholic solutions of the activated potentiated form of antibodies to histamine, activated-potentiated form of antibodies to gamma-interferon and the activated potentiated form of antibodies to S-100 protein in the ratio of 1 kg of antibody solution to 5 or 10 kg of lactose (1:5 to 1:10). To effect impregnation, the lactose granules are exposed to saturation irrigation in the fluidized boiling bed in a boiling bed plant (e.g. "Hüttlin Pilotlab" by Hüttlin GmbH) with subsequent drying via heated air flow at a temperature below 40°C. The estimated quantity of the dried granules (10 to 34 weight parts) saturated with the activated potentiated form of antibodies is placed in the mixer, and mixed with 25 to 45 weight parts of "non-saturated" pure lactose (used for the purposes of cost reduction and simplification and acceleration of the technological process without decreasing the treatment efficiency), together with 0.1 to 1 weight parts of magnesium stearate, and 3 to 10 weight parts of microcrystalline cellulose. The obtained tablet mass is uniformly mixed, and tableted by direct dry pressing (e.g., in a Korsch – XL 400 tablet press) to form 150 to 500 mg round pills, preferably, 300 mg. After tableting, 300mg pills are obtained that are saturated with aqueous-alcohol solution (3.0-6.0 mg/pill) of the combination of the activated potentiated form of antibodies to gamma interferon and the activated potentiated form of antibodies to S-100 protein. Each component of the combination used to impregnate the carrier is in the form of a mixture of centesimal homeopathic dilutions C12, C30, and C50 or a mixture of centesimal homeopathic dilutions C12, C30 and C200.

While the invention is not limited to any specific theory, it is believed that the activated potentiated form of the antibodies described herein do not contain the molecular form of the antibody in an amount sufficient to have biological activity attributed to such molecular form. The biological activity of the combination drug (*combination pharmaceutical composition*) of the invention is amply demonstrated in the appended examples.

The present invention further provides a method of significantly delaying the onset of symptoms of multiple sclerosis, said method comprising administering a

combination pharmaceutical composition comprising a) an activated-potentiated form of an antibody to gamma interferon, and b) an activated-potentiated form of an antibody to S-100 protein.

5 The present invention further provides a method of reducing the probability of relapse of episodes in a patient suffering from multiple sclerosis by administration of a combination pharmaceutical composition comprising a) an activated-potentiated form of an antibody to gamma interferon, and b) an activated-potentiated form of an antibody to S-100 protein.

10 Preferably, for the purpose of treatment, the combination of the invention is administered from once daily to four times daily, preferably twice daily, each administration including one or two combination unit dosage forms.

The invention is further illustrated with reference to the appended non-limiting examples.

15

EXAMPLES

Example 1

In this study female rats of the Wistar line (200-220 g) were used. EAE was induced in them by single inoculation of encephalitogenic mixture based on 100 mH of homogenate of homologous spinal cord, 0.2 ml CFA (content of killed mycobacteria 5 mg/ml) and 0.2 ml of physiological solution to one animal. The EGS was administered subcutaneously (at the base of the tail along the tail vein) under light ether anesthesia in the amount of 0.4 ml (0.2 ml on the right and left) (*Abdurasulova, I.N., et al, 2004; Zhitnukhin, Y.L., et al, 2008; Serebryanaya, N.B., et al, 2010*). The following were administered intragastrically 2 times a day at 7-hour intervals over 30 days, beginning from the day of EAE induction: (a) Ultra low dose of antibodies to S-100 protein (hereinafter "ULD Abs to S-100 protein") (n=10, 2.5 ml/kg/day); (b) ultra low dose of antibodies to gamma interferon (hereinafter "ULD Abs to γ -IFN") (n=10, 2.5 ml/kg/day); (c) the combination of ULD Abs to S-100 protein and ULD Abs to γ -IFN (hereinafter "the complex combination") (n=10, 5 ml/kg/day) and (d) the distilled water (control; n=10, 5 ml/kg/day). As a reference preparation, the immunomodulator Copaxone® (Teva,

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Israel) was used, which was administered intramuscularly at the dose of 4 mg/kg, from the 2nd to the 25th day after EAE induction. The results are shown on Fig. 2-5.

Clinical symptoms of experimental autoimmune encephalomyelitis (EAE) were assessed daily for 30 days starting on the day of induction of experimental autoimmune encephalomyelitis (EAE). Examination of each rat was carried out immediately before administration of drugs under study. In case of rapid disease progression the clinical symptoms were assessed twice daily.

