CLAIMS

1. ~~A method of~~Use of a composition in the manufacture of a medicament for ~~-~~elevating the level of interferon beta (IFNβ) in the gut of a mammal wherein the composition comprises ~~by providing said mammal with~~ a live bacterium and a prebiotic that is consumed by said live bacterium, and~~.~~

   wherein the mammal has or is at risk of one or more of the following conditions: an acute viral infection, a chronic viral infection, an autoimmune or allergic disease; or

   wherein the mammal has or is at risk of suffering from gut dysbiosis associated with an autoimmune disease selected from the group consisting of rheumatoid arthritis, psoriasis, multiple sclerosis, celiac disease, inflammatory bowel diseases (Crohn's, ulcerative colitis,) IBS, Type 1 diabetes mellitus, and idiopathic pulmonary fibrosis; or

   wherein the mammal has or is at risk of suffering from gut dysbiosis associated with an allergic disease selected from the group consisting of atopic dermatitis, asthma, or food allergy.

~~2. The method of claim 1, wherein the mammal has or is at risk of one or more of the following conditions: an acute viral infection, a chronic viral infection, an autoimmune or allergic disease.~~

~~3. The method according to claim 1 for the treatment or prevention of gut dysbiosis associated autoimmune and allergic disease, said method comprising stimulating a therapeutically effective dose of interferon beta to a mammal suffering from, or at risk of suffering from such disease.~~

~~4. The method of claim 3, wherein the method is intended to treat a mammal who has or is at risk of an autoimmune disease selected from the group consisting of rheumatoid arthritis, psoriasis, multiple sclerosis, celiac disease, inflammatory bowel diseases (Crohn's, ulcerative colitis,) IBS, Type 1 diabetes mellitus, and idiopathic pulmonary fibrosis.~~

~~5. The method of claim 3 wherein the method is intended to treat a mammal who has or is at risk of an allergic disease selected from the group consisting of atopic dermatitis, asthma, or food allergies.~~

62. The ~~method~~ use of ~~any one of claims 3-5~~claim 1, wherein ~~a~~ the composition is used as an adjuvant or complementary treatment to drug therapy for a particular disease or condition.

~~7. A method of claim 6, wherein the adjuvant or complementary treatment increases the lifetime use of a drug or delays mammal becoming resistant to a drug commonly used for the treatment of such a condition.~~

83. The ~~method~~ use of claim ~~5~~1, wherein the ~~method~~ composition is ~~intended~~ to specifically prevent or treat food allergy; and/or~~.~~

wherein desensitizing amounts of allergenic proteins are to be administered to the mammal; and/or

wherein the allergic protein is found in milk, egg, soy, wheat, shellfish, tree nut, peanut, fish, or sesame; and/or

wherein the amount of allergenic protein is less than 1 mg, less than 5 mg, less than 10 mg, less than 20 mg, less than 30 mg, less than 40mg, less than 50 mg, less than 60 mg, less than 100 mg or more than 100 mg; and/or

wherein the allergenic protein is added in increasing amounts over time as part of a treatment regime.

~~9. The method of claim 8 wherein the method of treatment further comprises administering to the mammal desensitizing amounts of allergenic proteins.~~

~~10. The method of claim 9, wherein the allergic protein is found in milk, egg, soy, wheat, shellfish, tree nut, peanut, fish, or sesame.~~

~~11. The method of claim 10, wherein the amount of allergenic protein is less than 1 mg, less than 5 mg, less than 10 mg, less than 20 mg, less than 30 mg, less than 40mg, less than 50 mg, less than 60 mg, less than 100 mg or more than 100 mg.~~

~~12. The method of any one of claims 9-11, wherein the allergenic protein is added in increasing amounts over time as part of treatment regime.~~