The severity of neurological abnormalities was assessed in points: presence of muscle weakness, tremor (0.5 point); resistant paresis (1 point); paralysis (1.5 points). Clinical Index (CI) was calculated as a sum of the symptoms for 4 limbs. In addition, CI was designated as zero if visible clinical signs of neurologic abnormalities were absent, and designated as 6 in case of animal death. The maximal CI value was taken into account at all days. Cumulative index for each rat calculated as a sum of individual CI over total disease period (30 days) was recorded. The 30-day disease period was divided into the following phases: latent phase (1-10 days); clinical manifestation phase (11-18 days); and recovery phase (19-30 days).

To assess the efficacy of drugs under study in the model of Experimental autoimmune encephalomyelitis (EAE), the following parameters were assessed in each study group: 1) time of disease onset (days); 2) changes of mean severity of the disease over time (CI, points); 3) mean severity of the disease at different phases (CI, points) 4) total number of relapses, return of disease symptoms (%).

ULD Abs to S-100 protein moved back the onset of manifestation of clinical symptoms of disease periods, both in comparison with the negative control ($p < 0.05$) and in comparison with Copaxone ($p > 0.05$). The onset of disease in two groups that received ULD Abs to γ -IFN and in a group that received Copaxone did not differ from the control. See Fig 2. At the same time, in animals that were administered the complex combination, the tendency was observed to shortening of period of appearance of clinical signs of multiple sclerosis in comparison with the control. It should be noted that statistically significant differences were revealed in the time of disease onset period

between the group receiving ULD Abs to S-100 protein and the group receiving the complex combination.

The proportion of animals with severe course of disease (>3 points) was also lower in the group receiving ULD Abs to S-100 protein. In the groups that received the complex combination the percentage of animals with severe course was higher than in the other groups studied in all disease periods. See Fig 3.

In connection with the fact that, at various phases in the development of multiple sclerosis, different mechanisms of EAE pathogenesis were activated, the effect of the preparations on disease severity in the latent period, in the development of clinical signs phase and in the recovery phase was analyzed. Administration of ULD Abs to S-100 protein significantly contributed to reducing the average points of manifestation of clinical signs of disease in the clinical manifestation stage and in the recovery stage, while Copaxone and ULD Abs to γ -IFN significantly reduced the severity of the clinical symptoms only in the last phase. The complex combination, in comparison with the control and the groups receiving ULD Abs to γ -IFN alone or ULD Abs to S-100 protein alone, statistically significant increased the average points of the affection of animals in the appearance of clinical signs of disease stage and in the recovery stage. See Fig 4.

It should be noted that in a portion of the animals, after complete disappearance of the clinical signs of disease, a certain similarity to relapse, was noted, that is, the return of clinical manifestations of EAE. In the ULD Abs to S-100 protein group, in spite of its beneficial effect on the clinical course of EAE (later period of disease onset, lesser severity of manifestation of clinical signs), the greatest number of animals (25%) with relapses is noted. At the same time, in the complex combination group, which was characterized by early onset of disease and greater manifestation of pathologic process, no animal showed the development of relapses. See Fig 5.

Conclusions:

In the model of experimental autoimmune encephalomyelitis (EAE), ULD Abs to S-100 protein had a beneficial effect on the course of the disease. ULD Abs to S-100 protein diminished the clinical signs of the disease during an episode and reduced severity of symptoms. ULD Abs to γ -IFN and Copaxone comparison preparation did not

have an effect on the course of disease in the chosen experimental model of multiple sclerosis, that is for these substances, the magnitude of clinical signs of disease periods and the severity of symptoms did not differ from the control (distilled water).

5 Manifestation of the effects of preparations depended on the stage of development of EAE (latent phase, clinical signs phase, recovery phase).

The effect of the complex combination differed from the effect of the components, namely, from ULD Abs to S-100 protein or ULD Abs to γ -IFN alone. Use of the complex combination led to strengthening of the immune response. The complex combination led to earlier onset of disease, increase in the portion of sick animals and severity of
10 disease.

25% of animals in the ULD Abs to S-100 protein group and 15% of animals in the ULD Abs to γ -IFN group showed relapse during the study period (30 days). At the same time, relapse was not recorded in any animal in the complex combination group.

The most common course of multiple sclerosis is the relapsing-remitting subtype,
15 which is characterized by unpredictable attacks (relapses), followed by periods of relative remission with no new signs of disease activity.

The primary aims of multiple sclerosis therapy are reducing the neuronal damage during an acute attack and returning function after an attack, as well as preventing new attacks leading to disability.

20 ULD Abs to S100 protein alone was able to ameliorate clinical symptoms of EAE during all phases of experimental disease that makes it potentially useful in the treatment of multiple sclerosis attacks. The combination of ULD Abs to S100 protein + ULD Abs to γ -IFN completely prevented return of clinical symptoms of EAE, and thus, can be used in the treatment of multiple sclerosis in humans as a means of prevention
25 of relapse. Thus, the combination of ULD Abs to S-100 protein + ULD Abs to γ -IFN is a promising preparation for treating multiple sclerosis, which, it is believed, by strengthening of immune response at the peak of disease development, can contribute to more effective rehabilitation and prevention of relapses.

30 Example 2

Sigma-1 receptor - an intracellular receptor localized in the cells of central nervous system, the cells of the most of peripheral tissues, and immune cells. It is believed that this receptor, through control of homeostasis of intracellular calcium, regulates intracellular signaling events leading to activation of the corresponding transcription factors and transcription of a whole gene family. Sigma-1 receptor is involved in the pathogenesis of various diseases including, lemic and neurodegenerative conditions. In this regard, drugs influencing this receptor and the efficiency of interaction of ligands with this receptor may be regarded as effective drugs for the treatment of neuroinfectious and neurodegenerative diseases.

The effect of the complex combination whose composition includes ultra-low doses of S100 protein antibodies (mixture of homeopathic dilutions C12+C30+C50) and ultra-low doses of interferon gamma antibodies (mixture of homeopathic dilutions C12+C30+C50) in the ratio 1:1, and also components of the composition (ultra-low doses of S100 protein antibodies (mixture of homeopathic dilutions C12+C30+C50) (*ULD Abs to S-100 protein*) and ultra-low doses of interferon gamma antibodies (mixture of homeopathic dilutions C12+C30+C50) (*ULD Abs to γ -IFN*)), were investigated *in vitro* on binding of standard ligand [³H]pentazocine with recombinant human sigma 1 receptor and evaluated by radioligand method. As control, potentiated distilled water (mixture of homeopathic dilutions C12+C30+C50) (*potentiated water*) was tested.

20 μ l of the complex combination or 10 μ l of ULD Abs to S100 protein or ULD Abs to γ -IFN was introduced in the incubation medium. Thus, the quantity of ULD Abs to S100 protein and ULD Abs to γ -IFN introduced into the experimental well during testing of the complex combination was identical to the quantity of ULD Abs to S100 protein and ULD Abs to γ -IFN tested as monopreparations, thus making it possible to compare the effectiveness of the complex combination with the separate components that constitute the complex composition. Potentiated water was introduced in the incubation medium in the amount of 20 μ l and 10 μ l.

Then 160 μ l (~200 μ g of protein) of homogenate of Jurkat line cell membranes (line of human leukemic T-lymphocytes) was introduced, followed by 20 μ l of the tritium-labeled radioligand [³H]pentazocine (15 nM).

For measuring nonspecific bonding, instead of the preparations or potentiated water, 20 μ l of the unlabeled ligand Haloperidol (10 μ M) was introduced in the incubation medium.

Radioactivity was measured on a scintillation counter (Topcount, Packard) with use of a scintillation mixture (Microscint 0, Packard) after incubation for 120 minutes at 22°C in 50 mM Tris-HCL buffer (pH = 7.4) and filtration on fiberglass filters (GF/B, Packard). Specific binding (in the experiment or control) was calculated as the difference between covalent (in experiment or control) and nonspecific bonding.

Results (in measurement of covalent binding) are represented as a percentage of specific binding inhibition in the control (potentiated water was used as the control) (see Table 4).

Table 4

Effect of test preparations and potentiated water on binding of standard radioligand [³H]pentazocine with recombinant human sigma 1 receptor

Experimental group	Quantity introduced in experimental well	% of specific binding of radioligand in control			% of inhibition of radioligand binding in control
		1st measurement	2nd measurement	Average value	
Complex Combination	20 μ l	44.2	46.2	45.2	54.8
ULD Abs to S-100 protein	10 μ l	70.9	62.9	66.9	33.1
ULD Abs to γ -IFN	10 μ l	158.9	149.8	154.3	-54.3
Potentiated water	20 μ l	98.1	75.8	86.9	13.1
Potentiated water	10 μ l	140.1	106.2	123.2	-23.2

% of specific bonding in control = (specific bonding in experiment/specific bonding in control) * 100%;

% of specific binding inhibition in control = 100% - (specific bonding in experiment/specific bonding in control) * 100%).

Inhibition of over 50% shows that there exists a significant effect on binding. Inhibition from 25% to 50% shows weak to moderate effects. Inhibition of less than 25% are considered insignificant in terms of effect on binding, and are within background limits.