~~13~~4. The ~~method~~ use in the manufacture of a medicament as defined in ~~according to~~ claim 1 wherein the composition is for the treatment or prevention of gut dysbiosis in mammals with acute or chronic viral infections, wherein a ~~comprising stimulating~~ production of a

therapeutically effective amount of interferon-beta in ~~said~~ the mammal is to be stimulated ~~a therapeutically effective dose of interferon-beta~~, wherein the mammal suffers ~~to a patient suffering~~ from, or is at risk of suffering from such infection; and~~.~~

wherein the mammal has or is at risk of a virus causing a chronic viral infection, such as HIV, herpes, or hepatitis; or

wherein the mammal has or is at risk of an acute viral infection selected from a respiratory or gastrointestinal virus; and/or

wherein the respiratory viruses are selected from coronaviridae family, influenza, pneumonia, or respiratory syncytial virus; and/or

wherein the virus is in the family *Coronaviridae*, optionally wherein the virus is SARS-CoV-2 (COVID19) or one of its variants; and

wherein treatment success may result in less viral shedding, viral carriage, less, complications, less neuronal complications, and/or improved recovery time.

~~14. The method of claim 13, where treatment intended to treat a mammal who has or is at risk of a virus causing a chronic viral infection, such as HIV, herpes, or hepatitis.~~

~~15. The method of claim 10 intended to treat a mammal who has or is at risk of an acute viral infection selected from a respiratory or gastrointestinal virus.~~

~~16. The method of claim 15 wherein the respiratory viruses may be selected from coronaviridae family, influenza, pneumonia, or respiratory syncytial virus.~~

~~17. The method of claim 16, wherein the virus is in the family *Coronaviridae*, optionally wherein the virus is SARS-CoV-2 (COVID19) or one of its variants.~~

~~18. A method of any one of claims 13-17, wherein treatment success may result in less viral shedding, viral carriage, less, complications, less neuronal complications, and/or improved recovery time.~~

~~19~~5. The ~~method~~ use of claim 1 wherein the medicament is for reducing viral carriage in a mammal, wherein an anti-viral composition comprising a live bacterium and a mammalian milk oligosaccharide (MMO) prebiotic that is consumed by that live bacterium ~~by~~ is to be provided to~~providing~~ ~~said~~ the mammal~~. with an anti-viral composition comprising a live bacterium and a MMO that is consumed by that live bacterium.~~

~~20~~6. The ~~method~~ use of claim 1~~of any of the preceding claims~~, wherein the composition contains one or more live bacterium selected from *Bifidobacterium* and/or *Lactobacillus*; and/or

wherein the live bacterium is *Bifidobacterium* selected from the group consisting of *B. adolescentis*, *B. animalis*, *B. animalis* subsp. *animalis*, *B. animalis* subsp. *lactis*, *B. bifidum*, *B. breve*, *B. catenulatum*, *B. longum*, *B. longum* subsp. *infantis*, *B. longum* subsp. *longum*, *B. longum* subsp. *suis*, *B. pseudocatanulatum*, and *B. pseudolongum;* and/or

wherein the *Bifidobacterium* is *B. infantis*, optionally where it *is B. infantis* is strain EVC001 or a genetic equivalent to strain EVC001; and/or

wherein the *B. infantis* has a functional H5 gene cluster and/or has function to cleave N-glycans from whey or other glycosylated proteins *in vivo;* and/or

wherein the live bacterium is *Lactobacillus* selected from the group consisting of *L. acidophilus*, *L. brevis*, *L. casei*, *L. crispatus*, *L. curvatus*, *L. fermentum*, *L. pentosus*, *L. plantarum*, and *L. sakei L. antri*, *L. coleohominis*, *L. gasseri*, *L. johnsonii*, *L. mucosae*, *L. reuteri*, *L. rhamnosus, and L. salivarius; or*

wherein the Lactobacillus is *L. rhamnosus* or *L. reuteri;* and/or

wherein *L. rhamnosus* is LGG; and/or

wherein the live bacterium is activated and dried prior to administration; and/or

wherein the live bacterium is stabilized and dried and/or;

wherein the live bacterium is present in 0.1 million to 500 billion colony forming units (CFU) per serving, per gram, per ml or per unit dose of the composition, optionally wherein the bacterium is present in 1 million to 100 billion CFU or 5 million to 50 billion CFU per serving, per gram, per ml or per unit dose of the composition; and/or

wherein the dried bacterium is suspended in oil; and/or

wherein the dried bacterium is suspended in oil; and/or

wherein the oil is medium chain triglyceride (MCT), mineral, palm olein, soy, coconut, high oleic sunflower oil.