Conclusion:

The complex combination more effectively inhibits binding of standard radioligand [³H]pentazocine with recombinant human sigma 1 receptor than its separate components (ULD Abs to S100 protein or ULD Abs to γ -IFN).

5 ULD Abs to S100 protein, introduced in an experimental well in the amount of 10 μ l, inhibits the binding of standard radioligand [³H]pentazocine with recombinant human sigma 1 receptor, but expression of the effect is inferior to expression of the effect with the complex combination.

10 ULD Abs to γ -IFN, introduced in an experimental well in the amount of 10 μ l, did not have an effect on the binding of standard radioligand [³H]pentazocine with recombinant human sigma 1 receptor.

Potentiated water, introduced in an experimental well in the amount of 10 μ l or 20 μ l, did not have an effect on the binding of standard radioligand [³H]pentazocine with recombinant human sigma 1 receptor.

What is claimed is:

1. A combination pharmaceutical composition comprising a) an activated-potentiated form of an antibody to gamma interferon and b) an activated-potentiated form of an antibody to S-100 protein.
5
2. The combination pharmaceutical composition of claim 1, wherein the activated-potentiated form of an antibody to gamma interferon is to the entire gamma interferon, of SEQ ID NO 1 or SEQ ID NO 2.
3. The combination pharmaceutical composition of claim 1, wherein the
10 activated-potentiated form of an antibody to gamma interferon is to a fragment of gamma interferon having sequences selected from group consisting of SEQ ID NO. 3, SEQ ID NO. 4, SEQ ID NO. 5, SEQ ID NO. 6, SEQ ID NO. 7, SEQ ID NO. 8, SEQ ID NO. 9, SEQ ID NO. 10, SEQ ID NO. 11, SEQ ID NO. 12 and SEQ ID NO. 13.
4. The combination pharmaceutical composition of claim 1, wherein the
15 activated-potentiated form of an antibody to S-100 protein is to the entire bovine S-100 protein.
5. The combination pharmaceutical composition of claim 1, wherein the activated-potentiated form of an antibody to S-100 protein is to the entire S-100 protein having SEQ ID NO 14.
- 20 6. The combination pharmaceutical composition of claim 1 wherein the activated-potentiated form of an antibody to S-100 protein is to the entire S-100 protein having SEQ ID NO 17.
7. The combination pharmaceutical composition of claim 1, wherein the activated-potentiated form of an antibody to gamma interferon is in the form of a mixture of
25 C12, C30, and C50 homeopathic dilutions impregnated onto a solid carrier and the activated-potentiated form of an antibody to S-100 protein is in the form of mixture of C12, C30, and C50 homeopathic dilutions subsequently impregnated onto the solid carrier.
8. The combination pharmaceutical composition of claim 1, wherein the activated-potentiated form of an antibody to gamma interferon is in the form of a mixture of
30 C12, C30, and C200 homeopathic dilutions impregnated onto a solid carrier and the

activated-potentiated form of an antibody to S-100 protein is in the form of mixture of C12, C30, and C200 homeopathic dilutions subsequently impregnated onto the solid carrier.

9. The combination pharmaceutical composition of claim 1, wherein the activated-potentiated form of an antibody to S-100 protein is in the form of mixture of C12, C30, and C50 homeopathic dilutions impregnated onto a solid carrier and the activated-potentiated form of an antibody to gamma interferon is in the form of mixture of C12, C30, and C50 homeopathic dilutions subsequently impregnated onto the solid carrier.

10. The combination pharmaceutical composition of claim 1, wherein the activated-potentiated form of an antibody to S-100 protein is in the form of mixture of C12, C30, and C200 homeopathic dilutions impregnated onto a solid carrier and the activated-potentiated form of an antibody to gamma interferon is in the form of mixture of C12, C30, and C200 homeopathic dilutions subsequently impregnated onto the solid carrier.

11. The combination pharmaceutical composition of claim 1, wherein the activated-potentiated form of an antibody to gamma interferon is a monoclonal, polyclonal or natural antibody.

12. The combination pharmaceutical composition of claim 11, wherein the activated-potentiated form of an antibody to gamma interferon is a polyclonal antibody.

13. The combination pharmaceutical composition of claim 1, wherein the activated-potentiated form of an antibody to gamma interferon is prepared by successive centesimal dilutions coupled with shaking of every dilution.

14. The combination pharmaceutical composition of claim 1, wherein the activated-potentiated form of an antibody to S-100 protein is a monoclonal, polyclonal or natural antibody.

15. The combination pharmaceutical composition of claim 14, wherein the activated-potentiated form of an antibody to S-100 protein is a polyclonal antibody.

16. The combination pharmaceutical composition of claim 1, wherein the activated-potentiated form of an antibody to S-100 protein is prepared by successive centesimal dilutions coupled with shaking of every dilution.

17. A method of treating neurodegenerative disease, said method comprising administering to a patient in need thereof, substantially at the same time a) an activated-

potentiated form of an antibody to gamma interferon and b) an activated-potentiated form of an antibody to S-100 protein.

18. The method of claim 17, wherein said neurodegenerative disease is multiple sclerosis.

5 19. The method of claim 17 or 18, wherein said activated-potentiated form of an antibody to gamma interferon and said activated-potentiated form of an antibody to S-100 protein are administered in the form of a combined pharmaceutical composition.

10 20. A method of reducing the frequency of appearance of relapse in a patient suffering from multiple sclerosis by administration of the combination pharmaceutical composition of claim 1.

21. The method of claim 19, wherein the combination pharmaceutical composition is administered in one to two unit dosage forms, each of the dosage form being administered from once daily to four times daily.

15 22. The method of claims 19, wherein the combination pharmaceutical composition is administered in one to two unit dosage forms, each of the dosage form being administered twice daily.

20 23. A pharmaceutical composition for use in treating a patient suffering from multiple sclerosis, said composition having been obtained by providing a) an activated-potentiated form of an antibody to gamma interferon and b) an activated-potentiated form of an antibody to S-100 protein, each prepared by consecutive repeated dilution and multiple shaking of each obtained solution in accordance with homeopathic technology, and then either combining the potentiated solutions by mixing them, or, alternatively, impregnating a carrier mass with said combined solution or with the solutions separately.

25 24. A pharmaceutical composition for use in treating a patient suffering from multiple sclerosis, said composition having been obtained by providing an activated-potentiated form of an antibody to S-100 protein, prepared by consecutive repeated dilution and multiple shaking of each obtained solution in accordance with homeopathic technology, and then either combining the potentiated solutions by mixing them, or, alternatively, impregnating a carrier mass with said combined solution or with the solutions separately.

25. A method of treating multiple sclerosis, said method comprising administering to a patient in need thereof an activated-potentiated form of an antibody to S-100 protein.

26. The method of claim 25, wherein the activated-potentiated form of an antibody to S-100 protein is to the entire bovine S-100 protein.

5 27. The method of claim 25, wherein the activated-potentiated form of an antibody to S-100 protein is to the entire S-100 protein having SEQ ID NO 14.

28. The method of claim 25, wherein the activated-potentiated form of an antibody to S-100 protein is to the entire S-100 protein having SEQ ID NO 17.

10 29. The method of claim 25, wherein the activated-potentiated form of an antibody to S-100 protein is in the form of mixture of C12, C30, and C50 homeopathic dilutions impregnated onto a solid carrier.