~~21. A method of any preceding claim wherein the live bacterium is *Bifidobacterium* selected from the group consisting of *B. adolescentis*, *B. animalis*, *B. animalis* subsp. *animalis*, *B. animalis* subsp. *lactis*, *B. bifidum*, *B. breve*, *B. catenulatum*, *B. longum*, *B. longum* subsp.~~

~~*infantis*, *B. longum* subsp. *longum*, *B. longum* subsp. *suis*, *B. pseudocatanulatum*, and *B. pseudolongum*.~~

~~22. A method of claim 21, wherein the *Bifidobacterium* is *B. infantis*, optionally where it *is B. infantis* is strain EVC001 or a genetic equivalent to strain EVC001.~~

~~23. A method of claim 21, wherein the *B. infantis* has a functional H5 gene cluster and/or has function to cleave N-glycans from whey or other glycosylated proteins *in vivo*.~~

~~24. A method of any preceding claim wherein the live bacterium is *Lactobacillus* selected from the group consisting of *L. acidophilus*, *L. brevis*, *L. casei*, *L. crispatus*, *L. curvatus*, *L. fermentum*, *L. pentosus*, *L. plantarum*, and *L. sakei L. antri*, *L. coleohominis*, *L. gasseri*, *L. johnsonii*, *L. mucosae*, *L. reuteri*, *L. rhamnosus*, *and L. salivarius*.~~

~~25. A method of claim 24, wherein the Lactobacillus is *L. rhamnosus* or *L. reuteri*.~~

~~26. A method of claim 24, wherein *L. rhamnosus* is LGG.~~

~~27. A method of any of the preceding claims, wherein the live bacterium is activated and dried prior to administration.~~

~~28. A method of any of the preceding claims, wherein the live bacterium is stabilized and dried.~~

~~29. A method of claim 23, wherein the live bacterium is present 0.1 million to 500 billion colony forming units (CFU) per serving, per gram, per ml or per unit dose of the composition, optionally wherein the~~ bacterium is present 1 million to 100 billion CFU or 5 million to 50 billion CFU per serving, per gram, per ml or per unit dose of the composition.

~~30. A method of any one of claims 27-29, wherein the dried bacterium is suspended in oil.~~

~~31. A method of claim 30, wherein the oil is medium chain triglyceride (MCT), mineral, palm olein, soy, coconut, high oleic sunflower oil.~~

~~32~~7. ~~A method of any of the preceding claims~~The use of claim 1, wherein the prebiotic composition comprises a MMO, a galacto-oligosaccharide (GOS), a fructo-oligosaccharide (FOS), a polydextrose (PDX) or resistant starch; and/or

wherein the prebiotic comprises one or more MMO selected from group consisting of lacto-N-biose (LNB), N-acetyl lactosamine, lacto-N-triose, lacto-N-tetraose (LNT),

lacto-N-neotetraose (LNnT), fucosyllactose (FL), lacto-N-fucopentaose (LNFP), lactodifucotetraose, (LDFT) sialyllactose (SL), disialyllacto-N-tetraose (DSLNT), 2'-fucosyllactose (2FL), 3'-sialyllactosamine (3SLN), 3'-fucosyllactose (3FL), 3'-sialyl-3-fucosyllactose(3S3FL), 3'-sialyllactose (3SL), 6'-sialyllactosamine (6SLN), 6'-sialyllactose (6SL), difucosyllactose (DFL), lacto-N-fucopentaose I (LNFPI), lacto-N-fucopentaose II (LNFPII), lacto-N-fucopentaose III (LNFPIII), lacto-N-fucopentaose V (LNFPV), sialyllacto-N-tetraose (SLNT), their derivatives, or combinations thereof.~~.~~