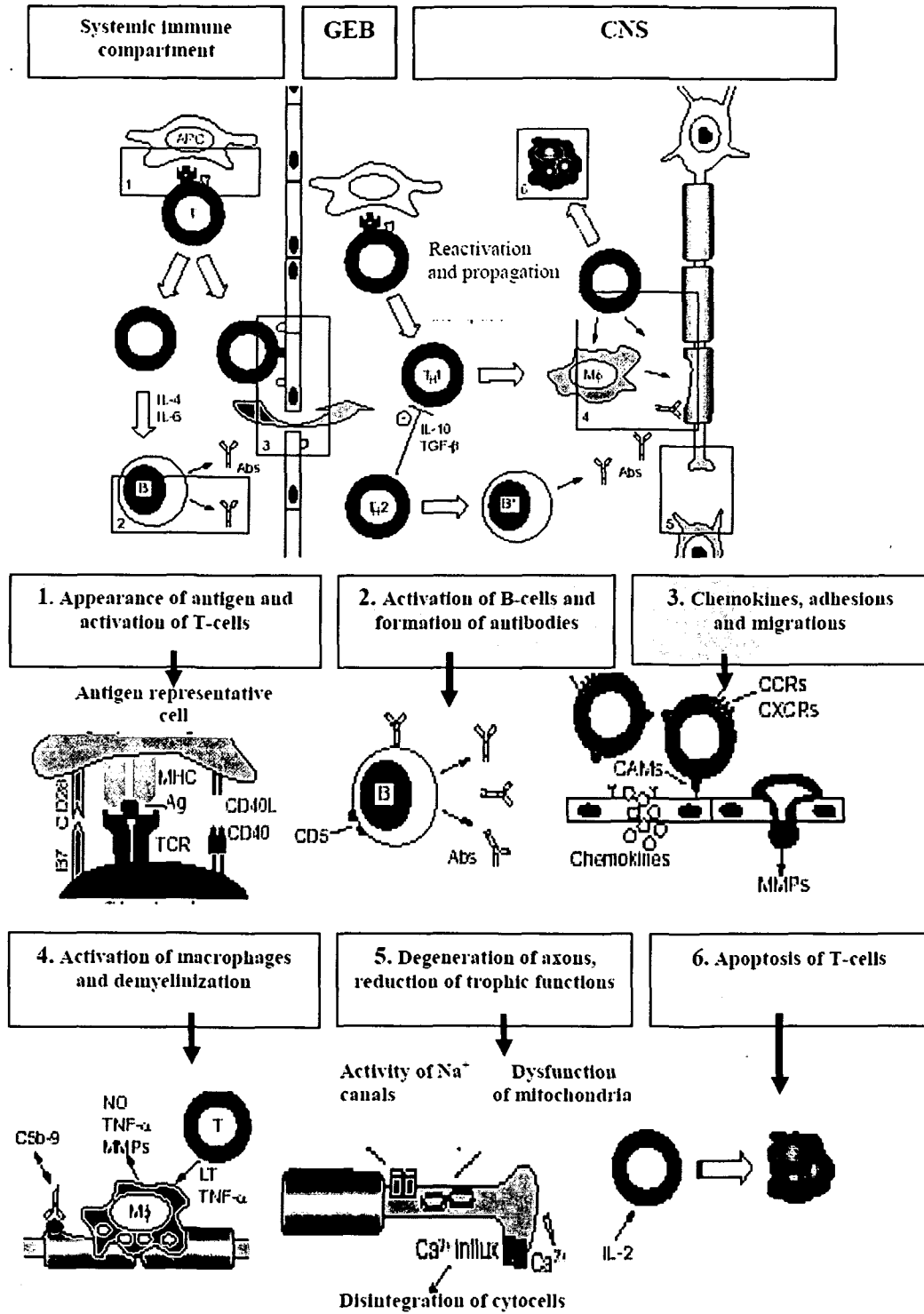
30. A method of claim 25, said method comprising administering to a said patient an activated-potentiated form of an antibody to S-100 protein, whereby said administration leads to delay in the onset of symptoms in the patient suffering from multiple sclerosis.

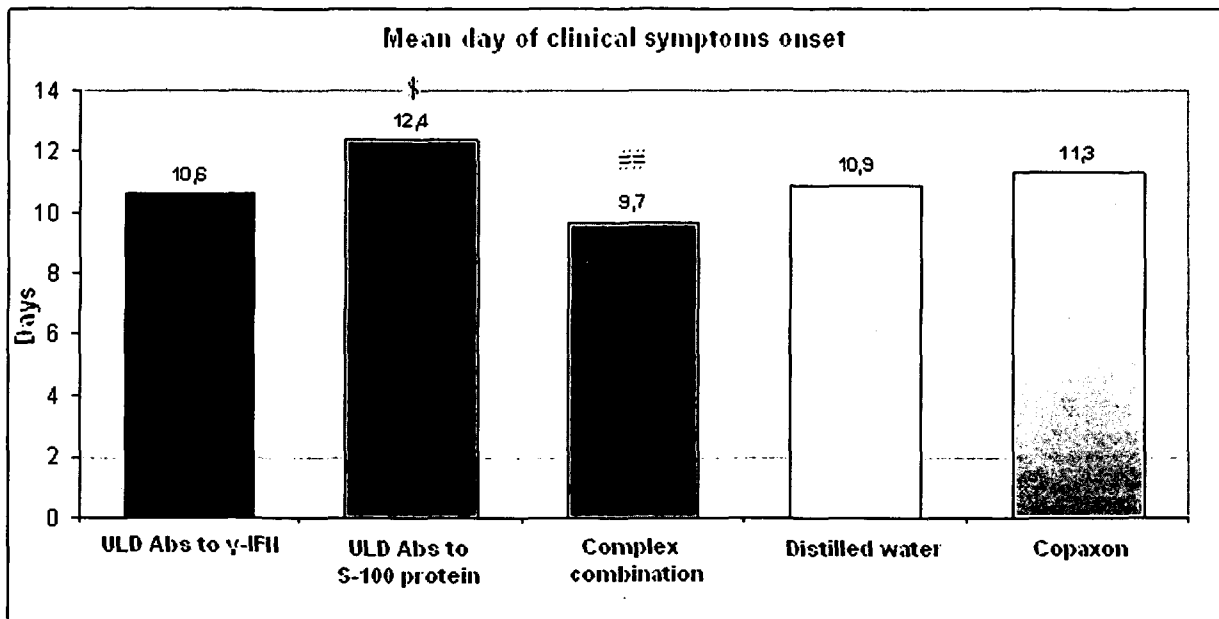
15 31. A method of mitigating of multiple sclerosis attack, said method comprising administering to a patient in need thereof an activated-potentiated form of an antibody to S-100 protein.

20 32. A method of treating neuroinfection, said method comprising administering to a patient in need thereof, substantially at the same time a) an activated-potentiated form of an antibody to gamma interferon and b) an activated-potentiated form of an antibody to S-100 protein.

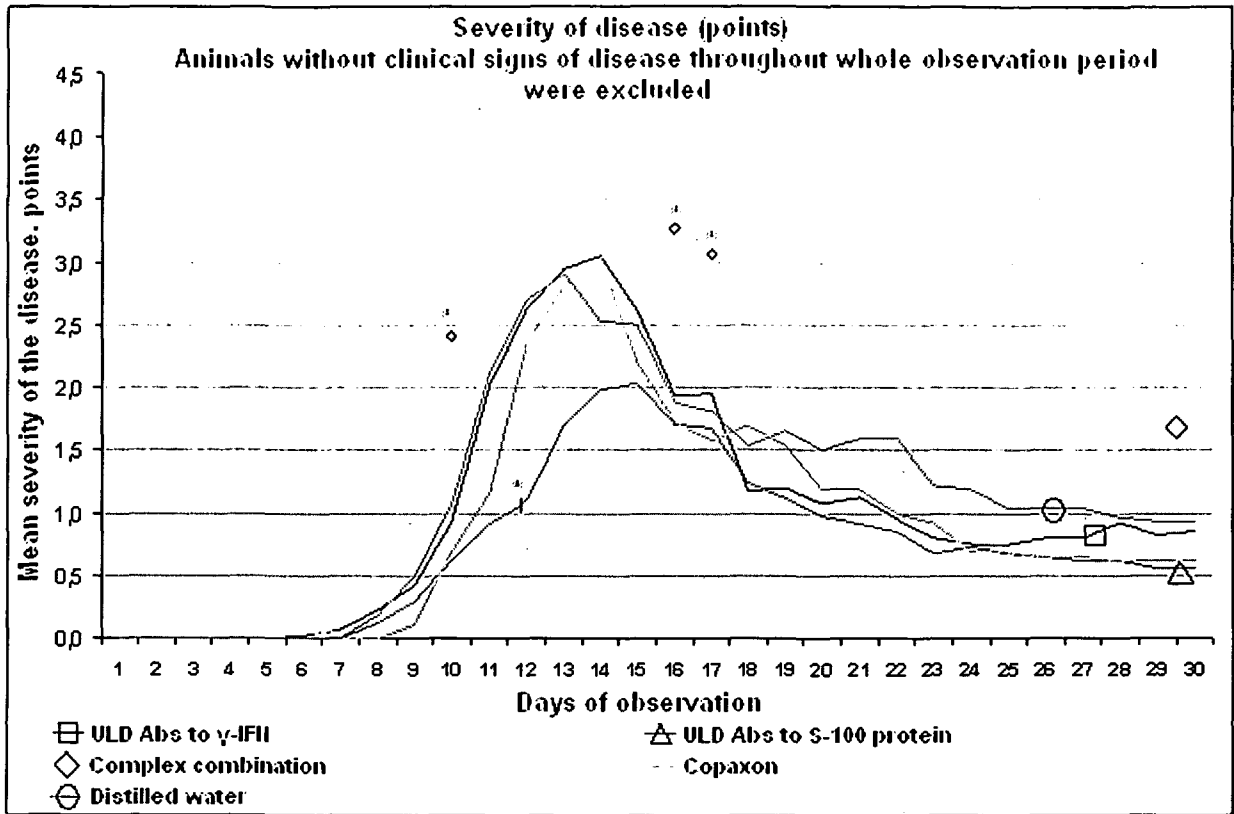
33. The method of claim 32, wherein said activated-potentiated form of an antibody to gamma interferon and said activated-potentiated form of an antibody to S-100 protein are administered in the form of a combined pharmaceutical composition.

25 34. A method of treating neuroinfection, said method comprising administering to a patient in need thereof an activated-potentiated form of an antibody to S-100 protein.