~~33. A method of any preceding claim, wherein the prebiotic comprises one or more MMO selected from group consisting of lacto-N-biose (LNB), N-acetyl lactosamine, lacto-N-triose, lacto-N-tetraose (LNT), lacto-N-neotetraose (LNnT), fucosyllactose (FL), lacto-N-fucopentaose (LNFP), lactodifucotetraose, (LDFT) sialyllactose (SL), disialyllacto-N-tetraose (DSLNT), 2'-fucosyllactose (2FL), 3'-sialyllactosamine (3SLN), 3'-fucosyllactose (3FL), 3'-sialyl-3-fucosyllactose(3S3FL), 3'-sialyllactose (3SL), 6'-sialyllactosamine (6SLN), 6'-sialyllactose (6SL), difucosyllactose (DFL), lacto-N-fucopentaose I (LNFPI), lacto-N-fucopentaose II (LNFPII), lacto-N-fucopentaose III (LNFPIII), lacto-N-fucopentaose V (LNFPV), sialyllacto-N-tetraose (SLNT), their derivatives, or combinations thereof.~~

~~34~~8. ~~A method of any preceding claim~~The use of claim 1, wherein the prebiotic comprises MMO that is an HMO; and~~.~~

wherein the HMO is LNT and LNnT; and

wherein LNT and LNnT are in 10:1 ratio or a ratio of 4:3; and/or

wherein the prebiotic comprises MMO having at least one structure with sialic acid that is not sialyllactose, at least one structure with fucose that is not fucosyllactose, and at least one of LNT or LNnT; and/or

wherein the MMO comprises at least 2 MMO selected from 2'FL, 3'FL, 3'SL, 6'SL, LNT, LNnT, LNFP, and DFL; and/or

wherein the prebiotic, MMO or HMO composition is provided in a sterile liquid, a gel or a paste; and

wherein the sterile liquid is water with an HMO concentration of at least 1 g/L, at least 2 g/L, at least 4 g/L, at least 6 g/L, at least 8 g/L, at least 10 g/L, at least 12 g/L, at least 15 g/L, at least 20 g/L, or at least 30 g/L; and/or

wherein the prebiotic in sterile liquid is consumed throughout the day to deliver a total daily intake of 1 gram (g), at least 4 g, at least 8 g, at least 12 g, at least 15 g, at least 20 g, at least 25 g, at least 30 g, at least 35 g, at least 40 g, at least 45 g, at least 50 g, or more than 50 g; and/or

wherein the prebiotic in sterile liquid is used to prepare infant formula or other prepared food for a mammal of any age.

~~35. A method of claim 34, wherein the HMO is LNT and LNnT.~~

~~36. A method of claim 35, wherein LNT and LNnT are in 10:1 ratio or a ratio of 4:3.~~

~~37. A method of any preceding claim, wherein the prebiotic comprises MMO having at least one structure with sialic acid that is not sialyllactose, at least one structure with fucose that is not fucosyllactose, and at least one of LNT or LNnT.~~

~~38. A method of any one of claims 32-37, wherein the MMO comprises at least 2 MMO selected from 2'FL, 3'FL, 3'SL, 6'SL, LNT, LNnT, LNFP, and DFL.~~

~~39~~9. The use of claim 8, wherein the medicament further comprises ~~A method of claim 38 further comprising~~ GOS, FOS, PDX or resistant starch; and~~.~~

wherein the GOS is provided in a 1:10 to 10:1 ratio with the MMO; and

wherein the GOS is preferably DP4 and DP5.

~~40. A method of claim 39, wherein the GOS is provided in a 1:10 to 10:1 ratio with the MMO.~~

~~41. A method of claim 40, wherein the GOS is preferably DP4 and DP5.~~

~~42. A method of any one of claims 32-40, wherein the prebiotic, MMO or HMO composition is provided in a sterile liquid, a gel or a paste.~~

~~43. A method of claim 42, wherein the sterile liquid is water with an HMO concentration of at least 1 g/L, at least 2 g/L, at least 4 g/L, at least 6 g/L, at least 8 g/L, at least 10 g/L, at least 12 g/L, at least 15 g/L, at least 20 g/L, or at least 30 g/L.~~

~~44. The method of claim 42 or 43, wherein the prebiotic in sterile liquid is consumed throughout the day to deliver a total daily intake of 1 gram (g), at least 4 g, at least 8 g, at~~

~~least 12 g, at least 15 g, at least 20 g, at least 25 g, at least 30 g, at least 35 g, at least 40 g, at least 45 g, at least 50 g, or more than 50 g.~~

~~45. The method of any one of claims 42-44, wherein the prebiotic in sterile liquid is used to prepare infant formula or other prepared food for a mammal of any age.~~

~~46~~10. The use of claim 8~~ method of claim 45~~, wherein the infant formula does not contain FOS, GOS, PDX or other resistant starches.

~~47~~11. The use of claim 1, wherein ~~method of any of the preceding claims where in~~ the mammal's diet is restricted to provide low or no non-MMO dietary fiber; and~~.~~

wherein the live bacterium is to be administered once daily; and/or

wherein the daily intake of MMO is modified to increase or decrease based on effectiveness of elevating IFNβ; and/or

wherein the live bacterium and HMO are provided contemporaneously in a stabilized powder format.

~~48. The method of any preceding claim wherein the live bacterium is administered once daily.~~

~~49. The method of any preceding claim wherein the daily intake of MMO is modified to increase or decrease based on effectiveness of elevating IFNβ.~~

~~50. The method of any preceding claim wherein the live bacterium and HMO are provided contemporaneously in a stabilized powder format.~~

~~51~~12. The ~~method of any of the preceding claims~~use of claim 1, wherein the composition further comprises DHA and ARA; or~~.~~

wherein the composition further comprises vitamin A and/or vitamin D; or

wherein the composition further comprises glycosylated whey protein and/or tryptophan or a milk fat globule membrane complex.

~~52. The method of any one of the preceding claims, wherein the composition further comprises vitamin A and/or vitamin D.~~

~~53. The method of any one of the preceding claims, wherein the composition further comprises glycosylated whey protein and/or tryptophan or a milk fat globule membrane complex.~~

~~54~~13. The use of claim 1 ~~method of treatment for any preceding claim~~ further comprising pre-administration and/or contemporaneous administration of an exogenous source of IFNβ to a mammal, said administration may be oral, rectal, intramuscular, intravenous, or in a nebulized form.

~~55~~14. The use of claim 1, ~~method of any one of the preceding claims,~~ wherein the ~~composition~~ medicament is to be administered as a unit dose, ~~a medicament,~~ a food, an infant food, a medical food, a dietary supplement, or a pharmaceutical agent; and/or~~.~~

wherein the composition is to be delivered as part of a dietary regime specific to the needs of the mammal during treatment; or

wherein the food is an infant food, or a food for a mammal with an acute viral infection, a chronic viral infection, an autoimmune or allergic disease; and/or

wherein the composition is used to supplement human milk, human milk fortifier of human or bovine origin, infant formula, follow-on formula, a prepared food, enteral nutrition, or a meal replacer for a subject of any age; and

wherein said mammal is a human, non-human primate, cow, horse, sheep, pig, goat, buffalo, dog or cat; and/or

wherein the human mammal is selected from an age group comprising infant 0-3 months, infant 3-6 months, infant 6-12 months, toddler 1-3 years, child 3-5, 5-10, 1-16, 16-18 years or an adult 18+, 20+, 30 +, 40+, 50+, 60+, 70 + 80+, 90+ or 100+ years.

~~56. The method of any one of the preceding claims, wherein the composition is delivered as part of a dietary regime specific to the needs of the mammal during treatment.~~

~~57. The method of claim 55, wherein the food is an infant food, or a food for a mammal with an acute viral infection, a chronic viral infection, an autoimmune or allergic disease.~~

~~58. The method of any preceding claims, wherein composition is used to supplement human milk, human milk fortifier of human or bovine origin, infant formula, follow-on formula, a prepared food, enteral nutrition, or a meal replacer for a subject of any age.~~

~~59. The method of any one of the preceding claims, wherein said mammal is a human, non-human primate, cow, horse, sheep, pig, goat, buffalo, dog or cat.~~

~~60. The method of claim 59, wherein the human mammal is selected from an age group comprising infant 0-3 months, infant 3-6 months, infant 6-12 months, toddler 1-3 years, child 3-5, 5-10, 1-16, 16-18 years or an adult 18+, 20+, 30 +, 40+, 50+, 60+, 70 + 80+, 90+ or 100+ years.~~

~~61~~15. The use of claim 1, ~~method of any one of the preceding claims~~ wherein the IFNβ is measured enterically or systemically from a stool or blood sample; and~~.~~

wherein the measurement from said stool or blood sample is used to diagnose need and/or monitor effectiveness of compositions used in treatment; and/or

wherein *Bifidobacteriaceae*, and/or certain cytokines, calprotectin, or *Enterobacteriaceae* is monitored to tailor treatment to achieve necessary clinical improvements.