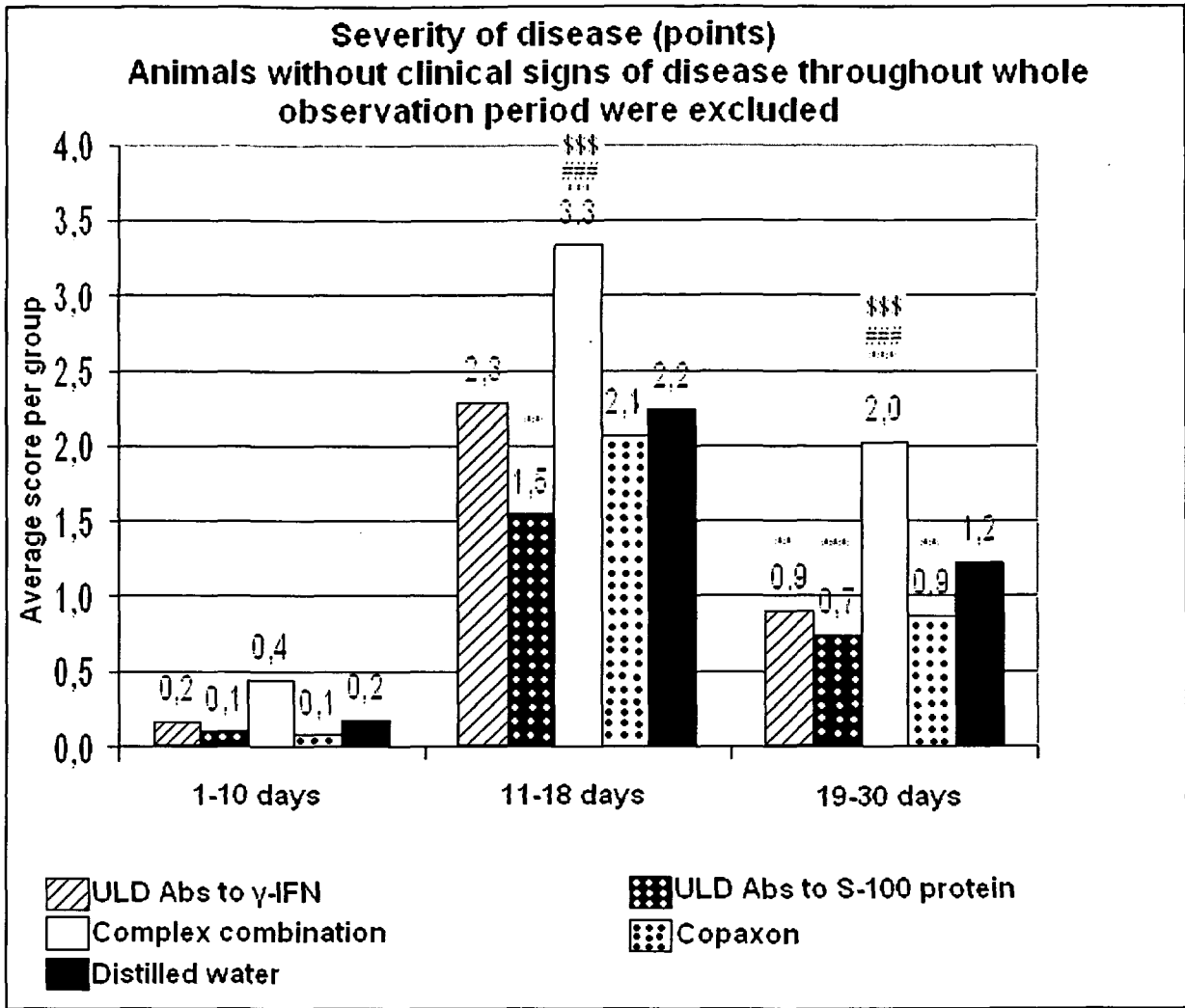




- differences are statistically significant in reference to ULD Abs to S-100 Protein with $p < 0.01$;
\$ - differences are statistically significant in reference to ULD Abs to γ -IFN with $p < 0.05$



* - differences are statistically significant in reference to distilled water with $p < 0.05$



** - differences are statistically significant in reference to distilled water with $p < 0.01$;

*** - differences are statistically significant in reference to distilled water with $p < 0.001$;

- differences are statistically significant in reference to ULD Abs to S-100 Protein with $p < 0.001$;

\$\$\$ - differences are statistically significant in reference to ULD Abs to γ -IFN with $p < 0.001$