~~62. The method of claim 61, wherein the measurement from said stool or blood sample is used to diagnose need and/or monitor effectiveness of compositions used in treatment.~~

~~63. The method of claim 61 or 62 for maintaining IFNβ levels, further comprising monitoring *Bifidobacteriaceae*, and/or certain cytokines, calprotectin, *Enterobacteriaceae* to tailor treatment to achieve necessary clinical improvements.~~

~~64~~16. The use of claim 15 wherein the medicament is ~~A method~~ to improve symptoms of rheumatoid arthritis or psoriasis, ~~said method~~ comprising delivering a live bacterium and MMO to a mammal having said symptoms, and monitoring increase in IFNβ and decrease IL-7, IL-21 and IL-22.

~~65. The method of claim 61 or 62 for monitoring effectiveness of treatment for food allergy and other allergic diseases comprising monitoring clinical symptoms and/or monitoring~~

~~increased IFNβ production and/or decreased IL-4, IL-5 and IL-13, and/or antigen specific IgE reactions enterically and/or systemically.~~

~~66~~17. The ~~method~~ use of claim 15 ~~61 or 62~~ for maintaining IFNβ production, ~~further comprising monitoring~~wherein enteric and systemic inflammation are to be monitored to prevent HIV-1 progression of disease towards AIDS.

~~67~~18. Use of a composition in the manufacture of a medicament ~~A method~~ for reducing viral carriage in a mammal, wherein an anti-viral composition comprising a live bacterium and a MMO that is consumed by that live bacterium ~~by providing~~is to be provided to said mammal ~~with an anti-viral composition comprising a live bacterium and a MMO that is consumed by that live bacterium~~; and

~~.~~ wherein reducing the carriage of a virus in a patient comprises the steps of:

a. a daily dosing of from 10^6 to 10^{11} cfu of *B. infantis* contemporaneously with from 1-50 g of a mammalian milk oligosaccharide is to be provided to the patient who is infected with the virus;

b. the patient is to be monitored for the presence of the virus; and

c. the daily dosing is to be repeated until the titer of the virus drops by 95%; and/or wherein the virus is a Corona Virus.

~~68. The method of claim 67, wherein reducing the carriage of a virus in a human comprises the steps of:~~

~~a. providing the patient that is infected with the virus with from 10^6 to 10^{11} cfu of *B. infantis* contemporaneously with from 1-50 g of a mammalian milk oligosaccharide;~~

~~b. monitoring the patient for the presence of the virus; and~~

~~c. repeating the daily dosing until the titer of the virus drops by 95%.~~

~~69. The method for reducing the carriage of a Corona Virus in a human, said method comprising the steps of:~~

~~a. providing the patient that is infected with a Corona Virus with from 10^6 to 10^{11} cfu of *B. infantis* contemporaneously with from 1-50 g of a mammalian milk oligosaccharide;~~

b. monitoring the patient for the presence of a Corona Virus; and

c. repeating the daily dosing until the titer of the Corona Virus drops by 95%.

70. A method for reducing the severity of infection and/or comorbidities of a human with a Corona Virus, said method comprising the steps of:

a. providing the individual with from 10^6 to 10^{11} cfu of *B. infantis* contemporaneously with from 1-50 g of a mammalian milk oligosaccharide; and

b. repeating the daily dosing until through the time of a viral outbreak.

71. A method for preventing infection of a human who may have been in contact with another person who was carrying a Corona Virus, said method comprising the steps of:

a. providing the human with from 10^6 to 10^{11} cfu of *B. infantis* contemporaneously with from 1-50 g of a mammalian milk oligosaccharide;

b. monitoring the human for the presence of a Corona Virus; and

c. repeating the daily dosing for from 14-21 days.